IDENTIFICATION AND FACILITATION OF POSTTRAUMATIC GROWTH AFTER BURN INJURY IN AN ADULT POPULATION IN WESTERN AUSTRALIA.

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This thesis is presented for the degree of Doctor of Philosophy of The University of Western Australia
School of Surgery
Burn Injury Research Unit
2018
Thesis Declaration

I, Lisa Joanne Martin, certify that:

This thesis has been substantially accomplished during enrolment in the degree.

This thesis does not contain material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution.

No part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of The University of Western Australia and where applicable, any partner institution responsible for the joint-award of this degree. This thesis does not contain any material previously published or written by another person, except where due reference has been made in the text.

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The research involving human data reported in this thesis was assessed and approved by The University of Western Australia Human Research Ethics Committee. Approval #: RA/4/1/6819. Written patient consent has been received and archived for the research involving patient data reported in this thesis.

The following approvals were obtained prior to commencing the relevant work described in this thesis: Royal Perth Hospital and Fiona Stanley Hospital sites Approval #: EC13-178.

The work described in this thesis was funded by scholarships via the Australian Postgraduate Award and the University of Western Australia Top-up awards. The Julian Burton Burns Trust funded the Cogmed intervention program.

This thesis contains published work which has been co-authored.

Signature:

Date: 21/07/2017
Abstract

Introduction
Posttraumatic growth is self-reported positive psychological change that is superior to the pre-trauma state. First, this thesis explores the process, presentation and measurement of posttraumatic growth after burn and then explores potential barriers. Next, it explores the relationship of posttraumatic growth to depression, stress and overall recovery from burn. Finally, it assesses whether a cognitive training intervention can improve posttraumatic growth.

Methods
This was a three phase multi-model study. Phase 1 used a convergent parallel mixed-method approach with a thematic analysis of semi-structured interviews together with patient-reported posttraumatic growth inventory scores. The aim was to assess how posttraumatic growth presented in a population of burn survivors in Western Australia, and whether this growth could be adequately measured using this tool. Phase 2 used quantitative methods to assess posttraumatic growth and quality of life after burn. Phase 3 used a cross-over study to quantitatively assess the effects of a cognitive training program on posttraumatic growth.

Results
Phase 1 showed that burn survivors experience aspects of posttraumatic growth, which can be reflected by posttraumatic growth inventory scores overall. However, there were additional burn-specific influences on growth. Influencing factors were related to burn severity, burn scarring and activity constraints. The location of visible scarring led to social challenges. Growth-related coping strategies included use of humour, reframing, downward comparison, gratefulness and planning. The integration of all related published research led to the production of the Model of Postburn Growth and Coping. Phase 2 of the study showed that self-reported growth scores are positively related to stress, inhibited by depression, and stabilise following acute recovery, supporting the close link of postburn growth with coping. The cognitive training program used in Phase 3 did not show an improvement in growth scores overall. This study expanded the understanding of growth after burn, and expanded the general theory of posttraumatic growth. It makes conceptual links about posttraumatic growth theory and the sense of coherence theory that has not been explicitly stated in previous literature.

Conclusion
Posttraumatic growth after burn is similar to other types of trauma and can be measured by the posttraumatic growth inventory. There are other general aspects of growth to consider, as well as burn-specific elements and barriers to growth. Postburn growth is closely related to coping and social support. It is related to stress and inhibited by depression, therefore early identification and management of these psychosocial symptoms by the clinician is important. The thesis concludes by presenting an information resource for patients and potential intervention strategies for health care professionals.
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I also express my thanks to my husband Nigel, for supporting me, and to my (now adult) ‘children’ Zoe and Nick for your understanding and patience over the last few years. May this inspire you to realise you are never too old to follow your heart, and I hope that we also give you wings, roots and direction.
Authorship Declaration: Co-authored Publications

This thesis contains work that has been published or submitted for publication which has been co-authored by my supervisors. The bibliographical details of the work and where it appears in the thesis are outlined below. The thesis comprises my own original work, and I am responsible for study design, proposal writing, ethics applications, recruitment and follow-up of patients, data collection, interview transcription, data analysis and interpretation, preparing discussion, drawing conclusions and troubleshooting solutions under the guidance of my supervisory team and the acknowledgments as listed below. I am responsible for 100% of the drafting of this thesis and the arising publications, and my supervisors for the editing. Supervisor contributions to authorship to the qualitative publications are Winthrop Professor Fiona Wood 5%, Professor Suzanne Rea 4%, Dr Michelle Byrnes 6%, Dr Sarah McGarry 5%, and contributions to the quantitative publication are Winthrop Professor Fiona Wood 5%, Professor Suzanne Rea 4%, Dr Michelle Byrnes 6%, Dr Sarah McGarry 2%, and Professor Max Bulsara 3%
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Preface

After a major burn not only do you go through critical acute illness, serial surgeries and the most painful dressing changes you could never imagine without first-hand experience, you then have to deal with long term scarring which might mean you can’t move how you used to, you can’t bend or stretch, you knock the scar and it breaks down, you can’t tolerate the heat, you can no longer sit in the sun, It itches, it is painful and to cap it all you look in the mirror and a different face looks back at you. Burn injury is hugely challenging, it is not just an acute injury... it is a chronic health problem. We want to ensure good mental health as well as good physical health, and the two are inseparable.

It has been observed by different members of the multi-disciplinary team in our clinical environment that patients express the desire to change following their burn event. Some patients, like 26 year old John, who had been burnt when a fire in the back of his utility truck caused an aerosol can to explode, thought the event was ‘the best thing’ and that it was ‘meant’ to happen. He planned to take the forced hiatus in the normal passage of his daily life to pause, reflect, and improve himself. Other patients, like Gemma, also 26 years old, reflected that “I think I am a much better person since my burn” saying that she was more tolerant of other people who weren’t as smart or as attractive as she had been. Vicky, in her late forties, had been fit and athletic until the day her life changed for ever when the light aircraft she was in crashed. She suffered an 80% burn, and after the initial eight month battle with her life-threatening injury, she faced a future with profound scarring to her face, trunk and all four limbs. She had to learn to walk again, she was unable to lift her arms to dress herself, and has had many reconstructive surgeries since. Despite this, Vicky said that she was very happy that she had survived because she wanted to see her (then unborn) grandchildren... “And now I have”. It took these brief comments to change three years of my life, and provided the inspiration for this project.

I would like to open my personal professional background up to the reader to add some contextual depth to this work. I proudly started my working life many moons ago in the UK as a Registered Nurse in critical care environments; intensive care, coronary care and the emergency department. I loved the challenges that caring for very sick patients, and their families, brought. I always have had an interest in research; are there things that we can do for our patients today that have a big positive impact tomorrow? Conversely, do we do things for our patients that are not beneficial in the long term? Professionally, I moved into research, first in clinical trials in a wide range of specialities, and then into burn care. Physically, I moved to Australia, having started the research phase of my career in the often cold and cloudy UK, and
continuing it in the warmer sunnier climes of Perth. I have now worked as a research nurse in both the adult and paediatric burn units in Western Australia for the past 9 years, and continue to enjoy the variety of my work, my wonderful colleagues, and best of all, the generous patients I am fortunate enough to work with.

The Burn Service of Western Australia

The Burn Service of Western Australia has specialised inpatient facilities for adults at the new Fiona Stanley Hospital in the State capital, Perth and has recently moved from similar facilities at Royal Perth Hospital. Patients are accepted from the whole of the State, which covers 2.6 million square km. This is a new unit which has 10 beds to give a high standard of burn care to an anticipated 275 inpatient admissions and 3500 outpatient appointments each year. Comprehensive patient care includes close proximity of ICU services with good surge capacity for disaster situations (for example the Bali bombings 2002, 2005, the Ashmore Reef disaster 2009). The service includes multidisciplinary care for surgical and conservative burn treatment, comprehensive rehabilitation services, and telehealth management to provide follow up care for those who live in rural areas away from Perth. Research is embedded into the culture of care, and helps provide access to new treatment techniques for patients.

A note about burn severity classification

The thesis proposed to assess posttraumatic growth in patients who we perceived would be more affected by their burn; i.e. those whose burn injury was more severe than others. It is fortunate that the numbers of patients who present to our unit with major burns of more than 20% total body surface area (TBSA) are few. Thus in chapters 2,3 and 6 we have specifically recruited patients whose burn was greater than 10% TBSA and have dichotomised these patients as the more severe burns. It was necessary to use the 10% TBSA as a cut off in order to maximise recruitment. We recognise that the term severe in this case represents the moderate to major burn classifications widely used in the burn care community. Chapter 5 opens the investigation of posttraumatic growth after burn to all burn admissions regardless of TBSA.

List of oral presentations and posters arising from this thesis


**List of publications arising from this thesis**


1. General Introduction

1.1 Overview

The overall aim of this doctoral study was to examine the phenomena of posttraumatic growth (PTG) after burn injury in Western Australia. This multimethod study had three phases. The first phase used mixed methods (paper 1) and quantitative methods (paper 2), and led to the formation of the Model of Postburn Growth and Coping (paper 3). The second and third phases used quantitative methods (paper 4). The first phase examined whether PTG exists after burn injury, and if it exists, how it presents and whether it can be adequately measured with a pre-existing assessment tool. Further it examines the influence of scarring after burn. The second phase assessed the factors that were associated with PTG and how PTG related to other quality of life measures. The third phase assessed a cognitive training program intervention to assess whether improved cognitive function could improve growth. The combinations of these three phases of investigation are discussed, and future research projects and potential interventions suggested.

Mixed method and qualitative studies

1. Phase 1 assessed the presentation and process of PTG after burn, and how it presented in a Western Australian population. In particular we wanted to assess whether the posttraumatic growth inventory could measure PTG after burn injury, or if there were additional factors to consider.

   a. Semi-structured interviews were conducted following with the completion of the posttraumatic growth inventory (PTGI). The journal article “Evaluation of the posttraumatic growth inventory after severe burn injury in Western Australia: Clinical implications for use” has been published in the peer-reviewed journal Disability and Rehabilitation (1). The study found that that PTG after burn is similar to PTG after other types of trauma, but presents with its own burn-specific challenges. This paper can be found with an introductory preface in Chapter 2. Posttraumatic growth after burn injury.

   b. A particular challenge to burn patients is that of visible scarring. A second peer-reviewed paper entitled “Social challenges of visible scarring after severe burn injury: A qualitative analysis” has been published in the peer-reviewed journal Burns. This paper resulted from additional findings from the interviews which revealed burn-specific influences on posttraumatic recovery and growth. These barriers revolve around management of social situations and coping strategies for patients. This has been incorporated into Chapter 3:
Social challenges, reduced interpersonal connection and potential barriers to posttraumatic growth after burn injury.

c. The findings which arose from the interviews, when integrated with the findings from related published literature, created a new understanding of PTG after burn and enabled the synthesis of a new model of burn-specific PTG. This model is of Postburn Growth and Coping is presented in the article published in the peer-reviewed journal Burns entitled “Posttraumatic growth after burn injury in adults: An integrative literature review” and can be found in Chapter 4.

Quantitative studies

2. Phase 2 assessed how other quality of life factors are associated with posttraumatic growth. Quality of life data from the PTGI, the Depression, Anxiety and Stress Scale (DASS), the SF36 (acute version), and the Burn Specific Health Scale- Brief (BSHS-B) were collected at each patient visit. This allows comparison of the positive psychological responses to burn with negative psychological responses to burn, general quality of life measures and burn-specific quality of life measures. This analysis was able to use the quality of life data collected in phase 3 (described below) because the intervention strategy had no effect on PTGI scores. Longitudinal analysis of repeated measures was undertaken and the results are presented in Chapter 5. This paper is has been accepted for publication in Elsevier Burns and is the first longitudinal study to examine this phenomenon.

3. Phase 3 assessed an intervention strategy to improve PTG after burn. The intervention chosen used a training program to improve cognition, in order to assess additional effects on quality of life generally and PTG specifically. Unfortunately recruitment to this was slower than anticipated due to a number of factors. The program was particularly time consuming for patients and required a high level of commitment on their part. The eligibility criteria, especially in combination (TBSA>10%, able to attend FSH for 3 research appointments, the intensive and time consuming nature of the online training, no pre-existing cognitive impairment), considerably reduced the number of potential participants and proved to be a barrier to recruitment and compliance. An interim analysis showed that there was no hint of an effect and recruitment stopped at 30 participants. The results are presented in Chapter 6 and have not been submitted for publication.
Hypotheses

1. We hypothesise that the Posttraumatic Growth Inventory is a valid tool for measuring positive psychological change after major burn injury in an Australian population.

2. We hypothesise that specific factors that can be identified at the time of injury will be associated with posttraumatic growth.

3. We hypothesise that improving cognitive function with a cognitive training program will enable posttraumatic growth through neuroplastic change.

Aims of this research

1) To validate the PTGI in burn injured patients in Australia,
2) To identify factors associated with posttraumatic growth, and
3) To assess an intervention strategy to improve PTGI in burn injured patients.

Organisation of the thesis

The thesis starts with an introduction to the theory of posttraumatic growth, with an overview of research that has been conducted in non-burn populations, and growth can be measured. Chapter 2 describes the presentation of posttraumatic growth in a cohort of patients with more severe burn injuries, and assesses this against a valid and reliable assessment tool. Chapter 3 discusses the problems faced by patients who have visible burn scarring, which was identified as a possible barrier to growth in the interview analysis. Chapter 4 integrates all available research about postburn psychological growth and helps to identify possible factors associated with growth. Chapter 5 uses a quantitative analysis to assess which other quality of life factors are associated with posttraumatic growth and the nature of those relationships. Chapter 6 assesses an intervention strategy aimed at positively influencing growth. Finally, Chapter 7 discusses the expansion of the theory of growth, how it relates to burn injury, and provides a patient information resource with an explanation of the rationale based on the overall findings of the study. Recommendations for future research interventions are given, and the thesis closes with a succinct summary of the whole.
1.2 The theory of posttraumatic growth

Posttraumatic growth (PTG) is ‘the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma’ (5). It is described as growth because it describes development that has occurred beyond pre-trauma psychological functioning, beliefs and values. It is different to resilience which has been defined as the ability to maintain relatively stable, healthy levels of psychological and physical functioning (6). PTG is not a new phenomenon; the role of suffering in generating positive psychological change has long been recognised in religion, literature and Greek tragedy (7). Historically, growth was seen to be part of resilience, but more recently growth has been identified as a separate construct. It is an important part of this study to differentiate between these two interrelated concepts.

Posttraumatic growth is a term that was first used by Tedeschi and Calhoun in 1995 (8) and was inspired by work on thriving by O’Leary and Ickovics in relation to women’s vulnerability (9). A number of theories have been proposed for the process of PTG. Early work in this area, before the moniker of Posttraumatic Growth was coined, builds evidence around this subject. Mahoney’s (1982) model of human change process suggests that human change originates from psychological disequilibrium, and occurs from ‘the pursuit, construction, and alteration of meaning’ (10). Hager suggested that during a chaotic state people establish new adaptive and representational patterns. He described this chaotic state of mind as a ‘gestation’ period, claiming it was different to the chaotic mental states of regression or resistance (11). Miller and C’deBaca investigated the phenomenon of ‘quantum change’. Quantum change is sudden, unexpected and profound psychological change. People who experience quantum change can often identify the date and time of the change, and claim an external source for the triggering experience. The change was characterised by reprioritising values, and these findings concur with current PTG findings. In their study, those with intuitive and feeling personality types reported more quantum change experiences than other types (12). In a study that explored the changes to the self that arise after the death of a loved one, the process of self-reflection was important to make meaning, and was identified as an important component for personal growth (13). This fits well with the process theories of PTG, which suggest that the process of self-reflection creates a new understanding of the self and others.

Tedeschi and Calhoun have explored this phenomenon extensively and propose that PTG arises from a profoundly traumatic event which shatters the assumptions that we have about the world (8, 14). Janoff-Bulman (15) has comprehensively researched the concept of shattered assumptions. The assumptions are the ‘bedrock’ of our understanding of the world, and often operate at a preconscious level. A worldview is the lens through which each individual sees the
world; their perceptions and interpretations of situations and events. It is an intrinsic part of each of us that develops from the moment we are born, and is influenced by our culture, country, religion, immediate environment, parents, family, friends, teachers, television, media, and more. These influences shape attitudes, beliefs, values, personality and, very importantly, our baseline assumptions about the world (15). When an individual’s worldview has been shattered, it is because these core traits have been shattered and we no longer understand the world we thought we knew, so we have to rebuild our thoughts. But we do not have the luxury of the time we had through childhood, or the blank canvas from which we began to build our understanding of the world from birth. We have to recreate something from the shattered pieces.

Janoff-Bulman suggested that there are three core assumptions about the world at large that we share; first that the world is benevolent, second that life and events are meaningful and third that we believe we are worthy (15). Benevolence of the world means that predominantly the world is a good place and that it is the minority who spoil it for the rest. Hence, overall the world is not hostile or malevolent, but is safe and benevolent. Meaningfulness of the world means that we try to understand the distribution of good and bad events to try to make sense of an outcome, to find relationships between a person and what happens to them. This stems from Lerner’s “just world theory” from the 1970s (16) who suggests that people believe that the world is ‘just’ or fair and that we benefit from this belief because if negative events were random then then we feel deeply threatened that events might happen to us. Therefore if we believe that bad things happen to bad people, we protect ourselves from the risk that they might happen to us. If they are not random, and they have meaning, then we will be fine. This leads us on to the third assumption, that we are self-worthy. This is a general evaluation of our own morality, and a general sense that we have some control over outcomes. For instance, that if we eat well and exercise then we will stave off illness, or that if we have knowledge and don’t use it, then it is our own mistake, such as being injured in a car accident when choosing not to wear a seatbelt. These assumptions have been reasoned through the worldview lens of a North American psychologist. North American culture, morality and spirituality will differ to other countries, with different philosophies, religions and accepted behaviours.

Janoff Bulman (17) proposes three paths to PTG. The first path is strength through suffering where she suggests that just as bodies get stronger when pushed physically, personal strengths get stronger when pushed psychologically. The pain of trauma increases awareness of previously undiscovered strengths, and the process involves learning new ways of coping that provides new possibilities in life. Coping is defined as “the use of cognitive and behavioural strategies to manage the demands of a situation when these are appraised as taxing or
exceeding one's resources or to reduce the negative emotions and conflict caused by such demands” (18) (p.97). These are sometimes based on newfound courage and self-confidence in own abilities, or changes to constraints on an old lifestyle. The second path is psychological preparedness in which coping with the traumatic event and its aftermath prepares us for future trauma and allows less traumatisation from future events. This occurs when challenges to the assumptive world results in changes in thinking that allows it to be rebuilt to accommodate an understanding of the traumatic event and acknowledges the possibility of future trauma. The third and final path to PTG proposed by Janoff-Bulman is that of existential re-evaluation. This is when reordered priorities of one’s own health, relationships with others and more connection with God or nature leads to more self-reports of greater life appreciation (17). If posttraumatic growth is dependent on redefining assumptions to rebuild a new worldview, and these assumptions are universal or commonplace, then the traumatised person will be drawing their new redefined assumptions from deep within themselves. The people around them are likely to hold the worldview of the majority. Introspection and deep contemplation might be necessary for ‘coming to terms’ with a situation in the long term. However, it is reported that supportive family environment and active coping through discussion are also necessary for good PTG to occur. Therefore, a number of theories have been proposed to explain how PTG occurs. These theories share similar attributes: a degree of posttraumatic stress leads to rumination and an increased understanding of the self, others and the world. Making meaning of the trauma is important, as is the use of specific coping styles.

Resilience is a separate construct and can be considered a personality trait. Personality traits are broad dispositions and they allow prediction of present human behaviour from past behaviours. Key resilience theories such as Inoculation Theory (19) and Steeling Theory (20) suggest that brief intermittent moderate stress exposure builds resilience. The theories of hardiness and self-efficacy drove work with respect to a “sense of coherence” by Antonovsky. Antonovsky was a medical sociologist who worked extensively with Holocaust survivors and who highlighted the inadequacies of the pathogenic view of health being the absence of disease. Instead, he described health as being on a continuum of ease - disease, with the concept of ‘health’ as being somewhere in this continuum in a ‘steady state’ but with a potential for change. He described a “sense of coherence” as ‘the extent to which one has a pervasive, enduring though dynamic feeling of confidence’ that environmental stimuli are ‘structured, predictable and explicable’. He proposed that the individual has personal resources available to meet the demands posed by these stimuli, and that the demands are challenges which are worthy of investment and engagement. He proposes that for a resilient response to trauma, the traumatic stimuli should be comprehensible, meaningful and manageable (21).
Resilience and posttraumatic growth are often confused in the general post-trauma literature and there is a lack of consensus about how resilience is described (22). A review of resilience after burn has revealed three themes that characterise postburn resilience; namely, relational strengths, positive coping and resistance to trauma symptoms (23). This review illustrates that there are clear areas of overlap between the concepts of resilience and growth, and that has occurred because historically growth was seen to be part of resilience. More recently growth has been identified as a separate construct and it is helpful to separate the two because the differences between them can help us to understand the different effects of trauma and how we can best help our patients. Steele and Kuban (24) describe the differences between growth and resilience, and their concepts are summarised in table 1-1.

Table 1-1 Differences between posttraumatic growth and resilience

<table>
<thead>
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<th>Differences between PTG and resilience</th>
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<td><strong>PTG</strong></td>
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<td>Dynamic.</td>
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<td>Growth.</td>
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<td>Greater posttraumatic stress levels.</td>
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<td>Change to worldview and a rebuilding of assumptions.</td>
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<td>Rumination.</td>
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<td>Focus on event.</td>
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<td>Repressive coping detrimental.</td>
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<td>Develops a better understanding of own personal strengths and so increases self-esteem.</td>
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<td></td>
</tr>
<tr>
<td>Internal struggle to make meaning of the trauma and understand the event.</td>
</tr>
</tbody>
</table>

We propose that the following distinctions should be made; firstly, posttraumatic growth (PTG) is positive change which occurs beyond the pre-trauma condition (8, 9) and secondly, resilience is an attribute which allows a person to remain relatively unchanged by the trauma and to maintain stable, healthy levels of psychological and physical functioning throughout the traumatic episode (25).

Resilience has been described as the capacity to change oneself to adapt to a stressor in order to recover from the effects of that stressor (7). Much of the research informing resilience has studied children. Resilient children are described as having good self-esteem, a good problem-solving ability and good self-regulation. Resilient children ‘bounce back’ to normal relatively unchanged by trauma. It has been reported that in the acute stages after trauma resilient
children need support, but can benefit from repressive coping so they can focus on the future and the present. In comparison, traumatised children do not benefit from repressive coping because they need to tell their story (24). Resilience has been described as a ‘lower bar’ than growth, but it also should be noted that those who report growth may do worse over all (26). A poster submitted to the Australia and New Zealand Burn Association annual conference entitled “Posttraumatic growth and resilience: Similarities and differences” is in Appendix IV.

The five factors of Posttraumatic Growth

Five themes arose from the studies into PTG conducted by Tedeschi and Calhoun. These themes are relating to others, new possibilities, personal strength, spiritual change and appreciation of life (27). The first theme suggests that a better understanding of the value of relationships enable deeper, stronger, closer relationships with trusted partners, family and close friends. Trauma tests the quality of relationships, and strains them. Friends are lost and there is a sense of discovering who your true friends are. They found some people are more willing to open themselves up to others, to say what they think, with a greater freedom to talk about feelings and to reveal vulnerability. Compassion is sometimes greater, particularly for others who have suffered a similar trauma, and this compassion can cause people to reach out to help others (28).

The themes of personal strength and new opportunities are related to a changed sense of the self and a sense of being ‘more vulnerable, yet stronger’ (28). The realisation occurs that the ability to endure this crisis means the ability to endure future events and traumas. This feeling of self-reliance is based on the realisation that they have coping strategies that work for them, but would only be tested in the event of another trauma. Perceiving themselves as survivor, not victim, allows self-labelling that is more positive and impacts on their outcome. The survivor label alludes to having ‘special status and strength’ (14). Life can take a new direction, and the forced opportunity to pause, take stock and reconsider their life path can lead to new opportunities.

Spiritual and philosophical changes present with a realisation of values and changing priorities. Trauma survivors can find more appreciation in ‘the little things’ and of having a ‘second chance’ at life. Changes in spiritual thinking can be found when people endure suffering. Often this is not a strengthening of faith or the continuing belief in a traditional religious doctrine. It can present with a reassessment of spiritual matters, and greater exploration about the meaning and purpose of life. In fact there can be a departure from their original beliefs as they come to terms with their trauma and reassess their questions about life (28).
1.3 The relationship between growth and stress

The relationship between posttraumatic growth and posttraumatic stress has been widely explored in the non-burn literature, but little has been explored in the burn literature. As described above, it has been postulated that growth arises from stress, and that stress is a necessary precursor to trigger growth (15). Some studies have shown a curvilinear relationship between the two with most growth occurring at moderate levels of stress (29, 30) although that pattern has not been identified in burn injury to date (31). Severe trauma causes profoundly negative emotions with posttraumatic stress presenting as normal after a trauma, however progression to posttraumatic stress disorder (PTSD) occurs in a minority of the population. The lifetime risk of PTSD has been reported at 7.8% despite a lifetime exposure of over 50% to trauma (32), highlighting that resilience is a common trait. The relationship between PTG, PTSD and resilience were explored by Bensimon in 2012 who state that trait resilience influences growth after trauma both directly and via PTSD. PTSD is not essential for growth after trauma, but growth is affected by PTSD (33). It is important to remember that much of the knowledge about resilience, posttraumatic growth and posttraumatic stress were documented based on a population who have been impacted enough to seek treatment (25). It is also important to understand that PTG is not the opposite of PTSD (34). Not everyone experiences PTG as a result of suffering, and it has been reported that 30-90% of people who suffer a trauma will experience some aspect of growth (7). A poster submitted to the Australia and New Zealand Burn Association annual conference entitled “Posttraumatic growth and stress: A discussion of the literature” can be found in Appendix V.
1.4 Measuring psychological growth after trauma

There are a number of quantitative scales which have been psychometrically tested to measure positive psychological growth following trauma. There are two scales which assess both positive and negative changes, namely the Changes in Outlook Questionnaire (35) and the Perceived Benefit Scale (36), and there are four scales which focus specifically on positive change, namely the Thriving Scale (37), the Stress-Related Growth Scale (38), the Benefit Finding Scale (39) and the Posttraumatic Growth Inventory (27). These are all Likert scales which ask respondents to assess changes in themselves that have occurred due to the trauma. They are all retrospective self-report measures of psychological change and further details are given below. First, a brief summary of each is given. Next, the Posttraumatic Growth Inventory (PTGI) is discussed in detail as this is the most commonly measure of psychological growth used in the literature and is the measure used in this study.

**The Changes in Outlook Questionnaire**

The Changes in Outlook Questionnaire (CiOQ) is a 26 item, 6 point Likert scale questionnaire that assesses negative and positive psychological changes of personal views about life. The positive items were reported to have a Cronbach’s $\alpha = 0.83$ and the negative items were reported to have a Cronbach’s $\alpha = 0.90$ (35).

**The Perceived Benefits Scale**

The Perceived Benefit Scale is a 30 item questionnaire, with a 5 point Likert scale which ranged from 0= “Not at all like my experience” to 4= “Very much like my experience”. This scale assesses benefits grouped into eight domains; self-efficacy, compassion, spirituality, lifestyle changes, material gain, faith in people, family closeness and community closeness (40). No psychometric properties have been reported for this scale.

**The Stress Related Growth Scale**

The Stress-Related Growth Scale (SRGS) is a 50 item Likert scale that assesses positive changes in personal resources, coping skills and social relationships. The Likert scale for the responses is 0= “Not at all” to 2=“A great deal”. The internal consistency was found to be excellent with a Cronbach’s $\alpha$ of 0.91 and the test-retest reliability over a two week period was $r=0.81$. This is a single factor questionnaire. All items are positively worded, thus there is the potential for response bias, although the authors claim further testing with an equivalent negatively worded scale has shown this not to be the case (38).

**The Thriving Scale**
The Thriving Scale is a 20 item scale which is a combination of 15 selected items from the SRGS, three items from the PTGI, and two additional items from the researchers’ qualitative interview analysis. The 5 point Likert scale, which is scored as a single factor, ranged from 0= “This didn’t happen to me” to 4= “I experienced a great deal of this”. This scale had a Cronbach’s $\alpha = 0.92$.

The Benefit Finding Scale
The Benefit Finding Scale was developed to measure positive psychological change in women with breast cancer (39, 41), and has been used in other areas of cancer and in HIV/AIDS research (42). This 17 item, 5 point Likert response scale claims an excellent internal consistency of Cronbach’s $\alpha = 0.95$ (43), and is scored as a single factor.

The Posttraumatic Growth Inventory
The five themes of posttraumatic growth theory drove the framework for the Posttraumatic Growth Inventory (27). This 21 item questionnaire sets out a series of statements (see table 1-2 for details) and asks how much did the respondent experience this change as a result of their trauma. The responses to each statement are made on a 6 item Likert scale as follows: 0= “Not at all”, 1= “To a very small degree”, 2= “To a small degree”, 3 = “To a moderate degree”, 4= “To a great degree” and 5= “To a very great degree”.

The development of the scale started with a literature review of the perceived benefits of trauma and yielded 34 items. As the inventory was designed to capture positive growth the researchers worded the questions neutrally, to avoid agreement with negative change. The full 34 items, together with a demographics form were tested on 604 psychology students at a single university in the United States. All had experienced a negative adverse event in the previous five years. Events included bereavement, injury, separation/divorce of parents, relationship breakdown, and others. The students’ ages were mostly between 17 and 25 years old, and 95% were unmarried. Analysis showed that 21 items were easily interpretable and that the Pearson product-moment correlation of the Likert score of 34 items and the Likert score of 21 items was $r=0.98$ which demonstrated that there was no significant information loss using the shorter scale. A principal components analysis using varimax rotation identified five factors; relating to others, new possibilities, personal strength, spiritual change and appreciation of life (27).
Table 1-2 PTGI item statements and their factors

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I changed my priorities about what is important in life.</td>
<td>appreciation of life</td>
<td>5</td>
</tr>
<tr>
<td>2. I have a greater appreciation for the value of my own life.</td>
<td>appreciation of life</td>
<td>5</td>
</tr>
<tr>
<td>3. I developed new interests.</td>
<td>new possibilities</td>
<td>2</td>
</tr>
<tr>
<td>4. I have a greater feeling of self-reliance.</td>
<td>personal strength</td>
<td>3</td>
</tr>
<tr>
<td>5. I have a better understanding of spiritual matters.</td>
<td>spiritual change</td>
<td>4</td>
</tr>
<tr>
<td>6. I more clearly see that I can count on people in times of trouble.</td>
<td>relating to others</td>
<td>1</td>
</tr>
<tr>
<td>7. I established a new path for my life.</td>
<td>new possibilities</td>
<td>2</td>
</tr>
<tr>
<td>8. I have a greater sense of closeness with others.</td>
<td>relating to others</td>
<td>1</td>
</tr>
<tr>
<td>9. I am more willing to express my emotions.</td>
<td>relating to others</td>
<td>1</td>
</tr>
<tr>
<td>10. I know better that I can handle difficulties.</td>
<td>personal strength</td>
<td>3</td>
</tr>
<tr>
<td>11. I am able to do better things with my life.</td>
<td>new possibilities</td>
<td>2</td>
</tr>
<tr>
<td>12. I am better able to accept the way things work out.</td>
<td>personal strength</td>
<td>3</td>
</tr>
<tr>
<td>13. I can better appreciate each day.</td>
<td>appreciation of life</td>
<td>5</td>
</tr>
<tr>
<td>14. New opportunities are available which wouldn't have been otherwise.</td>
<td>new possibilities</td>
<td>2</td>
</tr>
<tr>
<td>15. I have more compassion for others.</td>
<td>relating to others</td>
<td>1</td>
</tr>
<tr>
<td>16. I put more effort into my relationships.</td>
<td>relating to others</td>
<td>1</td>
</tr>
<tr>
<td>17. I am more likely to try to change things which need changing.</td>
<td>new possibilities</td>
<td>2</td>
</tr>
<tr>
<td>18. I have a stronger religious faith.</td>
<td>spiritual change</td>
<td>4</td>
</tr>
<tr>
<td>19. I discovered that I’m stronger than I thought I was.</td>
<td>personal strength</td>
<td>3</td>
</tr>
<tr>
<td>20. I learned a great deal about how wonderful people are.</td>
<td>relating to others</td>
<td>1</td>
</tr>
<tr>
<td>21. I better accept needing others.</td>
<td>relating to others</td>
<td>1</td>
</tr>
</tbody>
</table>

Reliability of the PTGI

The internal consistency of the total Likert score was found to have Cronbach’s $\alpha = 0.90$. Dropping items did not reduce this below 0.89. For each factor the scores were as follows:

- Relating to others $\alpha = 0.85$
- New possibilities $\alpha = 0.84$
- Personal strength $\alpha = 0.72$
- Spiritual change $\alpha = 0.85$
- Appreciation of life $\alpha = 0.67$

Test-retest reliability was demonstrated with a sample size $n=28$ and with a test repeat at 2 months. Total score Rho was $r=0.71$ for the total score, but with personal strength low at $r=0.37$, as was appreciation of life at $r=0.47$. The other three factors ranged from $r=0.68$ to $r=0.74$ but further details are not specified in the original paper (27).
Validity of the PTGI

Construct validity was demonstrated through the exploration of the relationship between severity of trauma and PTGI scores. A sample of university students (n=194) completed the PTGI and the Traumatic Stress Schedule (TSS). This latter tool assesses the impact of traumatic events. This tool was used to assess whether the participant had experienced trauma within the last 12 months. The PTGI responses requested were changes that had occurred within the last year. The TSS was used to categorise to trauma or no trauma, and demographic data was collected to categorise between male and female gender, as gender had shown a difference in response. The result was a 2 (female/male) by 2 (trauma/no trauma) design. The results supported the fact that women reported more benefits than men, both overall and in each factor except Appreciation of Life. Those who had suffered trauma reported more benefits than those who had not, both overall and in each factor except Spiritual Change (27). They hypothesised that PTGI scores would be unrelated to social desirability, which they tested using the Marlowe Crowne Social Desirability Scale (n=318). Social desirability was not found to be related to PTGI, but there was a negative correlation with Appreciation of Life; those who reported more Appreciation of Life responded in a less socially desirable way (p<0.01) (27).

Further research into the PTGI: Factor Analyses

The PTGI is commonly used as a single score in many studies, but can also be used for subscale analysis (44). However, a three factor configuration was suggested by Powell, Rosner, Butell, Tedeschi and Calhoun (45) when they used a Bosnian translation of the PTGI to assess positive psychological change in refugees and displaced people after war in Sarajevo. As table 1-3 demonstrates, this factor analysis is more complex with several items cross loaded.

Proposed factors:
1. Changes in self/positive life attitude
2. Philosophy of Life
3. Relating to Others

Original factors
1. Relating to others
2. New possibilities
3. Personal strength
4. Spiritual change
5. Appreciation of life
<table>
<thead>
<tr>
<th>Item</th>
<th>Original 5 factor format</th>
<th>Proposed 3 factor format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I changed my priorities about what is important in life.</td>
<td>5</td>
<td>Not used</td>
</tr>
<tr>
<td>2. I have a greater appreciation for the value of my own life.</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>3. I developed new interests.</td>
<td>2</td>
<td>2(1)</td>
</tr>
<tr>
<td>4. I have a greater feeling of self-reliance.</td>
<td>3</td>
<td>1(2)</td>
</tr>
<tr>
<td>5. I have a better understanding of spiritual matters.</td>
<td>4</td>
<td>1(2)</td>
</tr>
<tr>
<td>6. I more clearly see that I can count on people in times of trouble.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. I established a new path for my life.</td>
<td>2</td>
<td>1(2)</td>
</tr>
<tr>
<td>8. I have a greater sense of closeness with others.</td>
<td>1</td>
<td>3(2)</td>
</tr>
<tr>
<td>9. I am more willing to express my emotions.</td>
<td>1</td>
<td>1(2,3)</td>
</tr>
<tr>
<td>10. I know better that I can handle difficulties.</td>
<td>3</td>
<td>1(3)</td>
</tr>
<tr>
<td>11. I am able to do better things with my life.</td>
<td>2</td>
<td>1(2)</td>
</tr>
<tr>
<td>12. I am better able to accept the way things work out.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>13. I can better appreciate each day.</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>14. New opportunities are available which wouldn’t have been otherwise.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>15. I have more compassion for others.</td>
<td>1</td>
<td>2(3)</td>
</tr>
<tr>
<td>16. I put more effort into my relationships.</td>
<td>1</td>
<td>2(3)</td>
</tr>
<tr>
<td>17. I am more likely to try to change things which need changing.</td>
<td>2</td>
<td>2(3)</td>
</tr>
<tr>
<td>18. I have a stronger religious faith.</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>19. I discovered that I’m stronger than I thought I was.</td>
<td>3</td>
<td>1(3)</td>
</tr>
<tr>
<td>20. I learned a great deal about how wonderful people are.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>21. I better accept needing others.</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Linley et al (46) conducted a confirmatory analysis which compared the original five factor format and the three factor format suggested by Powell et al. on a sample of 372 participants (277 female, 93 male, 2 missing) pooled from two separate studies. They concluded that the original five factor format was a better fit than the later 3 factor format.

The debate about the categorisation of PTG factors continued with an analysis by Taku et al in 2008 (44) that explored the original five factors, a single domain and three higher order domains (table 1-4). The following five models were tested by meta-analysis of 926 adults (681 women, 242 men, 3 missing gender) from 14 studies:
1. single factor
2. three broad dimensional domains
3. five factors based on the subscales
4. three dimensional factors with a single higher-order factor
5. five factors with a single higher-order factor

Table 1-4 The five factors and three higher-order domains of the PTGi

<table>
<thead>
<tr>
<th>Factor</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relating to others</td>
<td>Changed relationships</td>
</tr>
<tr>
<td>New possibilities</td>
<td>Changed sense of self</td>
</tr>
<tr>
<td>Personal strength</td>
<td></td>
</tr>
<tr>
<td>Spiritual change</td>
<td>Changed philosophy of life</td>
</tr>
<tr>
<td>Appreciation of life</td>
<td></td>
</tr>
</tbody>
</table>

The results showed that for this large American sample the best fit was apparent with model three, supporting the original research, and that model one was statistically comparable. The combination of these studies helps to demonstrate the complex interrelationships between the items and factors of the PTGi.

Park and Lechner (7) consider that the evidence for a unitary or multidimensional model of posttraumatic growth is inconclusive. Joseph et al (47) claim that a unitary score for each of the TS, PBS and PTGi are preferred, although they concede that a three factor scale could be considered. The rationale behind the cross loading of factors in the reduced model by Powell et al (45) demonstrates the complexity of the interrelationships between the original five factors for PTG, and face validity would suggest these factors are intrinsically linked with one another.

The changing priorities and values categorised in Factor 5 could drive changes in other factors. The feelings of greater personal strength could be linked to how they relate to others and the quality of relationships. The lack of acceptance of the outcome of the event could lead the drive from dependence on others to self-reliance. Spiritual change could act as a coping strategy and add to personal strength factors. Thus the factors can interlink in a complex manner.

PTGi Short Form

In 2010, Cann et al (48) tested a 10 item short form of the PTGi (PTGi-SF) comprising of items 1, 2, 5, 7, 8, 10, 11, 18, and 19. The strategy was to use two items from each of the five factors to measure growth for a quick and easy research tool with the two items with the greatest loading used. The form had an internal consistency of $\alpha = 0.89$ for the total score, and a range of $\alpha = 0.72$ to 0.84 for each factor. The form performed well, but was only recommended for use if a
total PTGI is required. If the factors are used for individual analyses, then the full 21 item form is preferred. Kaler et al (49) explored the short-form further in a study which assessed PTG in 327 National Guard soldiers as veterans of the Iraqi war. Convergent validity was shown by the positive correlation of total PTGI-SF scores against the post-deployment and unit social support, depression, subjective well-being, intrusive re-experiencing and avoidance symptoms. Additionally, it was hypothesised that there would be a small negative association with depression, but this was not found.

**Content Validity**

An Australian study compared the responses of 88 trauma survivors and a significant other (partners, family members or close friends) to assess behavioural changes and PTGI (Finch 2012). The respondents were asked to rate the trauma on a 5 point scale from mild to very severe, with the intention of omitting those who reported their trauma as mild from the analysis. In fact, all respondents reported their trauma to be moderately severe or worse. They then completed the 21 item PTGI and answered five open ended questions which reflected each of the factors of the PTGI. Almost all (96.6%) of trauma survivors reported post-trauma behaviour changes. They scored highly for Appreciation of Life (86.2%) and Relating to Others (79.5%), less for Personal Strength (48.3%) and New Possibilities (48.9%) and least for Spiritual Change (31.8%). These responses were corroborated by the responses made by their significant other. The study adds to the construct validity of the PTGI.

Further research by Finch, in conjunction with Calhoun and Tedeschi, was completed in 2013 (50) to qualitatively assess the PTGI. The PTGI was completed, and the respondents interviewed to assess their item responses. Saturation was reached by 11 interviews, with a further three completed to ensure that saturation had been reached. The traumas experienced by the participants were surviving a tsunami, physical and psychological abuse by a parent, sexual assault, witnessing multiple suicide attempts by a parent, being on a sinking sea vessel, being attacked by their partner, living with a partner involved in the illicit drug scene, experiencing a house fire and assault, bereavement, stroke and motor vehicle accident. The findings supported the validity of the PTGI finding consistent responses between participants. Two items provided some discrepancies, firstly item 4 "I have a greater feeling of self-reliance" was a little ambiguous with some reporting whether they ‘felt’ self-reliant and others reporting they ‘were’ self-reliant. The second area of ambiguity was the meaning of ‘others’, which was interpreted as both family/friends or as those who have had a similar traumatic experience. Interestingly, those who wanted to indicate that they had experienced a negative change would indicate this by recording a low number of 1 or 2 on the PTGI instead of a zero. Overall, the study demonstrated support for the PTGI, its factor format and its validity.
Criticisms have been made of the PTGI in its lack of ability to encapsulate the full range of positive effects of a trauma, for example improvements in health behaviours have been noted after trauma, and it is likely that after burn injury is a complex and unique trauma that will have positive effects not reflected by PTGI domains (51) This supports the use of the mixed method design in this study.

Negative scales
Criticisms about the absence of a negative scale have been made with respect to the PTGI. The suggestion is that the positive focus can add bias which has been described as a social desirability bias (41) or positive response bias (52). The study of posttraumatic depreciation has been studied by Baker et al (53). Firstly, by creating a Likert scale that runs from negative, through neutral, to positive and secondly, by adding the equivalent question phrased negatively. A bipolar Likert scale forces the respondent to choose between positive effects and negative effects in the same domain. The reality of a traumatic event is that the effects are not so defined and discrete, feelings are mixed and processes are complex. In fact, it appears that this is a normal response to major stressors (27). The point of the assessment is to measure growth, it is not clear how the respondent would choose between the two extremes and could under report both.

Another alternative is to create a 42 item scale which uses the 21 item PTGI and rewords each item into a positive and negative format. The first study by Baker was administered to 286 (226 females, 60 males) undergraduate psychology students in the United States. They completed a Life Events Report to assess exposure to highly stressful events, and then completed the PTGI (as an intact measure) and a depreciation questionnaire which consisted of the same items as the PTGI negatively worded and in the same order as the PTGI. They found that 27% of respondents indicated change on corresponding item pairs. They then assessed the pairs for correlated responses, and found no association on analysis. This demonstrates that growth and depreciation found in the same domain are independent of each another.

The second study assessed 184 participants (136 females, 48 males) and the study was repeated with an essential difference. The items were paired on a single form; some with the PTGI item first, others with the depreciation item first. The findings were similar to the first study; again 27% of participants indicated change in corresponding items despite them appearing next to each other on the form. Again there was no association between growth and depreciation. In both studies, the only items to reach statistical significance were those recorded on the PTGI. The fact that there was no correlation between depreciation and growth in the same domain emphasises the complexity of the construct of PTG, and the fact that
growth was changed enough to reach statistical significance and depreciation was not, emphasises the importance of the construct.

Rationale for using the PTGI in this study
The PTGI was used in this study for several reasons. First, the PTGI is the only measure that has been used to assess positive change after burn to date, and thus it is necessary to use this measure to compare like with like. Secondly, it is the most widely used measure of growth across all types of trauma. Next, it has the flexibility of being used as a single unitary measure or can be analysed at factor level. In addition, the measure specifically assesses positive change, which was the focus of our study, and finally, the 21 item questionnaire is less of a burden to the respondent compared to a longer measure.

The other measures of growth outlined here have some similarities and some differences to the model proposed by Tedeschi and Calhoun. For example, as described above, the Perceived Benefits Scale (PBS) assesses benefits grouped into eight domains; self-efficacy, compassion, spirituality, lifestyle changes, material gain, faith in people, family closeness and community closeness. Commonalities to the PTGI were found in the PTGI factors of priorities, personal strength, spirituality, and closer relationships. Compassion was singled out as a separate entity in the PBS, whereas it is a single item in the domain of relating to others in the PTGI. It is interesting that other measures of growth in the PBS concur with the PTGI items despite having been developed differently, the PTGI items were developed from theory whereas the PBS items were developed from lists of statements given by survivors. The remaining outcome measures for PTG are single factor measurements, but regardless of whether the construct consists of discrete factors or factors that are complexly interdependent, it is evident that specific threads have emerged, and the identification and measurement of these are the main concern.
1.5 Individual factors that have the potential to influence PTG

Demographics

Gender, age and socioeconomic status (SES) all have the potential to affect PTG. Gender differences in posttraumatic growth have been reported in the literature since the initial study in 1996 by Tedeschi and Calhoun with women reporting higher levels than men (27). A meta-analysis of 70 studies agree with this and showed that small to moderate differences have been a consistent finding following a wide range of trauma types (54). These differences were found in respondents who used both the PTGI and the SRGS questionnaires, thereby reducing the chance that the findings are the consequence of using a specific measurement tool. In addition, in this analysis, women reported incrementally more growth than men with increasing age and more growth was reported in adults over the age of 35 compared to those aged 18-34 years. The authors note caution with this finding as there were only five studies which assessed growth in older adults (mean age ≥ 60 years). Akbar & Witruk (55) studied gender, coping and PTG in earthquake survivors in Indonesia, claimed that coping style mediates the relationship between gender and PTG. They suggest that this might be because women are more likely to engage in deliberate rumination and deeply consider helpful issues, such as an appreciation of the importance of their social network and personal relationships. In addition, they reflect that it is socially expected for women to seek social support, whereas seeking support from others can be seen as a weakness in men.

The relationship of PTG and socioeconomic status (SES) has been explored in cancer survivors with mixed results. SES can be quantified by income, education, employment status, or a combination of measures which might make comparison between studies complex and account for contradictory results. Some studies reported that PTG showed a positive association with higher income (56) and education level (57), while others have showed a negative association (41), or did not show a significant relationship between PTG and measures of SES (43). A systematic review that assessed PTG after acquired brain injury found that higher levels of PTG were moderately associated with higher education level, that older age and being of female gender had a small positive effect on PTG scores, and that return to work has a moderate association with higher PTG scores (58).
Personality

Tedeschi and Calhoun (27) used the NEO personality inventory (59) with 325 participants to assess the relationship of the PTGI to personality factors. They hypothesised that growth scores would be positively correlated with extraversion, optimism and openness; for extraversion and optimism these associations were statistically significant in all PTGI factors, for openness the association was significant for total PTGI, new possibilities and personal strength. They state that PTGI scores were negatively correlated with neuroticism, but the magnitude of this correlation is not declared in the results as this finding was not statistically significant. They also claimed that the PTGI scores were positively correlated with religious participation (27). However, it is not within the scope of this study to explore the effect of personality on PTG after burn.
1.6 Posttraumatic Growth after burn injury

PTG has been explored after cancer, sexual abuse, assault, military combat, and other traumatic events (60-64) but there has been little research after burn injury. Current models of burn care and treatment concentrate on the ‘deficit model of adversity’ as a consequence of trauma (65). It is important to explore PTG after burn injury because the constant focus on the negative responses to trauma, and therefore to burn injury, can bias the patient, influence meaning-making and reduce hope for the future (66). Burn injury is unique for many reasons. It is excruciatingly painful, can be life-threatening, and can result in functional deficit, chronic pain, itch and physical and psychological scarring (67-70). In addition, the injury event can incorporate multiple factors which contribute to psychological trauma; unexpectedness, unusual circumstances, feelings of lack of control and guilt, apportioning blame, loss of property, loss of positive body image, long lasting health problems, physical disability and daily changes in the management of activities of daily living, all of which can suddenly shatter assumptions and change worldview (71). At the commencement of this study there were only two studies (72, 73) that had started an exploration of this phenomena in a burn population, with a third published during the course of the study (31).

The first study, published by Rosenbach and Renneberg in 2008 (72), studied a population of 149 burn survivors in Germany. This quantitative cross-sectional study analysed the PTGI against HRQoL measures of coping, general health, social support and mental distress, finding that active coping and social support were the biggest predictors of PTG. The chief limitation of this study was the cross-sectional design, and the authors recommend further longitudinal research, which is a feature of the current study reported in this thesis. Zhai et al (2010) published the second study which was a qualitative study of ten patients in China (73). This study breaks the findings into the two overarching themes of process and presentation of PTG after burn. The authors claim differences in the domain of ‘relating to others’ which they attribute to cultural differences between China and North America. This study had two main limitations, first there was no information about whether the analysis of the small sample size had reached saturation, which is when no new information is revealed by each subsequent interview analysis. The second limitation is the limited geographical area for recruitment, thus limiting extrapolation of the findings to a wider population. The third study, published by Baillie in 2014 (31), was a second quantitative, cross-sectional study in England. It identified that coping styles and perceived social support predicted PTG, and distress and trauma catalysed PTG in their population of 74 patients. The limitations of this study included low response rate of only 33%, and an over representation of women compared to the usual proportion of male: female burn ratio, indicating response bias. These authors also recommend a longitudinal
design for future research. These three papers, together with the initial findings from the mixed method analysis in phase 1 of this doctoral study and related discussion papers, are analysed in great depth in the integrative review in Chapter 4 of this thesis to expand our understanding of PTG after burn, however a short introductory summary of each is given here.

Zhai *et al* (73) interviewed patients, aged 24-48 years, who had sustained a burn injury, between 5 months and six and a half years previously (mean 2.8 years) with a mean tbsa of 69.2% (range 11-90%). A total of ten patients (7 males, 3 females) were interviewed and thematic analysis was conducted. They divided their findings into two categories; process of PTG and presentation of PTG. Under the heading process of PTG they report four themes. First, effective coping strategies indicate specific coping mechanisms; finding an outlet for negative emotions, downward comparison (it could have been worse) and social support. Second, the desire to show gratefulness for the efforts made by their significant others. Third, the need to make meaning from the injury event and fourth, self-efficacy. Self-efficacy is a person’s belief in their ability to succeed in a specific situation and it affects how challenges are approached. The interviews showed expectation to improve, with verbal persuasion and motivation from peers. Presentation of PTG in this population also revealed four themes. First, greater feelings of personal strength occurred in 90% of participants. Second, a new life philosophy was apparent in 70% of participants; the appreciation of life itself was apparent, and new possibilities in life were linked to life orientation and changed priorities, like health over power and money. The third theme for presentation, articulated by 50% of participants, was increased closeness and better communication with their significant others and the loss of friends. Fourth, altruism born of suffering that was linked to greater compassion and finding meaning in 50% of patients. This small study did not reveal differences in stronger faith or religious growth overall, however one patient reported newfound Christianity as a coping mechanism, brought about by the kindness of his mother’s churchgoing friends. Apart from this difference, the findings aligned well with the concept of PTG as defined by Calhoun and Tedeschi. The researchers attribute the differences found in the relating to others domain to the collective vs individual cultural differences between East and West, and the differences in spiritual growth to differences in definition of spiritualism between the cultures. It was interesting that this research was consistent with the changing priorities and new possibilities factors of the original PTGI, as it has been suggested that Eastern style collectivistic thinking would be less likely to foster flourishing in these domains (7). As our individual worldview is shaped by our culture, country, religion, immediate environment, parents, family, friends, teachers, television, media, and more (7, 15) it is likely that PTG would present differently in different cultures.
Rosenbach and Renneberg’s (72) study of 149 patients at 3 months or more postburn sought to identify factors that helped or hindered the acceptance of positive change. These patients had a mean age of 44 (range 16-88) and 57% were male. The mean burn severity was 32.2% (range 1.5% to 90%) and the number of surgeries ranged from 0 to 80, with a mean of 8. In addition to the PTGI, the four following questionnaires were administered. The Coping with Burns Questionnaire (33 items) assesses active and avoidant coping strategies, the Symptom Checklist (9 items) measures subjective impairment concerning physical and psychological symptoms, the Social Support Questionnaire is a 14 item version which measures perceived social support and the SF-12, a 12 item Health Related Quality of Life Questionnaire. A comparison of PTGI scores between those with a TBSA greater than 30% was made with those with a TBSA less than 30% and showed no significant difference, but a limitation of this approach is that by dichotomising the TBSA variable there is a loss of statistical power. In addition, there is no rationale given for the cut-off point. They used correlations and linear regression analysis to assess the relationship of PTG to coping, mental distress, social support, and quality of life. Mean overall score for the whole questionnaire was 57 (out of 105). Mean item PTGI scores was 3.19, with women scoring significantly higher than men overall (p=0.02), and in the factors of new possibilities (0.00) and appreciation of life (0.02). Not surprisingly, mental and physical quality of life scores and emotional distress scores were significantly worse than the nonclinical population norms (p=0.01) and women reported significantly poorer quality of life (mental) than males (p=0.04). Their results identified that those who used active coping and those who had better social support achieved better PTGI scores than those who did not.

Baillie et al (31) sent a battery of questionnaires to 233 patients, and received completed forms from 74 (43 females, 31 males) giving a response rate of just 33%. The mean age was 45.7 years (range 18-82) and they were between 4 and 624 weeks postburn (mean of 69 weeks). Burn severity was 9.41% tbsa (mean), with a range of 1-90% tbsa. In addition to the PTGI, respondents completed the Coping with Burns Questionnaire (33 items), the Multidimensional Scale of Perceived Social Support (12 items), the Impact of Event Scale – Revised (22 items) the Burn Specific Health Scale – Brief (40 items) and the Life Orientation Test-Revised (6 items). These were used to measure coping, social support, posttraumatic stress, postburn functioning and optimism respectively. The geometric means for PTG were reported in this sample at very low levels. Total item mean PTGI scores were 1.26 (range 0 to 4.67), with a total questionnaire score of 32.82. Stepwise linear regression analysis identified statistically significant differences for the following: a positive association with burn severity, action coping, avoidant coping and social support. The researchers state that patients who had face and hand burns had higher PTGI scores than those who had face and body. They then make an illogical leap of speculative
thought in their discussion stating this indicates “function may be more important than visibility”. In contrast to other studies on PTG there was no association found with optimism traits. There was a statistically significant positive correlation between PTG and PTS ($r=0.32$, $p<0.01$) consistent with the theory of PTG proposed by Tedeschi and Calhoun (27). Their findings were limited by the lack of generalisability to the overall burn population due to low response rate, and the misrepresentation of the usual burn male: female ratio. It would appear that females are over-represented in this sample, and as women have been shown to report higher levels of PTG, the overall levels of PTG will be overstated.

**Demographic and burn injury factors**

The influence of age, gender and SES on PTG might differ in a burn population. Baillie et al did not find an association between PTGI scores and age or gender and so these findings were not consistent with Rosenbach and Renneberg who found women reported higher PTGI scores in the factors of appreciation of life and new possibilities. They also report that the oldest category of patients (aged 53-88 years) reported the most growth, but an inconsistent pattern across the four age groups was reported, and significance levels were not reported. (72) Baillie et al did find an association with burn severity as measured by TBSA, in contrast with Rosenbach’s study, who did not. However, Rosenbach’s sample had a mean TBSA of 32.2% with a mean total PTGI score of 57.12 and Baillie’s sample had a mean TBSA of 9.4% and a mean total PTGI of 32.82. The differences observed in each of these two studies suggests that the associations between burn severity, gender and age need further exploration.

**Quality of life measures and posttraumatic growth after burn**

This study uses three patient reported outcome measures throughout. The SF-36 is used to measure general quality of life and the BSHS-B is used to measure burn specific quality of life. These two measures are used routinely to assess patients in our unit. The third measure is the Depression, Anxiety and Stress Scale and is used to measure the negative psychological aspects of postburn recovery. The psychometric properties of these measures are reported in the published paper in Chapter 5, and therefore for the sake of repetition are not detailed in this Introduction. The BSHS-B was used by Baillie et al and a summary of her findings follow. The SF-12, a reduced version of the SF-36, was used by Rosenbach and Renneberg, and so I have also provided the outcomes of this relevant analysis. The DASS has not been previously used in this context.

The BSHS-B and PTG was assessed for association by Baillie et al (31) who found that the overall score of the BSHS-B had a strong positive correlation with PTGI ($p<0.001$). The BSHS-B factor scores were analysed for correlations with total PTGI scores, finding that body image was
associated with PTG (p=0.03) and that heat sensitivity, hand function and work difficulties were strongly associated with PTG (p=0.00). Association with the different factors of the PTGI were not presented in this paper. These would have been interesting because in addition to the implied worse burn severity reflected in these scores, the new possibility factor could reflect changes made in response to these BSHS-B factors. For example, burns survivors will find new activities or new ways to manage previous activities if they are restricted due to heat intolerance or sun avoidance. Equally, restrictions in work type or hours can lead to changes in these areas, and again would be reflected in the new possibilities factor of the PTGI. However, the PTGI scores for this factor in this study were very low (GM=0.74) suggesting that a reported association would not be statistically robust, however it would have been interesting to have reported this analysis.

The SF12 and PTG was assessed for association by Rosenbach and Renneberg (72) and the physical and mental component scores were correlated against PTGI scores (table 1-5). There was a statistically significant negative correlation between the factor of ‘relating to others’ of the PTGI and the physical component score of the SF12. There was also a statistically significant negative correlation between reports of ‘spiritual change’ and a highly significant positive correlation between the factors of ‘personal strength’ and the mental component score of the SF12.

Table 1-5 Correlation coefficients (r) for posttraumatic growth (PTG) and Quality of Life (* P<0.01 and † P <0.05).

<table>
<thead>
<tr>
<th>SF12 domain</th>
<th>PTGI factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of life (physical)</td>
<td>0.207†</td>
<td>-0.004</td>
<td>0.029</td>
<td>-0.055</td>
<td>-0.130</td>
<td>-0.106</td>
<td></td>
</tr>
<tr>
<td>Quality of life (mental)</td>
<td>0.101</td>
<td>-0.032</td>
<td>0.276*</td>
<td>-0.183†</td>
<td>0.016</td>
<td>0.070</td>
<td></td>
</tr>
</tbody>
</table>

1.7 The importance and strengths of this study

The area of psychological recovery after burn has been identified as an important research priority (74), however it is important that we do not limit attention to the correction of health deficits, but that we aim to raise standards and optimise the psychological health of all burn patients. PTG after burn may differ when compared to other types of trauma. Burn-specific factors might influence the presentation, process and progression of PTG, including burn severity, acute and chronic pain, and long-term scarring. Identification of the factors that affect PTG will help us to identify patients who have the potential for good psychological growth after burn injury, and will help us to identify those at risk of poor posttraumatic growth after their injury. Therefore, appropriate and early intervention for this latter group has the potential to help their long-term recovery. While SES and personality factors are not explored within this study, the study is important because it aims to reveal how PTG presents after burn injury, the similarities and difference in PTG after burn compared to non-burn trauma, the relationship of PTG with other quality of life measures during burn recovery, including the relationship with stress and depression. It delivers a new model of postburn growth and coping, and identifies six qualities of growth-related postburn coping that can guide helpful strategies for the burn patient during recovery.

The strength of this study lies in the mixed method design. Mixed methods research draws upon the strengths and perspectives of both quantitative and qualitative methods, by enabling measurement and statistical analysis, and by adding context and breadth to results. Not just the ‘what’ but also the ‘how’ and the ‘why’. Qualitative research is a rigorous, robust, systematic and prime approach to exploring psychosocial aspects of burn injury (75). Combining the research methods is a pragmatic approach that recognises the empirical and practical consequences of a phenomenon (76). When the phenomenon of interest encompasses the reality of human experience, the reduction of these to 21 items in a measurement tool leaves much unsaid. Add to this the knowledge that the measurement tool in question, the PTGI, was originally validated in a population of college students, it is likely that there is more information to capture from the experiences of someone who has survived a burn injury. It is known that quantitative questionnaires do not capture all domains of psychological growth (36) and the qualitative component will add further elements that are relevant to burn injury and meaningful to the patient. In this way, triangulation of the data obtained through quantitative and qualitative inquiry will integrate findings and clarify the theory (77). In this study, a mixed method design was applied to the first phase of the study, without using this design it would not have been possible to identify all the changes that were experienced by the patients, and to assess whether the PTGI scores reflected their experiences. The study design allowed the
identification of other relevant factors to growth, or barriers to growth as perceived by the patient. Strength is added to the final discussion because both the qualitative findings from phase 1 of the study and the discussion of the theories of growth are supported by the quantitative findings about PTG, stress, depression and quality of life measures presented in Chapter 5. Further strength in the study design is added through the longitudinal data collection and analysis which allows greater statistical power from a smaller sample size and insights into the progression of PTG across time.
2. Evaluation of the posttraumatic growth inventory after severe burn injury in Western Australia: Clinical implications for use.

2.1 Preamble

The first phase of this study into posttraumatic growth after a burn injury in a Western Australian population had two main aims. The first aim was to establish whether posttraumatic growth existed in this population, and if it did exist, how it presented. It is important to know which positive changes can occur after a burn injury so that realistic goals can be set for these patients in the future. The second aim was to assess whether posttraumatic growth after a burn injury could be adequately and efficiently measured by the existing tool, namely, The Posttraumatic Growth Inventory (PTGI).

This initial phase of the study used interviews, questionnaires and mixed method analyses to assess these aims and found that posttraumatic growth after burn injury has similar characteristics to posttraumatic growth after other trauma and can be adequately measured by the PTGI. Some of the positive changes experienced by the participants were driven by burn-specific circumstances, and therefore details of the changes differed between different trauma types. As the details themselves are not assessed by the PTGI they are not a barrier to overall measurement.

The PTGI is an assessment tool that takes five minutes to complete. The fact that there is a quick and easy way to measure psychological growth, or lack of it, means that there is an efficient way to assess the need for intervention to promote growth, and equally there is an efficient way to assess the effectiveness of the interventions themselves in a research setting. Hence this can be used clinically as part of a bigger psychological assessment, and it can be used in research as an outcome measure.

Paper published in the Journal of Disability and Rehabilitation; accepted for publication 04\textsuperscript{th} December 2015. Copyright Taylor & Francis; attached in Appendix I and available online at the following link: \url{http://dx.doi.org/10.3109/09638288.2015.1129448}

Keywords: Severe burn injury; burn; trauma; posttraumatic growth; posttraumatic growth inventory; positive change; Western Australia
2.2 Abstract

**Purpose:** Posttraumatic growth (PTG) is ‘the subjective experience of positive psychological change reported as a result of the struggle with trauma. Very few studies have explored PTG after burn injury. The Posttraumatic Growth Inventory (PTGI) is a 21 item questionnaire which assesses five domains in which PTG has been found. Firstly, the aim of this study was to assess how PTG presented after severe burn, and secondly, whether it could be measured by the PTGI in Australian burn survivors.

**Method:** A mixed method approach was used. Seventeen patients who had a severe burn injury at least two years previously were interviewed and completed the PTGI. The interviews were analysed, then compared to the PTGI responses.

**Results:** PTG in burn survivors had similarities to PTG arising from other trauma. Burn-specific context such as heat intolerance and functional problems influenced the type of changes made. Barriers to PTG in relationships were related to guilt burden and visible scarring.

**Conclusions:** PTG presents similarly after burn to other trauma types, but has other features to consider when devising intervention strategies. The PTGI is a five minute screening tool that adequately identifies the presence or absence of PTG in burn survivors in Western Australia, and can guide intervention.
2.3 Introduction

Posttraumatic growth (PTG) is ‘the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma’ (5). It is growth because it describes development that has occurred beyond pre-trauma psychological functioning. Thus, it differs from resilience, which suggests the return to a previous state. PTG is thought to arise from a ‘shattering of an individual’s worldview’, which is shaped by culture and related aspects (7, 15). Rumination about the trauma might initiate and be related to the amount of PTG experienced (7). Posttraumatic stress symptoms can occur concurrently with PTG as one is not considered to be the opposite of the other (34).

Posttraumatic growth was first described by O’Leary and Ickovics (1995) in relation to women’s vulnerability (9). Further exploration led to the development of the Posttraumatic Growth Inventory (PTGI) (71). This tool identifies beneficial psychosocial changes that occur after trauma. PTG has been explored after traumatic events; e.g. in cancer survivors, in war veterans, after myocardial infarction and after domestic violence (60-64).

There are few studies that explore PTG after burn injury. A literature review which assessed religiosity found that North American burn survivors suggested that spiritual beliefs used as a coping strategy might improve PTG scores overall (65). A qualitative study (73) investigated PTG in Chinese burn survivors; they found little change in spiritual growth, but claim differences in other factors such as motivation borne of their obligation and gratefulness to loved ones. The study helped to validate the use of the PTGI in the burn survivor population, however diverse cultural contexts must be considered when generalising research findings and it is likely that PTG would present differently in different cultures.

Two studies used the PTGI as an outcome measure after burn injury. In Germany, a study investigating PTG after severe burn injury (mean total body surface area burn [TBSA] 32%, mean PTGI score 3.19) (72) assessed factors hypothesised to be associated with positive posttraumatic growth. Those who used active coping and had better social support achieved more PTG. Whereas the second study from the United Kingdom assessed PTG after smaller burn injuries (mean TBSA 9.4%), and reported a mean PTGI of 1.26. In this study, higher PTGI scores correlated with worse burn severity, better social support and coping (31). However, evaluation of the PTGI itself has not been explored in burn survivors, thus validation of the tool is required for the interpretation of research. Additionally, recommendations for score interpretation have not been suggested for this population in the literature.
It is important to understand the positive psychological outcomes that are realistic and achievable following a severe burn injury. A tool which accurately measures posttraumatic growth after burn injury is required to identify those who do not experience PTG and to enable the implementation and effectiveness of interventions.

The first aim of the study was to assess how PTG presented after severe burn injury. The second aim was to assess whether the PTGI reflected the lived experience of PTG in those burn survivors; whether it measured PTG adequately, captured all the elements of PTG, and if elements are included which are not relevant. Overall, the aim was to assess whether the PTGI is a valuable tool for use in the Australian burn survivor population.

2.4 Method

A mixed method approach was used to allow detailed understanding of the topic. Qualitative interviews explored the subjective lived experience of burn survivors’ PTG, and were compared against their objective PTGI scores. This qualitative approach put context around the quantitative variables, and allowed the shift of ‘expert’ from the clinician to the patient (78). If the PTGI is to be used as valuable outcome measure after burn injury we expect that the coding from the interviews will corroborate with the self-reported scores on the PTGI. The interviews also help to reveal difficulties in item interpretation, and differences in interpretation between respondents. In addition, the interviews allowed the identification of burn-specific challenges which affect PTG. Thus, this final comparison of qualitative and quantitative results is described as a convergent parallel mixed method approach (79).

Ethical approval was obtained from the institutional Human Research Ethics Committee (REG 13-178). Adults who had experienced a moderate or severe burn injury (TBSA >10%), more than two years previously were approached to participate and were identified from hospital databases. Twenty-nine patients who met the inclusion criteria were invited to participate by letter, five declined, seven did not respond. Thus seventeen were recruited. Following informed consent participants completed the posttraumatic growth inventory screening tool. The PTGI has an overall internal consistency of $r=0.90$ and a test-retest reliability of $r=0.71$ (27). This is a tool that takes five minutes to complete. Participants were asked to carefully consider their responses and were aware that these would be discussed in the interview that followed. Each participant was interviewed by the primary author to explore experiences within each area of PTG. The questions related to the PTGI items but were composed in a neutral format, allowing positive or negative responses equally. The five factors were explored in a semi-structured recorded interview, using both direct questioning and flow. The interviews followed a
conversational format that explored each factor in turn, ensuring discussion around each of the 21 inventory items. Participants were able to expand on ideas and to contribute new information around the area of psychological growth in the context of burn injury.

Analysis

The screening tool has five factors; relating to others, new possibilities, personal strength, spiritual change and appreciation of life. These factors were analysed and assessed for interrelationships. The factors in the screening tool are not represented equally, therefore the median score of each was assessed as total scores are difficult to interpret. The interviews were transcribed verbatim, each interview listened to, and read, twice. Coding was completed using deductive and inductive thematic analysis, and the accuracy of the findings were established using Tesch’s eight step method (79). NVivo software Version 10 (QSR International, Victoria, Australia) was used for data analysis. Saturation point, which is when there is no new information arising, was reached by 15 interviews. A further two interviews were conducted and analysed to confirm saturation (80).

Thematic analysis was performed on the qualitative interview data in two ways (80). Firstly, because the analysis of data draws on the existing concept of posttraumatic growth (27, 34) a top down deductive approach to analysis was used to assess if the interviews corresponded to this framework (81). Each factor of PTG was explored discretely in each interview so that the PTGI could be assessed for adequate fit. PTGI median scores for each factor (tables 2-2 to 2-6) and mean total scores (table 2-7) were calculated and compared to the interview data. Therefore, stage one of the analysis used a confirmatory and hypothesis driven approach (82). Secondly, the data was explored for other themes that related to positive psychological change arising from the context of the burn injury. This required an exploratory approach where the themes were drawn from the individual experiences as identified from the interview data. Therefore, stage two of the analysis used an exploratory and content driven approach (82).

Rigor or trustworthiness was ensured by the following means: Triangulation of data from several sources or references within a source was used to draw conclusions; member checks were performed with a sample of the participants; conflicting information was presented and considered; all members of the research team had relevant experience, and verification of the analysis was performed by researchers experienced with the methods. An audit trail was created and a reflective journal was kept by the first researcher (79, 83).
Demographics

Seventeen participants (11 males, 6 females) were interviewed, this gender ratio (64% males) is representative of the hospitalised burn population in Western Australia (67% males) (84). The median age was 48 years (range 21-75y), and participants were a median of eight years postburn (range 2-33y) with a median TBSA of 30% (range 15-85%) (table 2-1).

Table 2-1 Patient characteristics

<table>
<thead>
<tr>
<th>PSEUDONYM</th>
<th>AGE</th>
<th>YEAR OF BURN</th>
<th>%TBSA</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADRIAN</td>
<td>67</td>
<td>2008</td>
<td>32</td>
<td>Hot gas blast</td>
</tr>
<tr>
<td>ANDREW</td>
<td>37</td>
<td>2002</td>
<td>60</td>
<td>Flame and explosion (blast)</td>
</tr>
<tr>
<td>CHLOE</td>
<td>27</td>
<td>2012</td>
<td>25</td>
<td>Bushfire</td>
</tr>
<tr>
<td>CRAIG</td>
<td>50</td>
<td>1982</td>
<td>65</td>
<td>Bushfire</td>
</tr>
<tr>
<td>DAVID</td>
<td>42</td>
<td>2010</td>
<td>15</td>
<td>Backyard bonfire</td>
</tr>
<tr>
<td>GRANT</td>
<td>70</td>
<td>2002</td>
<td>54</td>
<td>Flame and explosion (blast)</td>
</tr>
<tr>
<td>HANNAH</td>
<td>54</td>
<td>2005</td>
<td>25</td>
<td>Flame and flash (petrol)</td>
</tr>
<tr>
<td>JULIE</td>
<td>21</td>
<td>2011</td>
<td>15</td>
<td>Campfire</td>
</tr>
<tr>
<td>LEWIS</td>
<td>61</td>
<td>2006</td>
<td>30</td>
<td>Flame and flash (petrol)</td>
</tr>
<tr>
<td>MARK</td>
<td>48</td>
<td>2003</td>
<td>30</td>
<td>Flame – light aircraft accident</td>
</tr>
<tr>
<td>MARTIN</td>
<td>75</td>
<td>2006</td>
<td>20</td>
<td>Scald – vehicle radiator</td>
</tr>
<tr>
<td>MAX</td>
<td>41</td>
<td>2003</td>
<td>30</td>
<td>Flame – light aircraft accident</td>
</tr>
<tr>
<td>PETER</td>
<td>46</td>
<td>2011</td>
<td>20</td>
<td>Electrical explosion</td>
</tr>
<tr>
<td>RACHEL</td>
<td>32</td>
<td>2012</td>
<td>65</td>
<td>Car fire</td>
</tr>
<tr>
<td>SHELLEY</td>
<td>22</td>
<td>2011</td>
<td>30</td>
<td>Campfire</td>
</tr>
<tr>
<td>VICKY</td>
<td>66</td>
<td>1998</td>
<td>85</td>
<td>Flame – light aircraft accident</td>
</tr>
<tr>
<td>WALTER</td>
<td>52</td>
<td>2005</td>
<td>54</td>
<td>Flame and flash (acetone)</td>
</tr>
</tbody>
</table>

2.5 Results

Interpersonal Relationships (PTGI Factor 1)

The following themes arose from the interviews in response to the questions around interpersonal relationships, and their relationship to the corresponding items in the PTGI are shown in table 2-2.

Trust and loyalty

The theme of trust was essential to maintaining relationships and defined the breadth of their close network. For example Julie reflected “I just don’t tell my brother as much as I used to... I don’t trust him as much”. She continued “I put more of an effort into Chris’s (partner) relationship... and mine and my mum’s”. Relationships with those outside this close network of confidantes were lost, through the actions or inactions of either party, highlighting the importance of loyalty. A common theme of loyalty was reflected by Andrew “You get to know who your real friends are... the ones that will hang around and help you and the ones who aren’t
your real friends, they sort of disappear”. These themes produced relationships which were closer, smaller, and stronger with a better understanding of the value of those relationships.

Long term support

What appeared consistently was that long term support was often valued and an important dynamic for growth. Those close, supportive relationships were particularly important from family and friends who were present before the burn injury, as they knew the person before the injury and understood their journey since the burn injury with less explanation about the challenges they had faced. Shelley explained about her sister; “She’s been there from day one whereas my friends have been there half way through”, explaining that her friends “are there for like a few months and then they are like ‘oh, this is too hard, I can’t handle it’”. Vicky’s is “amazed” by the ongoing support from friends and family many years after her accident.

Emotional transparency

Transparency of emotions, and the willingness to feel and process these were important to the process of growth. Some participants demonstrated open and accepting experiences of emotion, whilst others reflected emotional suppression. Vicky said that she expresses her love for people more deeply because of heightened awareness of how quickly someone can be lost “now I will say ‘see you later, I love you’”. Whilst other participants expressed and inability to freely access and process their varied emotions as reflected by Julie “sometimes I bottle it up and then it gets too much” resulting in her breaking a few doors, whereas before “I would have just raised my voice”.

Independence vs dependence

Early after the injury, participants were forced to rely on others for physical, emotional and financial support. This was often “frustrating”, “annoying” and hard to accept. The determination to become independent motivated participants and helped them to realise their own personal strength. The transition from dependence to independence occurred over time, and recognising milestones, both small and large was extremely important. Mark resulted in a new level of understanding other people “I’m probably more accepting because I understand a bit more, now I am past that event. They just want to be able to provide some help… and be able to do something for me.”

Compassion

Those who demonstrated self-compassion indicated compassion for others. Hannah, who attributed her burn to “a silly mistake” was more forgiving of herself and others. She described “shock” at how deeply she felt compassion for others after her burn. The experience of
surviving a burn injury gave the participants a point of reference to assess the severity of an experience. Max reflected that his feelings of compassion had “disappeared” because the trauma had been so profound; he revealed that “you start seeing anything else happening to other people as less” and that other people should “get on with it”. Hannah described “intolerance” to those “playing to a sick role” claiming that “you’re not sick until your legs are falling off”. Peter reflected that “bad things” happen to everyone but you can only compare it to “the worst thing that has happened to you”. He showed further insight when he continued that comparison is difficult because “I haven’t experienced your worst thing and to you your worst thing is your worst thing.”

Community
Support from the wider community was valued, and it was recognised that other people wanted to help. Support from the community was described as “amazing” and “stunning”. This “unexpected” community response caused “delight”, and “helped with healing.” Shelley said it was a “good feeling” that they wanted to help. Peter stated that little thoughtful acts of other people helped him to feel better. He believed that people wanted to help and that they “do what they can”. He gave the example of his boss’s wife who cooked meals for his family when he was in hospital. Shelley agreed “the community, they have been amazing, they did a quiz night and the ladies, they did a garage sale and like a bake-off, and so many people did so many things.”

Burden
Participants felt they were a physical and psychological burden to their loved ones, therefore feelings of guilt were barriers to relationships. Walter commented that it is also “about the effect it causes on your family and friends”. Shelley felt stressed not wanting to “burden” her Mum saying that it is hard to “open up” to her family because of causing them stress “I’d rather keep that load on me and you know express it in playing netball”. Likewise, she didn’t want to “push the limits” of her friendships. A combination of admiration and guilt came from Max about his wife “she’s a strong woman, she’s borne the cost of it all as well unfortunately. It’s wore her down a bit”.

PTGI Items for Factor 1

Table 2-2 Factor 1 Interpersonal relationships PTGI scores and corresponding themes

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>ITEM</th>
<th>N</th>
<th>MEDIAN</th>
<th>IQR</th>
<th>POSSIBLE RANGE</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>I more clearly see that I can count on people in times of trouble.</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>0-5</td>
<td>Independence vs dependence</td>
</tr>
<tr>
<td>8</td>
<td>I have a greater sense of closeness with others</td>
<td>17</td>
<td>3</td>
<td>4</td>
<td>0-5</td>
<td>Trust and loyalty</td>
</tr>
<tr>
<td>9</td>
<td>I am more willing to express my emotions</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Emotional transparency</td>
</tr>
<tr>
<td>15</td>
<td>I have more compassion for others</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>0-5</td>
<td>Emotional transparency</td>
</tr>
<tr>
<td>16</td>
<td>I put more effort into my relationships</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Trust and loyalty</td>
</tr>
<tr>
<td>20</td>
<td>I learned a great deal about how wonderful people are</td>
<td>17</td>
<td>5</td>
<td>3</td>
<td>0-5</td>
<td>Community</td>
</tr>
<tr>
<td>21</td>
<td>I better accept needing others</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Independence vs dependence</td>
</tr>
</tbody>
</table>

New Possibilities (PTGI Factor 2)

Three drivers to change were apparent. Firstly, some participants had more time available as a result of being unable to work due to the burn injury. Secondly, the burn necessitated that certain activities had to be undertaken, and other activities were not able to be. Burn-related factors included the avoidance of heat and sun exposure, cautiousness due to skin fragility, restrictions in physical function and the need to complete time-consuming care regimes. Thirdly, there was a change in activity due to new priorities and values. The following themes arose from the interviews in response to the questions around new possibilities, and their relationship to the corresponding items in the PTGI are shown in table 2-3.

Work-life balance

Work became a lesser priority, and with that came the need to find time for valued activities. Hannah said the injury gave her “enough of a wobble to make me contemplate things that I perhaps wouldn’t have contemplated”. She left her job as a Registered Nurse for two years to study Animation Studies. Andrew considered “what’s life all about? He wanted to “make a positive contribution to society” and changed career from fleet controlling to Occupational Health and Safety. Chloe is now less career-focussed and is “trying to find the meaning” in her work role. She made changes to work close to home and to volunteer doing environmental
work in the cool early mornings so she can manage her burn-related intolerance to heat. Others have reduced their hours at work because of functional limitations, or have been close to retirement age and not returned.

Recreation and leisure

Maintenance of physical health was a new priority but required new methods. Chloe previously enjoyed surfing but can no longer because of the need to avoid the sun. Shelley has continued to play netball, but is “scared” to play how she did before because her skin is more fragile. Vicky’s new hobby is gardening, and she likes to socialise, but only when temperatures are cool. Others tinker with cars, travel the “lap” of Australia, walk the Bibbulmen track, and go camping. Travel and family holidays, are important, but can be limited by the sequelae of the burn. Chloe chose Alaska over California for travel, choosing the cold climate because of heat intolerance. Phobias about flying and claustrophobia influenced Vicky; she said “the thought of being stuck on the tarmac for an hour because of whatever” would give her “a complete meltdown”.

Citizenship

Finding ways to contribute to the community was important to some, and was found to help with healing. Andrew said his life was “enriched” through involvement in a community activity that arose as a result of his injury. Others have been involved in peer support groups for burn injury, often with the desire to help others. Craig, badly burnt at 18, attended a retreat to be a “role model” because so he could “benefit someone by talking to them” but instead made new friends. Andrew has joined a public speaking club to improve his confidence to speak to people about burn prevention. Vicky has gained confidence to speak in front of others about her burn. Shelley agreed “I’ve been wanting to do like motivational speaking or going to primary schools...just to help people with fire safety, you know what happens when you do get burnt”.
PTGI items for Factor 2

Table 2-3 Factor 2 New Possibilities PTGI scores and corresponding themes

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>ITEM</th>
<th>N</th>
<th>MEDIAN</th>
<th>IQR</th>
<th>POSSIBLE RANGE</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>I developed new interests.</td>
<td>17</td>
<td>0</td>
<td>3</td>
<td>0-5</td>
<td>Work-life balance Recreation and leisure</td>
</tr>
<tr>
<td>7</td>
<td>I established a new path for my life</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Work-life balance Recreation and leisure</td>
</tr>
<tr>
<td>11</td>
<td>I am able to do better things with my life</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>0-5</td>
<td>Work-life balance Recreation and leisure</td>
</tr>
<tr>
<td>14</td>
<td>New opportunities are available which wouldn't have been otherwise.</td>
<td>17</td>
<td>0</td>
<td>3</td>
<td>0-5</td>
<td>Work-life balance Recreation and leisure</td>
</tr>
<tr>
<td>17</td>
<td>I am more likely to try to change things which need changing</td>
<td>17</td>
<td>3</td>
<td>2</td>
<td>0-5</td>
<td>Work-life balance Citizenship</td>
</tr>
</tbody>
</table>

Participants perceived that some of their changes were not due to their burn injury, more to a resurgence of previous interests. However, those who reported change in the interview reflected this in the PTGI (table 2-3). Item 17, ‘I am more likely to try to change things which need changing’, presented difficulties in interpretation due to its general nature because participants were not sure what “things” we being asked about.

Personal Strength (PTGI Factor 3)

The following themes arose from the interviews in response to the questions around personal strengths, and their relationship to the corresponding items in the PTGI are shown in table 2-4.

Coping

Gratefulness, planning and humour were strategies used to cope. Craig was grateful that his injury was not worse. He said “there are always people out there who are a lot worse off than I am so that lifts your spirits up”. Rachel agreed “be happy with what you are, you know, you could be a lot worse”. Max wanted to “map out” the things he needed to do to recover, and meeting milestones was important. Vicky said of an inappropriate comment about her injury “I was speechless, and then I had this irresistible urge to laugh”.

Strength

Feelings of increased personal strength and pride in oneself were distinct themes. Shelley feels “a lot stronger since the accident.” Hannah was “impressed with herself” and Rachel was
“proud” of her progress. Julie explained “I’ve made it three years, I can make it another three.” Failure was less daunting for Hannah who said the injury had “opened her eyes”; she was “more willing to take a plunge” and felt “less frightened of difficult things”.

**Determination**

The determined drive for mastery or independence, return to normal function, activity and work was a revealed strength. Rachel’s “determination kicked in rapidly” to be able to walk again and dress herself. She said that she hated relying on others and “wasn’t going to be that person”. Craig was reluctant to accept help “she’d just ask if I needed a hand and I would be ‘no, I’m alright’”. Julie did not see her determination to be self-reliant as new “I always did everything myself, I still do everything myself”. Walter said “I took the attitude that to make myself better there was only one person who was going to do it”.

**Acceptance**

The injury was generally accepted and described as “old news” and participants “just learnt to live around it”. A deterministic view was expressed by David who said that “everything happens for a reason” and reflected by Andrew, who was injured in a terrorist attack; “you couldn’t avoid it because it was just something that happened”. The sequelae of the injury was harder to accept. Max said “I lost my hands, I lost my face. Losing your face, I don’t think you ever come to terms with that”.

**PTGI items for Factor 3**

Table 2-4 Factor 3 Personal Strength PTGI scores with corresponding themes

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>ITEM</th>
<th>N</th>
<th>MEDIAN</th>
<th>IQR</th>
<th>POSSIBLE RANGE</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>I have a greater feeling of self-reliance</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>0-5</td>
<td>Strength Determination</td>
</tr>
<tr>
<td>10</td>
<td>I know better that I can handle difficulties</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Coping Strength</td>
</tr>
<tr>
<td>12</td>
<td>I am better able to accept the way things work out</td>
<td>17</td>
<td>2</td>
<td>2</td>
<td>0-5</td>
<td>Coping Strength</td>
</tr>
<tr>
<td>19</td>
<td>I discovered that I’m stronger than I thought I was</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Coping Strength</td>
</tr>
</tbody>
</table>
Spiritual Change (PTGI Factor 4)

There was a deeper understanding that life experiences are both negative and positive. Peter stated that “bad things have happened to everyone.... good things have happened to everyone”. Andrew reflected this and said that things happen as “part and parcel of life” and it was necessary to “ride the cycle” of life. He believed “there is a reason for things”. The use of existing faith as a support was applied to just three participants. Participants described “deeper awareness” of spirituality and that their faith had “helped”. Mark had become more “engaged” in the local Catholic community which thereby provided an expanded social support network. Chloe said her faith was stronger and that she felt a greater desire to be true to herself and tell others “I always knew God was there, but now I’m willing to talk to people about it because it is who I am”.

Others found no change in the type or depth of their religious beliefs. Vicky felt anger towards people who thought she should be happy that “God had saved her ... because I think hang on, that God that saved me took my husband, took my children’s father”. She went on to say that “nature” was her “spiritual guide”. Hannah said she believed that all things were “connected” but didn’t know how. The relationship to the PTGI is shown in table 2-5.

PTGI items for Factor 4

Table 2-5 Spiritual Change Factor 4 PTGI scores and corresponding themes

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>ITEM</th>
<th>N</th>
<th>MEDIAN</th>
<th>IQR</th>
<th>POSSIBLE RANGE</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>I have a better understanding of spiritual matters</td>
<td>17</td>
<td>1</td>
<td>3</td>
<td>0-5</td>
<td>Spiritual change</td>
</tr>
<tr>
<td>18</td>
<td>I have a stronger religious faith</td>
<td>17</td>
<td>0</td>
<td>1</td>
<td>0-5</td>
<td>Spiritual change</td>
</tr>
</tbody>
</table>

Appreciation of Life (PTGI Factor 5)

The realisation that life can change instantly, dramatically and unexpectedly underpinned thoughts. “Everything can change in the blink of an eye, so if you don’t do it now, you may never do it” (Peter). The realisation of the transient nature of life “you never know when it’s going to be over” (Andrew) led to a greater appreciation of life and to make the most of the present moment. Identification and heightened awareness of personal values caused changes in priorities, with the importance of living to these values was evident in the changed nature of activities. The following themes arose from the interviews in response to the questions around appreciation of life, and their relationship to the corresponding items in the PTGI are shown in table 2-6.
Survival

The theme of gratefulness for survival and having a second chance at life was evident. This was regardless of severity of the burn injury. When asked what she appreciated about her life Julie responded simply “That I’m actually alive”. This was reiterated by Shelley who described her “second chance at life” as a “huge, huge thing”. Adrian described finding his “true order” because before the injury he would “say a prayer and ask for something” but after the accident he would say “thanks very much, I’m alive … and thanks very much I appreciate what you gave me yesterday.”

Well-being

Health became a priority for participants, both physically and mentally; particularly in managing the difficulties of burn injury. Physically, this related to the management of heat intolerance, sun avoidance, and reduced function related to the management of fragile scarred skin. This led to the adoption of protective behaviours on a daily basis that changed the way activities were approached and ultimately restricted activity. Shelley said “I’ve changed the way I play netball and picking stuff up and bending down and I don’t use the bottom drawer”. Mentally, this related to coping with the psychological effects, changes in appearance, and the memories of the injury event. The link between physical and mental health was recognised “I know that if I am physically active I’m more mentally better, I appreciate things better when I’m more mentally in a good space” (Hannah). Happiness was a new priority, revealing an increase in self-compassion; for example Hannah’s main priority had shifted to seeking her own happiness, with the happiness of others coming a close second. Vicky said “I’m happy, I’ve got my family, my friends.”

New normality

Accepting a new normal was an important theme. Resuming normal life and return to work was a priority for Julie, who wanted “to get better, and … go back to work.” Determination was a quality that came to the fore in order to overcome both acute and chronic challenges of injury in order to achieve this. Shifts in thinking enabled the acceptance of a new normal “I’ve got a very happy life, you know, it’s not what I would have thought I would have at this stage” (Vicky).

Present moment

Realising the value of life changed priorities and led to changes in how time was spent. The focus had “shifted” from material possessions to family and friends. Peter explained “there is no point in being the richest man in the cemetery”. New experiences became important such as travel and learning. Shelley “can’t wait” to travel. Hannah appreciated her days more and
makes the most of having the time and opportunity to do things she previously did not make time for such as walking and camping. As mentioned previously, less focus on work, and more focus on improving work-life balance was a theme from the interviews. David also attributed some meaning to his injury “to me that was a warning to say you need to slow down” and as a result has made the decision to work for 6 months in a year and travel in the time off.

**Relationships**

Realising the value of significant relationships drove the changes in factor 1. Often this was not seen as a new priority, but one that had been intensified by the experience of burn trauma. Vicky attributes her will to survive the acute stages of the burn injury to her desire to see her children grow up and be happy, and for her to see her future grandchildren. She said “I think you’ve got to have a reason to survive when it’s so severe and mine was always my children. I always wanted to see them happy... and grandchildren, so that really gave me something, and I’ve seen all that now.”

**PTGI items for Factor 5**

Table 2-6 Appreciation of Life Factor 5 PTGI scores and corresponding themes

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>ITEM</th>
<th>N</th>
<th>MEDIAN</th>
<th>IQR</th>
<th>POSSIBLE RANGE</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I changed my priorities about what is important in life</td>
<td>17</td>
<td>3</td>
<td>2</td>
<td>0-5</td>
<td>Life Well-being New normality Present moment Relationships</td>
</tr>
<tr>
<td>2</td>
<td>I have a greater appreciation for the value of my own life</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>0-5</td>
<td>Life Well-being New normality</td>
</tr>
<tr>
<td>13</td>
<td>I can better appreciate each day</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>0-5</td>
<td>Life Present moment New normality</td>
</tr>
</tbody>
</table>
2.6 Discussion

The aim to evaluate how PTG presented in a burn survivor population was achieved.
Understanding potential positive outcomes after burn injury is important so that we can use effective interventions to improve quality of life towards realistic, achievable goals. The components of PTG revealed in the interviews were interdependent. Suddenness and severity of injury changed perspective. Understanding the transience of life led to a greater appreciation of living and appreciation of survival was universal despite extraordinary difficulties. Changes were driven by a realisation of genuine priorities and values, and the desire to live to these.

People were more aware of the value of good relationships, and put more effort into those that were important. Burn survivors retreated into smaller, closer networks dependent on trust, with a realisation of finding out who were true friends. These findings are consistent with PTG after other trauma (7). Additionally, after burn injury, loyalty and long-term support from their significant others were important. Those who had been present and supportive for the long-

### Median factor scores and mean total scores

Table 2-7 Median factor scores and total mean score per respondent

<table>
<thead>
<tr>
<th>NAME</th>
<th>F1MED</th>
<th>F2MED</th>
<th>F3MED</th>
<th>F4MED</th>
<th>F5MED</th>
<th>TOT_MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
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<td>0.0</td>
<td>0.0</td>
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</tr>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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</tr>
<tr>
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</tr>
<tr>
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<td>0.5</td>
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</tr>
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<td>PETER</td>
<td>1.0</td>
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<td>1.5</td>
<td>0.0</td>
<td>3.0</td>
<td>1.6</td>
</tr>
<tr>
<td>MARK</td>
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<td>1.6</td>
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<td>3.0</td>
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<td>1.5</td>
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<td>3.0</td>
<td>3.5</td>
</tr>
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</tr>
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<td>4.0</td>
<td>3.0</td>
<td>5.0</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Key: F1MED=factor 1 median score; F2MED=factor 2 median score; F3MED=factor 3 median score; F4MED=factor 4 median score; F5MED=factor 5 median score.
term understood the full context of the overall situation of the burn injury for that person, without the need for explanation by the burn survivor.

A determination for independence, an increased priority for their own well-being and the need to establish a new normality pushed against the forced dependence they experienced early after their injury. Taking ownership and planning strategies to recover helped. As independence was gained, and improvements were seen, a feeling of greater inner strength and pride in their progress developed. It has been postulated that PTG might be a component of self-determination theory (85) and that higher levels of PTG drive motivation.

Those who revealed self-compassion also expressed compassion for others, especially those who had sustained a similar injury. The injury brought a new perspective and coping was helped if they could compare their circumstances favourably to others, allowing gratefulness and enabling acceptance. Humour was found to be a useful coping strategy, and this finding supports other research in burn trauma (86). The fact that life can change so quickly motivated people to do things today because otherwise the opportunity might be lost, and to try new things. Less focus on finance and work, more on learning and travel, led to a desire to obtain a healthy work-life balance. This is supported by work of the original authors (28).

Burn specific drivers to change were difficulties with heat tolerance and sun exposure, altered behaviours because of skin fragility and tightness, and the constant reminder of visible scarring resulting in the need to explain the injury. These physical restrictions are frustrating and extra determination is needed to overcome or accept these limitations, consistent with other literature (87). These factors often defined the type and detail of change made to work and leisure. A desire to find meaning was clear; both the wish to give back to the community, or to use newfound knowledge about burn injury to prevent others from the same misfortune.

Emotional transparency was influenced by two opposing factors. Feelings of guilt about burden on loved ones for necessities of recovery were barriers to communication because disclosure was perceived as extra emotional burden on them. Conflicting to this was to live true to values, part of which is to be able to express feelings.

Overall, there was little change in spiritual or religious viewpoints, consistent with the PTG after burn in the study from China (73) and other studies that assess PTG and spirituality (65, 88). Changes were occasionally negative; feelings of an unfair God, and occasionally positive; strength drawn from an existing, active faith. There appeared a shift of paradigm from individualist to collective thinking; the awareness that evil or bad things occur and that life is a
‘roller-coaster”, the recognition of greater interpersonal connections, and insight into the importance of community collective. Nature, sunsets and simple pleasures were important sources of spiritual support.

This was a qualitative study in a specific population of Caucasian and English-speaking educated individuals and generalisability of the findings may be limited. Participants relied on recall to complete the PTGI, which could be flawed. Additionally, it would be errant to presume that the burn injury was the only trauma or life changing occurrence in their lives over the years. In fact, participants considered whether changes occurred from the burn injury, other traumas or natural maturation and this reflected their responses. For example, Peter’s responses to the PTGI were marked low because he attributed any growth to another trauma, the diagnosis of multiple sclerosis. Other traumas included death of a loved one due to the injury event, and other life-changing diagnoses such as cancer or diabetes could have resulted in PTG, but analysis of the specific cause of PTG was sometimes difficult for patients to define.

The second aim was to assess whether the PTGI screening tool measures this in a Western Australian severe burn population. A useful tool to measure PTG is important to assess the effectiveness of interventions for research and clinical use. The comparison of the interview findings to the PTGI items were adequately equivalent and the answers given by respondents reflected the interview themes. The mean total scores ranged from 0.6 to 3.9 (possible scores 0 to 5) and represented overall growth. The analysis demonstrated that eight participants scored less than 2.5 and nine scored above 2.5. Therefore, it is possible to divide participants into two populations with a mean score of 2.5 as the dividing point. False low scores were possible if PTG was attributed to other trauma or lack of insight. The researchers suggest that those with a total mean score of less than 2.5 may benefit from interventions to improve PTG outcomes.

Current quality of life assessments are designed to identify and resolve difficulties. The PTGI allows us to measure and potentially facilitate growth. The use of the PTGI is important in clinical care to identify those with low posttraumatic growth scores so that interventions can be suggested for improvement. Additionally, the use of the PTGI in research is important to assess the effectiveness of interventions. Future research should encompass the testing of interventions to improve posttraumatic growth.
2.7 Conclusion

Severe burn injury is a major trauma which can result in PTG. Burn survivors had similar experiences of PTG to that arising from other trauma. Burn-specific context of heat intolerance and functional problems influenced the type of changes made. Barriers to PTG in relationships were related to guilt burden and visible scarring. The PTGI is a five minute screening tool that adequately identifies the degree of PTG in burn survivors in Western Australia. Therefore it is an easy and valuable tool to use to identify the need for intervention, and to evaluate the effectiveness of strategies designed to target PTG. A mean score of 2.5 can be used as a threshold to guide intervention strategy. Although all who have survived a severe burn could benefit from interventions to improve PTG, those with a lower mean score can be identified for more intensive intervention programs. Potential further research could assess appropriate interventions to improve PTG as measured by the PTGI, and potential interventions can be derived from the themes emergent in this paper. This is the first study to assess PTG and to suggest parameters for clinical use in a population of burn survivors in Western Australia.

2.8 Implications for rehabilitation

• The PTGI is a five minute screening tool that adequately identifies the degree of PTG in burn survivors in Western Australia.

• It is a quick and easy tool to use to identify the need for clinical intervention

• It will also evaluate the effectiveness of strategies designed to target PTG

• A mean score of 2.5 can be used as a threshold to guide intervention strategy

2.9 Interview questions

These exploratory questions relate to the PTGI items and are composed in a neutral format, allowing positive or negative responses equally.

Since your burn injury...

How have your personal relationships changed?

In what ways do you approach your relationships differently?

In what ways has your reliance on other people changed?

Are there people you feel closer to? In what ways?

Do you express your emotions differently? In what ways?

Do you see people differently? How?
What have you learnt about others?
Do you think you need people more? How?
What are the important traits you see in your friends?
What have you learnt about friendship?
What new activities have you developed? (Hobbies, sports and others)
What opportunities do you think have arisen that might not have been there otherwise?
In what ways do you do things differently?
How much do you feel you have established a new path in life?
In what ways have your openness to new experience changed?
How has work changed for you?
How have your feelings of inner strength changed?
Do you handle difficult situations differently?
How has your acceptance of outcomes changed?
How have your confidence in your own ability been affected?
Do you have a faith?
Have your religious/spiritual beliefs changed?
What is important to you in your life? Are these things different for you?
Has the appreciation of your own life changed? How?
Has the appreciation of your days changed? How?
3. Social challenges of visible scarring after severe burn injury: A qualitative analysis

3.1 Preamble

A specific burn-related issue was revealed by the interviews that warranted individual attention. This issue was that of reduced and altered social interaction with family, friends and strangers, and this occurred for a number of reasons. The interview questions that explored the first factor of the posttraumatic growth inventory, relating to others, revealed the difficulties encountered with the use of pressure garments and with visible scarring. This is important because the factor of ‘relating to others’ is a large part of PTG, and the items pertaining to this factor in the PTGI account for 7 of the 21 items, thereby revealing both its importance and its potential for impact on final scores. It reveals a potential problem that may limit the PTG gained by the burn survivor, and is particularly important to highlight the burn-specific hurdles faced by people who have endured this specific type of trauma. This means that the location of the burn on the body is important, and although the following paper focuses on the impact of visible scarring to the hands and face, it remains the fact that in our hot, sunny, Western Australian environment the areas of skin commonly visible to other people are much more than the just the hands and face.

This paper is an analysis of the interview for a subset of the patients presented in the previous chapter. The themes around the social challenges of visible scarring were so strong that this warranted its own chapter.

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Keywords: Posttraumatic growth, Social, Visible scarring, Coping, Interpersonal relationships
3.2 Abstract

Introduction: Visible scarring after burn causes social challenges which impact on interpersonal connection. These have health impacts which may worsen outcomes for burn patients and reduce the potential for posttraumatic growth (PTG).

Aim: The aim of the study was to investigate adult burn survivors’ experiences of interpersonal relationships as potential barriers to posttraumatic recovery following hand or face burns.

Method: This qualitative study explored patient experiences of interpersonal situations. A purposive sample (n = 16) who had visible burn scarring were interviewed more than two years after their burn.

Results: Emotional barriers included the fear of rejection, feelings of self-consciousness, embarrassment and humiliation. Situational barriers included inquisitive questions, comments and behaviours of others. Responses depended on the relationship with the person, how they were asked and the social situation. Active coping strategies included positive reframing, humour, changing the self, and pre-empting questions. Avoidant coping strategies included avoidance of eye contact, closed body language, hiding scars, and learning to shut down conversations.

Conclusion: Emotional and situational barriers reduced social connection and avoidant coping strategies reduced the interaction of people with burns with others. Active coping strategies need to be taught to assist with social reintegration. This highlights the need for peer support, family support and education, and social skills training.

Keywords: Burn injury; posttraumatic growth; social; visible scarring; coping; interpersonal relationships
3.3 Introduction

Visible scarring to the hands or face is common following a burn. In Australia, there is facial involvement in 29.6% of patients and hand involvement in 34.3% of patients admitted due to burn (89). The incidence of scarring after burn injury has been reported to be between 32 and 72% (90) and thus, by combining these figures, we suggest that the likelihood of scarring to the face or hands after burn could potentially lie between 10 and 25% of all burn admissions. Scarring after a burn is dependent on patient characteristics such as female gender, young age, genetic factors, and individual physiological response to injury, as well as the depth, size and clinical details of the wound itself (90, 91). Social challenges arise from the presence of visible scarring which has the potential to affect interpersonal relationships and social connection (92).

Social isolation is described as ‘the distancing of a person from their network of desired or needed relationships with others’ (93) and adversely affects physical and mental health (94). It has been reported that physically, increased levels of stress hormones can cause immune dysfunction, cardiovascular dysfunction and hypertension (95, 96). In addition, mentally, social isolation is associated with higher levels of clinical depression and suicidal ideation (97). In addition to the recognised risk of Post-Traumatic Stress Disorder (PTSD) (98, 99) following burn, those who have visible scarring are at greater risk of depression (100), distress and of becoming socially isolated (101) including associated adverse health sequelae.

Within our society, individuals use different strategies to cope with various traumatic life events. Carver et al (102) describe 14 different coping strategies and these have been broadly classified into approach and avoidant focussed strategies (103). Approach strategies are believed to be adaptive and more effective for the resolution of stress in the long term; these involve active coping, planning, seeking instrumental support, seeking emotional support, religion, venting, positive reframing, humour, and acceptance. Avoidant strategies are believed to reduced distress in the short-term, but ineffective in the long-term; these involve self-blame, self-distraction, denial, behavioural disengagement, and substance use. In order to promote optimal recovery, it is important to understand the relationship between coping, interpersonal connection and how this impacts on the potential for posttraumatic growth (PTG) after a burn which results in visible scarring.

Posttraumatic growth (PTG) is ‘the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma’ (5). Posttraumatic growth after burn injury is largely congruent with posttraumatic growth after other types of trauma (1), and is culturally specific (73). A major component of posttraumatic growth are the strengths of
interpersonal relationships and social connections. If these interpersonal connections are impacted significantly then the potential for PTG may also be impacted. It has been documented that interpersonal connection after burn injury is dependent on trust and loyalty, long-term support, emotional transparency, the drive for independence, compassion and community response. Some friendships break down as trust is breached, however valued relationships survive and core support networks become smaller, closer and stronger (1). Interpersonal considerations of psychosocial adjustment and PTG have both been identified as an area for further research in a recent literature review (104). The aim of the study was to investigate burn survivors’ experiences of interpersonal and social relationships as potential barriers to posttraumatic growth after visible scarring to either hands and/or face from severe burn.

3.4 Method

A phenomenological qualitative approach was used to facilitate the interpretation and exploration of meanings and assess the lived experience of burn survivors in relation to their interpersonal relationships. This approach uses thick descriptions to understand the phenomenon of interest. The philosophy of this is that the consciousness of human experience determines what this means to an individual, and was therefore the most suitable to investigate this research area. This was part of a larger mixed methods study which explored PTG after burn. Those who had sustained burn (≥15% total body surface area) at least two years previously were invited to participate for an interview by letter. Their responses to questions about interpersonal relationships in relation to difficult social encounters are reported here. To increase the trustworthiness and credibility of the information, multiple strategies were used. The interviews were initially audiotaped, then transcribed verbatim by the first researcher, with each interview listened to and read several times. Thematic analysis was conducted by the first researcher and confirmed by the second researcher using Tesch’s eight steps of coding (table 3-1). Member checks were completed to confirm the accuracy of the findings and an audit trail recorded coding decisions, data analysis and the critical thinking process (79). NVivo software Version 10 (QSR International, Victoria, Australia) aided data analysis. Data saturation is when no new information is gleaned from the interviews when the data is coded. For this study a further interview was completed to confirm saturation. Ethical approval was obtained from the institutional hospital ethics committee and all patients were recruited from the Burn Service of Western Australia (Human Research EC Approval # REG 13-178).
Table 3-1 Tesch’s eight steps of qualitative analysis

1. Get a sense of the whole: Read all transcriptions carefully. Jot down ideas as you read.
2. Pick one document (interview) go through thinking “what is this about?” Write thoughts about the underlying meaning in the margin. Complete for several participants.
3. List all topics and cluster into similar topics. Form into columns e.g. – major, unique, left over (in this case relevant, not relevant, other)
4. Take list and return to data. Abbreviate topics as codes and write next to appropriate segments of text. Organise to see if new categories or codes emerge.
(Reviewing themes: Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic ‘map’ of the analysis. Unsure of ref; needs rewording)
5. Find the most descriptive wording for your topics and turn them into categories. Look for ways of reducing your total list by grouping topics that relate to each other. Perhaps draw lines to show interrelationships.
(Defining and naming themes: Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme. Unsure of ref; needs rewording)
6. Make a final decision on the abbreviation for each category and alphabetise
7. Assemble the data material belonging to each category in place and perform a preliminary data analysis
8. If necessary recode your existing data

3.5 Results

The semi-structured interviews explored the lived experience of PTG and the influences of social challenges on interpersonal interaction caused by visible scarring are reported here. Of the 17 interviewed; 16 had visible scarring (6 females, 10 males). Thirteen patients had scarring to both hands and face, the remaining three patients had scarring to either the hands or face. Data saturation was reached by the completion of 15 interviews. The patients had a mean age of 46 years (SD 16.7; range 18–61 years), and a mean total body surface area burned (TBSA) of 39.6 (SD 20.3; range 15–85%). Interpersonal connections and relationships of adults with burns are a major component of the PTG experienced after a burn and accounts for seven out of the 21 items in the posttraumatic growth inventory (PTGI), an assessment tool which measures PTG after trauma [17,21,22]. It is feasible that the influences on interpersonal connection therefore may impact on the amount and type of PTG experienced by adults with visible scarring to either hands and/or face after severe burn. The participants in the study reported emotional and situational processes which altered their interpersonal behaviours and the key coping mechanisms that they utilised in their PTG and recovery process.
Emotional barriers to growth

Ten participants (5 male, 5 female) expressed feelings about fear of rejection, self-consciousness, and embarrassment or humiliation in their interviews which could be potential barriers to PTG.

Fear of rejection

A new understanding of their friendships emerged and participants reflected that their burn had polarised their friends into those who were supportive and those who distanced themselves at a time when supportive friendships were of paramount importance. Participants reflected that rejection by these former friends had been difficult to handle and led to the fear of rejection by other individuals that they interacted with. Thus loyalty and long term support were important qualities in friendships, and the remaining friendships were based on a foundation of trust. There was a sense of finding out who their “real” friends were because they would “hang around and help” compared to those who were “faking” their friendships. There was also a sense of shock that their perception of their previous friendship group was incorrect and that the presence and support of their friends was not maintained long-term as reflected by “all the friends I thought I had, they all disappeared” (# 11). The fear of rejection was also a barrier to social interaction because it led to a reluctance to voice their feelings in case friends saw them differently, and rejected their friendship as a result. This was reflected in the quote “I’ve lost so many friends from it . . . I don’t want that to happen I’d rather have them think I’m OK” (# 4).

Self-consciousness

Feelings of self-consciousness arose because of scarring, pressure garments and other burn sequelae, such as itch. One participant expressed the feeling of dehumanisation by others when she explained that “burns patients are not normal in society’s eyes” and many participants reflected that there was the constant feeling that other people “are looking” when they are out in public. Pressure garments also drew attention such as wearing complete pressure suits in hot weather which encouraged other people to think you are “strange because you’ve got all these clothes on” (# 8). Patient 6 was “agitated” by the fact that other people would not understand her problem with itch and worried that other people might assume she was “on drugs” when they see her scratching her facial scars. This phenomenon demonstrates that her worries were coloured by her own worldview and shows difficulty in perspective-taking. Patient 8 reflected that “how other people see you is important”. Feelings of self-consciousness were a barrier to social interaction and led to closed body language by patient 4 who stated “I used to walk with my head down because I didn’t want people to look at my face.”
Embarrassment and humiliation

The concept of public humiliation was a significant issue for some patients. Patient 3 felt “shocked” when a stranger approached her in a waiting room and expected her to discuss her situation in front of other strangers and reflected that the potential to be embarrassed or humiliated was increased when in a social situation with friends. On another occasion the same patient was acutely aware of her friends’ embarrassment when another stranger invited himself to sit at their coffee table and offer self-help advice such as “you know I don’t feel sorry for you”. Several patients reflected that time assisted them to learn to “handle” themselves and their reactions, and decide what was “appropriate”. If the approach or interaction was deemed inappropriate then there was a conscious choice to not respond to the comments and questions from others which illustrates a third mechanism which results in reduced interpersonal interaction.

Situational barriers to growth

Types of social situations encountered are many and varied, however worries about them were centred on two specific themes. Firstly, worry about inquisitive questions about scarring, and secondly, worry about behavioural reaction of others to scarring. Within the first theme, three continua regarding the situations themselves and the interaction were important including stranger-friend, hostile-friendly, and brief-protracted factors. These factors determined the response given by the participant at the time (figure 3-1).

Inquisitive questions

Several patients realised and reflected that questions were the inevitable consequence of visible scarring and were always aware of “what people see... and the questions you are going to get asked”. Patient 13 recognised that people asked questions to comprehend a situation which was beyond comprehension without personal experience “I burnt my finger and I couldn’t even imagine what you went through”. The type of response provided by the patient to questions depended on whether they were asked by strangers or friends, the social context and the manner in which they were asked.

Stranger-friend continuum

The degree to which the inquirer was considered a friend was important because the less known the inquirer was to the participant, the easier it was to decline to answer. It was often reflected that the questions asked by total strangers were particularly intrusive and unwanted. The use of closed body language, lack of eye contact, and verbal strategies were used to close conversations down rapidly. Patient 8 would close conversations by answering with “I had a car
accident. I don’t remember most of it.” Questions from friends were hard because greater explanation was expected. Patient 9 found that catching up with old friends was difficult because deeper discussion was expected: “I did find that catching up with really old friends I didn’t want to go through the explanation of what had happened. I just seemed to have such fabulously prominent scars”.

Hostile-friendly continuum
Patient 6 reflected that she would be cautious when asked “what happened?” and her response would depend upon the manner in which the question was asked by the stranger. If the question came up suddenly or abruptly from a stranger then she would often respond to the question with “none of your business” however if she was asked in kind and compassionate conversation, then she would explain her situation in more detail however she would still be “very careful”. Patient 3, who had sustained an 85% TBSA burn in a light aircraft accident, had reflected that she had learnt to minimise her response to reduce the amount of questioning. She explained that as soon as “you mention the word ‘aircraft’ people want to know more. So I learnt to say ‘I was in an accident’... which is ridiculous because it’s quite obvious!”

Brief-Protracted continuum
Patient 2 stated that transient social situations were less of a problem compared to those which are prolonged: “if you’re out at the shops it’s quick and it’s gone”. If a social situation was prolonged, such as a dinner party, then he would not wear his pressure gloves as he felt that, out of politeness, people were less likely to ask about his scars compared to his gloves. Only one patient (#13), reflected that he did not mind the questions “I can show people and let them know”. Patient 12 reflected that he wanted people to know his story “because I’m conscious of the (my) appearance” and therefore would pre-empt the inevitable questions with an explanation (# 12).

These three continua were factors in the breadth and depth of answers that the participants felt were expected or felt inclined to give. The participants reflected the importance of creating a balance between answering the questions minimally but without causing offence. Patient 8 described that it was “difficult” to answer other people’s questions when she wanted to be left alone. The balance between needing to explain the incident and the desire not to explain for fear of offence improved over time, and with increasing self-compassion, as Patient 3 reflected “before I would have felt that to be polite I would have had to explain... I thought ‘no’ that’s not appropriate”.
Behavioural barriers to growth

Reactions of others

A further theme was their worry about other people’s reactions as they became aware of the extent of the scarring. This worry regarding intimacy was a barrier to new relationships. Patient 4, now 22 years old, described that when you tell someone new about the burn injury “you can feel the change in them”, that they “don’t know how to react and they back off”. Knowing how much to tell strangers was particularly hard to judge and small talk was difficult as any conversation had the potential to lead to further questioning. Because burn scars are time-consuming to manage, chatting about the things that occupy your time results in questions about appointments, massage and exercise. Patient 8 commented that the application of cream and massage of the skin is very time consuming: “the creaming alone is 6 hours a day, and I’m still as dry as hell”. It was reflected that others think the massage “sounds really fun” when “it’s not fun at all, it hurts” (#4). In addition participants reflected that new opportunities for intimacy with others often led to “sky-high” feelings of self-consciousness and feeling “awkward” and “nervous”. It was reflected that enduring certain social situations were evident but a personal challenge: “I always put a brave face on and face the world as you always do” (#4).

Pressure garments

Some participants preferred to wear pressure garments because “people don’t look at your burns. Like I wouldn’t walk out … without my garments” (#4). Patient 8 agreed “at first I found it very constrictive, but I found that it also hid your scars and I felt better in some ways”. Others
preferred not to wear them: “I was supposed to wear one on my ear but I looked like a bank robber so I didn’t” (# 7). Patient 2 found that wearing them encouraged questions such as “people will tend not to comment on scars ... but they comment on gloves”. He continued with the statement that “I've never liked being centre of attention, wearing these (pressure gloves) is not good”. Patient 14 thought they helped him manage questions and accept his injury with “the only thing you got all the time was ‘oh what happened? He said that “it’s probably a good thing because you learn to deal with it. I just say look this is what happened and move on”. Acceptance of things that cannot be changed is an important milestone in the recovery journey.

Coping styles and strategies
Most participants used a combination of avoidant and active coping strategies; eight participants (three male, five female) conveyed avoidant coping techniques and eleven (eight male, three female) conveyed active coping strategies.

Avoidant coping
Several patients reflected that engagement with strangers was inhibited via the avoidance of eye contact and the utilisation of closed body language and closed posture. This form of behavioural disengagement was a common strategy used to avoid negative interaction with people. If interaction occurred which was unwanted and uninitiated by the respondent, then various strategies were used to close the conversation and minimise the interaction. Engagement with friends was inhibited as repeated accounts were tiresome for the patient reflecting “I don't like going over it again and again and again” (# 2).

Additionally, these interactions stir up unwanted emotions and often result in the recalling of the burn event when others asked questions. Patient 1 reflected that he was forced to “break down and cry”. He was very anxious that others might think “it was an act”. Seeking emotional support from close friends and family was sometimes hindered by their worries about maintaining long term relationships and inhibited due to feelings of guilt. Patient 4 worried about burdening her Mum if she opened up to her and Patient 13 agreed, saying “it’s about the effect it causes on your family and friends”.

Perception gaps between the reality of the situation as experienced by the respondent and the misconceptions held by the other people often remained unexplained by respondents in a social situation. Patient 4 removed her pressure glove because it was wet and then described her shock and disbelief when she was asked “did you drop your hand in acid or something?” Instead of explaining her injury she immediately put the wet glove on again “because who else is going to say something to me?” She was worried that others thought she wanted to be “the
centre of attention”. Patient 6 expressed disbelief, saying “some people have no idea” after being asked if her scarring was a “rash” and she said “are you kidding? Can a rash really be this bad?”

Active coping
Several respondents reflected that they used active coping strategies such as changing themselves. Patient 9 suggested that if people want to look at her facial scarring they might as well have something “interesting” to look at and “I died my hair bright white on this side... and I had a bit of a blue streak going for a while”. Patient 3 reflected that humour assisted to mitigate negative feelings when she was told “I bet you wish you were dead” by a taxi driver, and after her initial shock and disbelief suddenly found the situation funny when she thought to herself “thank God you’re not my husband, or I would be dead”. In addition, gratefulness that the injury was not worse helped maintain perspective. In a discussion about burn severity and TBSA in relation to other burn survivors known to the patient, she reflected “I wish I was only 20 (percent TBSA). Sixty-one is a bit of a difference! But then I look at people like XXXX and I am completely blessed in the fact that I still have a face” (Patient 8). The understanding that other people “find it hard to see scars” came from the partner of Patient 16, and illustrated the importance of personal supportive relationships.”

3.6 Discussion

Visible scarring is the external and public manifestation of an internal and personal struggle and is a reminder of the injury that cannot be avoided. The social challenges faced every day by adults with visible scarring from burn creates emotional barriers to interpersonal connection, and affects their behaviour in common social situations. Interpersonal connection between the person with a burn and others is a key component of PTG (14) and thus these factors may affect the potential for PTG.

The various emotional and situational barriers create a vicious cycle of impaired functioning. This study has demonstrated that feelings of embarrassment and self-consciousness reduced interactions with strangers and acquaintances; fear of losing friends reduced interactions with friends; and feelings of guilt related to the burdening of loved ones reduced the interactions with close friends and family. Fear of public humiliation due to other people’s questions and behaviours led to worries about social situations. The findings from this research show that an accumulation of difficult situations experienced increased negative feelings. This helps to explain why social reintegration has been found to be difficult for those with visible scarring (100) and why trust, loyalty and long-term support are such important key components of
successful relationships after burn (1, 27, 28). Self-esteem and patient rated scar assessments for facial burns were not related in the first few months after burn in a German Study (105) but it is important to repeat this investigation at two or more years after injury to assess whether the accumulation of negative experiences has had a negative effect.

The comment that others think they are not normal members of society is a dehumanising belief. If others display dehumanising behaviour towards them, it will reinforce this view of themselves and may promote social isolation (106). If a burn survivor has intrusive unhelpful thoughts, then social avoidance might occur if when triggered by inquisitive questionings. The specific circumstances and context of the social situation often determined the response and the three continua described in this study are logical if the person is anxious about causing offence. For example, if a stranger asked inquisitive questions, the prospect of causing offence was less important than if the person was a friend, although this could be augmented if the questions were asked in a hostile manner. In contrast, when the approach was more conversational, and the closer the friendship, the more open the responses were when given by the participant. This corresponds with early work published in the area of social phobia by Forgas (107) which describes the dimensions of social situations and his later body of work which determined that the manner in which someone asks the questions is important (108). In addition, the concept of self-compassion enabled the person to politely decline to answer, by elevating their own personal needs above those of others who were asking the questions. It also explains why humour is so important to positively reframe the situation and interaction and manage the feelings which evolved. The ability to see things from a different perspective or to use quick wit to respond were both valuable techniques to increase self-confidence to manage awkward social situations. This is in accordance with Kornhaber’s findings in which she describes humour as necessary for coping and acceptance (86). Burn survivors had learned over time to manage conversations or minimise cues that led to questions by pre-empting questions and shutting down conversation with closed responses.

Avoidant strategies included hiding scars under garments or clothing, and using closed posture to avoid other people seeing their scars. Additionally, participants often avoided eye contact or other non-verbal communication that might result in questions about their scarring. It has been documented previously that avoidant coping strategies are associated with higher levels of PTSD and depression after burn (98, 109) and Baillie et al. (31) claim both active and avoidant coping strategies are predictive of PTG after burn, and that posttraumatic stress has been shown to correlate with PTG after burn. Although PTG and PTSD are not the opposite of one another, they share some precursors, such as peri-traumatic loss of control (110). Willebrand et al. (111) claim that individuals who use avoidant coping strategies had the lowest health
status as measured by the Burn Specific Health Scale-Brief. These coping strategies are specific to the social challenges and do not describe the full range of techniques used by burns survivors to manage other aspects of their injury. The strong theme of questions about the injury demonstrates the widespread need of people to understand what had occurred to the burn survivor. On the one hand people wish to assimilate what they see and connect it to an experience they understand, while on the other hand burn survivors value their privacy and to maintain their prerogative to explain their scars when, how and if they please. Internal conflict between wanting to forget the incident and having to address other people’s curiosity was a barrier to social interactions for burn survivors and could lead to social isolation. It is plausible that social isolation could potentially augment existing physiological and psychosocial problems due to the physical injury, be a barrier to PTG and an additional risk to PTSD. This was an adult population of Caucasian and English speaking burn survivors and thus the generalisability of the findings may be limited, as with all qualitative investigation.

Further research could involve quantitatively assessing the association of PTG and coping styles using valid measurement tools such as the Posttraumatic Growth Inventory and the Coping with Burns Questionnaire. The impact of visible scarring on the development of PTSD is outside the scope of this study, and further research into the relationships between growth, distress and coping would add depth and understanding to this area. Further research into effective interventions to help patients is indicated. Cognitive-behavioural therapy (CBT) has been explored to promote PTG after general trauma (112) and CBT in combination with social skills training has been explored to help people cope with having a visible difference (113) showing a reduction in depression, anxiety and concerns about appearance. This latter programme is online and computer based, thus bridging the two gaps of wide geographical spread of participants and narrow resource capacity. Self-expression or disclosure interventions have also been shown to promote PTG after types of trauma (112). Therefore, activities such as expressive writing, written journals, audio and video diaries and talking therapies could be explored for their effect on PTG after burn, particularly for those with visible scarring. Thus, further research into CBT, social skills training and self-expression techniques are needed. Social and peer support assists burn survivors come to terms with their injury and can help them normalise their experiences and create a feeling that they are not alone (86) and has been previously identified as an important factor which influences PTG after burn (72). If those who have visible scarring can understand possible reasons behind comments, questions and non-verbal negative communication such as staring, it can assist them to reframe the situation in a positive manner. Social skills training might assist them to manage social situations and is another active way to help them feel more in control of the unexpected.
3.7 Conclusion

There is a dichotomy between other people’s need to understand different aspects of a burn and the burn survivors’ need for privacy. Visible scarring means that the survivor is unable to forget as questions are asked without warning by complete strangers. Emotional and situational factors interact to create barriers to connection with others in order to protect the self. Positive reframing, humour, personal change and gratefulness were all active coping strategies which helped burn survivors cope with their visible scarring. Avoidant coping strategies included avoidance of eye contact, closed body language, using pressure garments and clothing to hide scars, and shutting down conversations. These avoidant strategies are also barriers to effective and open communication. Visible scars due to burn have a substantial effect on interpersonal relationships, increasing risk of social isolation and the associated sequelae and acting as a potential barrier to PTG. Social skills training, peer support and good communication within their own close family and friends may develop active coping strategies which are useful in managing social challenges.

3.8 Implications for practice

- Burn survivors with visible scars accumulate bad experiences of social interaction
- Inquisitive questions, comments and stares are often encountered
- Emotional and situational barriers reduce interpersonal connection
- Responses depend upon who asked, how they asked and the social situation
- Humour, gratefulness, self-compassion and social support help with coping
- The provision of information to patients and families, support and education is necessary
- Psychosocial training for all staff who deal with patients who have visible scars from their burn injury is important
4. Posttraumatic growth after burn injury in adults: An integrative literature review

4.1 Preamble

The initial part of this study revealed the process and presentation of PTG in burn survivors in Western Australia. It revealed the similarities between PTG after burn and PTG after other trauma, and confirmed that the PTGI was an adequate assessment tool to measure growth after burn injury. An exploration of the qualitative interviews provided context around this, and revealed the differences between general trauma-related growth and specific burn-related growth. The next stage was to exhaustively search through the literature to determine related information about PTG after burn injury and to examine this in a thematic manner to look for commonalities and conflicts, and combine the findings from all available related literature, both qualitative and quantitative. This would also help assess cultural variations, and extrapolate the findings from the studies across cultural and geographical boundaries. The searches for this paper were completed in May 2016.

Paper published in Elsevier Burns: the Journal of the International Society for Burn Injuries; accepted for publication 13 October 2016, copyright Elsevier. This can be found in Appendix III and is available online at the following link: http://dx.doi.org/10.1016/j.burns.2016.09.021

Keywords: Burn injury; posttraumatic growth; trauma; psychological growth; positive change
4.2 Abstract

Introduction: Posttraumatic growth after burn injury is a relatively new area of study with only a small number of studies that have examined this phenomenon. It is important to understand the presentation of posttraumatic growth and coping in burn survivors, how it changes over time and the components which influence growth so that we can understand how to promote posttraumatic growth in burn survivors. The aim of this review was to assess these three parameters.

Method: Studies were identified through multiple databases with specific search terms to identify posttraumatic growth after burn injury. From the 813 articles found, 57 were identified as potentially useful, and 8 as eligible for review; three qualitative, one mixed methods, two quantitative, one discussion paper and part of a review which assessed all psychosocial outcomes.

Results: Growth presented as realising personal strength, reprioritising, spirituality, humanity, changed relationships, and compassion and altruism. Styles of coping included feelings of gratefulness and downward comparison, humour and planning. Suddenness of the event, and the severity and location of injury might affect the amount of growth experienced. Overall function, quality of life, social support and optimism, hope and new opportunities are postburn influences on growth, all of which have the potential for improvement through targeted intervention strategies.

Conclusion: The Model of Postburn growth and coping is proposed. Further research is required in many areas related to growth, intervention and measurement.
4.3 Introduction

Surviving a burn injury is associated with long-term physical and psychosocial impacts. Most postburn psychosocial research has focussed on psychopathology and quality of life (104) and thus the focus has been on problems and deficits brought about through burn injury. It is important to identify, measure and treat the impact of these appropriately to guide intervention. However, trauma has been known to promote psychological growth (8) and change our outlook (66) with little attention provided to this phenomenon after burn injury.

An important distinction needs to be made between the two constructs of posttraumatic growth and resilience. Posttraumatic growth (PTG) is positive change which occurs beyond the pre-trauma condition and was first described in 1995 (8, 9). Resilience is an attribute which allows a person to remain unchanged by the trauma, or to “bounce back” to the pre-trauma condition. However, definitions of resilience vary and there is a lack of consensus in the literature (22). Historically growth was seen to be part of resilience, more recently growth has been identified as a separate construct. Resilience has been described as a ‘lower bar’ in comparison to growth. However, it is a complex area and it also should be noted that those who report growth may also do worse over all (26).

The focus of this review is on how posttraumatic growth has been documented within the research literature specifically in relation to burn injury. The Posttraumatic Growth Inventory (PTGI) was designed by Tedeschi and Calhoun (27) to measure this construct, and has been used widely within general PTG research literature. There are other measures of positive outcomes in health such as the Benefit Finding Scale (39, 41), the Changes in Outlook Questionnaire (114) and the Stress-related Growth Scale (38), however these measures have not been reported in detail within the burn injury literature.

Although quality of life after burn injury survival has been widely explored within the research literature, the assessment tools used to measure quality of life after burn focuses on problem identification with the aim of restoring normal physical and psychological function (115-117). Therefore the quality of life assessment tools identify and evaluate negative health states in order to return to pre-burn functioning, rather than assessing progress beyond the pre-burn level. Thus quality of life measures will not be the focus of this review.

It is important that we understand the presentation, process and progression of posttraumatic growth (PTG) across time after burn injury, and the factors that influence its evolution. The clinical implications of understanding this better will mean that we can advise and support our
patients towards growth, and deliver and assess programs designed to promote growth. Potentially, this will ensure that we do not just aim to return our patients to a new normal, but that we can encourage them to progress beyond their previous level of psychosocial and physical functioning.

The overall aim of this integrative review is to explore the literature which explicitly describes posttraumatic after burn injury and discuss how this relates to other literature about psychosocial recovery. The specific aim is to identify and critique the current literature with respect to posttraumatic growth or positive change following burn injury in relation to its 1) presentation and coping 2) temporal changes and 3) associated factors in order to synthesise new insights, implications for practice and areas for investigation and research.

4.4 Method

An integrative review builds a comprehensive understanding of a phenomenon to inform clinical practice, future research and policy (118). It is a useful method to use for this subject area because it can assess quantitative, qualitative and mixed method research together. Evidence based practice is essential to drive quality care, and literature reviews play an important part in compiling and assessing the current evidence to understand the current position, identify the gaps that need to be bridged, and reveal future directions (119).

The search strategy was guided by the process detailed in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (120) and is summarised in figure 4-1. The databases Cinahl Plus; Medline; Embase; PsycINFO; Proquest; Pubmed; Cochrane; Scopus were searched in March 2016 using specific search terms. In addition to this search strategy, citation searches were completed on key papers which specifically investigated PTG after burn injury to ensure completeness. Hand searches of linked citations of relevant papers were conducted, and a search of the grey literature via the Trove database conducted. The results are shown in Figure 1.

Identification of relevant papers for inclusion

Search terms:
1. Burn injury AND
2. Posttraumatic growth; psychological growth; adversarial growth; positive change; adaptation; adjustment; thriving; benefit finding; resilience.
Population studied:

Burn injury in adults only. The rationale: For children, psychological growth is hard to differentiate from normal maturation, and in fact, it could be argued that the burn injury becomes integrated into this growth process.

Screening criteria for papers

These were screened for inclusion by an initial review of the title and abstract.

Included papers limited to:

1. English language papers or papers translated to English.
2. Since 1990.
3. Full text only.
4. Peer reviewed journal articles.
5. All study designs – qualitative and quantitative.

Full text assessed for eligibility

Exclusion criteria:

1. Not burn injury (burn-out commonly captured under above strategy).
2. Not PTG - PTG mentioned in the introduction or discussion, but the concept of growth itself not examined in the research.
3. Paediatric cohort or childhood burn injury.
4. No PTG or elements of PTG evident in paper. Thus papers which evaluated resilience, quality of life, or psychological adjustment that was not associated with growth were excluded.

Critical appraisal, analysis and integration of papers

After a thorough search and assessment of the literature, a total of eight papers were identified as eligible for review; three qualitative (73, 121, 122), one mixed method (1), two quantitative (31, 72), one discussion paper (65) and one review of psychosocial recovery after burn which included PTG as a theme (104). The mixed method paper (1) was research completed by the current authors of this review. All papers are summarised in table 1. The literature search was completed by the first author (LM) under the guidance of SM and the final selection discussed and confirmed by FW and SR. Critical appraisal of each article was completed using the appropriate guidelines as defined by Greenhalgh (119). Methodology for the integration and synthesis of data was completed using strategies described by Whittemore and Knaf1 (118) who recommend techniques for data reduction, display and comparison and define the key elements of data analysis. The qualitative data was compared for patterns, themes and relationships. It should be noted that McCormack et al (122) qualitatively investigated PTG in a
burn survivor after the Bali Bombings of 2005, and the authors attributed more change to the bombing rather than the burn. However, they stated that the participant “was positioned in close proximity to the suicide bomber during the attack and thus sustained extensive physical injuries” requiring long hospital treatment, and therefore this qualitative account has been included. The quantitative data was assessed for verification and support of the qualitative themes, and provided an understanding of the amount of growth reported in each area, if measured. These studies were useful to help understand the strength and quality of relationships between PTG after burn and related factors. Finally, a discussion of the findings summarises the evidence into a proposed model for postburn growth and coping.

Figure 4-1 Literature search flowchart
<table>
<thead>
<tr>
<th>Reference/Year/Country</th>
<th>Aims/Research questions</th>
<th>Study design/Outcome measurements</th>
<th>Population</th>
<th>Contribution to the PTG literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Askay SW &amp; Magyar-Russell G Post-traumatic growth and spirituality in burn recovery (65) 2009 USA</td>
<td>To discuss: PTG concepts in general and after burn. Measurement issues and make recommendations for future research. How a therapist can create an atmosphere for growth. The role of religion and spirituality in burn recovery.</td>
<td>Discussion paper that assesses two reviews about PTG after trauma (5, 66) and one article about PTG after burn (72) and discusses the need to meet the spiritual needs of the patient.</td>
<td>Not applicable</td>
<td>Reviews Rosenbach’s paper and discusses the role of spiritual support and religious coping after burn.</td>
</tr>
<tr>
<td>Attoe C, Pounds-Cornish E Psychosocial adjustment following burns: An integrative literature review (104) 2015 England</td>
<td>To identify key findings of all aspects of psychosocial adjustment postburn. To identify future directions for research and practice.</td>
<td>Integrative literature review about all aspects of psychosocial recovery after burn. The PTG component identified and assessed Askay et al (65) and Rosenbach et al (72).</td>
<td>Not applicable</td>
<td>Reviews Askay’s discussion paper and Rosenbach’s paper. Reinforces the recentness and paucity of literature around the construct of PTG, and recommends further research in the burns population.</td>
</tr>
<tr>
<td>Baillie SE, Sellwood W, Wisely JA Post-traumatic growth in adults following a burn (31) 2014 England</td>
<td>To examine PTG after burns, using quantitative measures of clinical severity, growth, social support, coping styles, dispositional optimism, posttraumatic stress and quality of life to determine potential predictors of PTG.</td>
<td>Quantitative cross-sectional analysis of questionnaires: PTGI; CBQ; MSPSS; IES-R; BSHS-B; The LOT-R; clinical burn severity measures. n= 74 (33% response rate). 42% male. Age 46y (range 18-82y). TBSA 9.41% (range 1-90%); Postburn time 69 weeks (range 4-624 weeks).</td>
<td></td>
<td>Assesses PTG in a population in a population with a wide ranging TBSA. Quantitative study which explores self-reported growth scores via the PTGI and associated factors.</td>
</tr>
<tr>
<td>Authors</td>
<td>Title</td>
<td>Year</td>
<td>Country</td>
<td>Aim</td>
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<tr>
<td>Martin L, Byrnes M, McGarry S, Rea S, Wood F</td>
<td>Evaluation of the posttraumatic growth inventory after severe burn injury in Western Australia: clinical implications for use (1)</td>
<td>2016</td>
<td>Australia</td>
<td>To assess how PTG presents after burn injury and if these changes were adequately measured by the PTGI.</td>
</tr>
<tr>
<td>McCormack L and McKellar L</td>
<td>Adaptive Growth Following Terrorism: Vigilance and Anger as Facilitators of Posttraumatic Growth in the Aftermath of the Bali Bombings (122)</td>
<td>2015</td>
<td>England</td>
<td>To explore the impact of a terrorist attack on the psychological wellbeing of a person who sustained serious burn blast injury.</td>
</tr>
<tr>
<td>McLean LM, Rogers V, Kornhaber R, Proctor MT, Kwiet J, Streimer J, Vandervord J</td>
<td>The patient-body relationship and the 'lived experience' of a facial burn injury: a phenomenological inquiry of early psychosocial adjustment (121)</td>
<td>2015</td>
<td>Australia</td>
<td>To gain greater insight into the lived experience of facial burn injured patients with a focus on the possible changes to relationship with the body and early psychosocial adjustment.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Year</td>
<td>Country</td>
<td>Study Objective</td>
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<tr>
<td>Rosenbach C, Renneberg B</td>
<td>Positive Change After Severe Burn Injuries</td>
<td>2008</td>
<td>USA</td>
<td>To investigate PTG in burn patients and to identify correlates facilitating or preventing the acceptance of positive change.</td>
</tr>
<tr>
<td>Zhai J, Liu W, Wu J, Jiang H</td>
<td>What Does Posttraumatic Growth Mean to Chinese Burn Patients: A Phenomenological Study</td>
<td>2010</td>
<td>China</td>
<td>To discover the experience PTG in Chinese burn patients and find out if there are dimensions of PTG that are not tapped by the PTGI, and to describe common and unique factors that facilitate PTG.</td>
</tr>
</tbody>
</table>
4.5 Results

The presentation and temporal evolution of PTG is described here, followed by other associated factors.

Presentation of PTG

Posttraumatic growth after burn injury presents in three domains; a better understanding of the self, a better understanding of the world, and a better understanding of other people. Each of these domains has two sub-domains. In addition, the relationship of coping to PTG is inherent in the presentation of PTG, and is discussed here.

Understanding the self

The first domain, a better understanding of the self, has two subdomains; realising personal strength and reprioritising due to realising true values.

1. Realising or finding personal strength

The theme of personal strength was strongly evident throughout the research literature. Qualitative studies found that burn survivors felt that they were either stronger as a result of managing the challenges of burn injury (65), or that they had realised their existing strengths (65) and better understood their innate robustness and resilience (121) which led to feelings of personal pride (1, 65). Personal strength was the predominant dimension of PTG occurring in 90% of study participants in China and was thought to reflect new found self-efficacy (73). Self-efficacy is the belief in one’s ability to manage tasks, control over their own events and reach personal goals (123), and this concept was supported by other researchers who identified that the determination to progress towards independence and recovery was important (1). Several of the quantitative research studies also provided support for this theme and revealed that the PTGI factor of personal strength depicted a notable area of change (1, 31, 72) with median scores of 2-3 (1) and mean scores of 1.41 (31) and 3.41 (72) out of a range from 0 to 5. Thus, the theme of increased personal strength, or recognising resilience with pride, is shown to be a key component of PTG and occurs as an individual develops a better understanding of their self.

2. Reprioritising

The theme of understanding one’s true values and reprioritising the important aspects of life was a major theme of posttraumatic growth after burn. Qualitative studies demonstrated that a new life philosophy or narrative was borne from the gratefulness of survival (1, 73) and the preciousness and fragility of life (121, 122). These feelings of fragility brought anxiety and the process of finding this new narrative took time (122). New priorities which were developed
included increased appreciation of one’s own health and well-being, and of other people and a return to family values (121) away from material possessions (1). It was clear that the reminder of one’s own mortality drove appreciation of the present moment and the premise to no longer take things for granted (1, 73, 121, 122). The various quantitative studies assessed factor 5 of the PTGI (Appreciation of Life) as having been positively impacted with a higher injury severity; with median scores of 3-4 (range 0-5) (1) and a mean score of 3.6 (72) out of a range of 0 to 5 in patients with mean TBSA of 30% or more, and moderately impacted in smaller TBSA injuries with a mean score of 1.4 (31). Thus, the theme of reprioritising values is a further component of PTG and may occur as an individual develops a better understanding of their own values.

Understanding the world
The second domain of a better understanding of the world has two subdomains of spirituality and humanity.

1. Spirituality
The theme of spirituality was identified as a factor in the PTGI and is discussed in full by Askay and colleagues who postulates that individuals who use religious or spiritual coping methods appear to have more growth potential (65). These qualitative studies appear to describe variable findings with faith being negatively or positively impacted by a burn trauma and the existence of faith can be used to support burn survivors or can be eroded by their traumatic experience (1). In some instances, changes may not be recognised by the burn survivor as relating to spirituality, and some burn survivors reflected changes in their thinking styles which were fatalistic (122) or deterministic (1). In some instances, spirituality assisted in meaning making and recovery for some burn survivors but was not noted for others (121) and 90% of the Chinese patients reflected not expressing changes in their religiosity (73). The quantitative studies report the PTGI factor ‘Spiritual Change’ and was measured by 2 items on the inventory. The quantitative studies reported median scores of 0-1 (1) and mean scores of 0.47 (31) and 2.09 (72) out of a range of 0 to 5. These scores are clearly lower than the other domains of the PTGI with changes in spirituality appearing to be both individual and cultural.

2. Humanity
A deeper understanding of the nature of humanity was a further theme that emerged from the review of the research literature. The qualitative studies reflected that the realisation of human vulnerability was a shock (1) and that the question ‘why me?’ could be a recurring question (122). This led people to seek meaning to assess why the burn happened, and the meaning of life (1, 73, 121, 122) and was identified as a priority in the discussion by Askay et al (65). In fact, the level of community support and generosity amazed the burn survivors and led them to
realise that people want to assist and will do what they can (1, 121). It was important to note that the process of creating a better understanding that people make mistakes appeared to foster forgiveness (1) and humanitarianism (122). As this aspect was not measured specifically by the PTGI, it was not reflected in the quantitative studies, but was closely linked to the theme of spirituality.

Understanding others
The third domain of a better understanding of others has two subdomains of changed relationships and compassion and altruism.

1. Changed relationships
An overriding theme was with respect to the changes that occurred to personal relationships. The qualitative studies described a process of greater connectedness and closeness with trusted family members (1, 73, 121) and the feelings of strength and resilience that this encouraged (121). It was reflected that long term support was important to aid recovery and growth, and assist with the transition from a position of dependence to independence (1). It was also noted that there was a greater awareness that people cared (73) and that friends and family want to assist in times of need (1) resulting in improved feelings of self-worth (121). This was overshadowed by the loss of some friends and an increased clarity of the true nature of previous friendships. The quantitative studies reported relationships with others via factor 1 of the PTGI. This was the largest factor accounting for seven of the 21 items of the PTGI. The quantitative studies reported median scores of 2-5 (1) and mean scores of 1.46 (31) and 3.41 (72) out of a range of 0 to 5. The themes of reprioritising values, combined with a better understanding of others and an improved clarity of existing relationships, drove the changes within this theme of changed relationships.

2. Compassion and altruism
Another theme that emerged involved a new understanding of other people which led to greater compassion and the drive towards altruism (1, 73). The qualitative studies revealed that some burn survivors felt a greater compassion towards others, particularly those who also had a burn injury. It appears that compassion, in conjunction with feelings of citizenship and connection with the community, motivated the desire to want to pay back or pay forward in altruistic ways (1, 73, 121). Zhai et al (73) suggested that this need to be altruistic was also borne of suffering, and that helping others increased self-worth, self-efficacy and positive connection and could potentially make the world feel more benevolent. Martin et al (1) suggested that compassion for others could be a reflection of the degree of compassion for self. The quantitative studies, because they are measured by the PTGI, only assess the construct of
compassion via a single item; (#15) “I have more compassion for others” with the factor scores not quantifying compassion in itself. The question scores were reported by Martin et al (1), and for the 17 participants, the median reported score for this factor was 2 out of 5 (IQR3). This score reflected that some burn survivors felt more compassionate while others did not experience this growth change in compassion. Indeed, the supporting qualitative information demonstrated that the degree of compassion felt was influenced by the perception of other people’s circumstances.

Coping
The theme of coping was often interweaved with the themes described above, and therefore individual coping styles which were linked to PTG were revealed by the examination of PTG in the review of these research studies. The qualitative studies emphasise the importance of specific coping strategies that are associated with PTG including use of humour (1, 65, 121), positive reframing (1) and downward comparison (73). Downward comparison is a process which can result in gratefulness which is a coping strategy itself (1). The process of making sense of the injury event or making meaning from the consequences of the event were also an important outcome from rumination about the trauma (1, 73, 121, 122). Those with an existing and active religious faith might continue to use this coping strategy for support both early after injury (65, 121) and in the long term (1). Planning for future recovery and the determination to return to normal life is a further strategy used to cope (1, 121). The quantitative studies did not measure coping and coping styles as a separate construct, however feelings with respect to the effectiveness of coping skills and acceptance are reflected in the personal strength factor. The overall PTG scale was positively correlated with active coping style as measured by the Coping with Burns Questionnaire (CBQ) $r= 0.53$ ($p<0.01$) and not with avoidant coping style in a German study (72). Different relationships were documented by Baillie et al (31) with moderate associations between PTG and avoidant coping ($r= 0.43$, $p<0.01$) and PTG and adjustment coping ($r= 0.40$, $p<0.01$), and a moderate correlation between PTG and instrumental/action coping ($r= 0.32$, $p<0.01$). Therefore, the theme of coping occurs widely throughout the qualitative literature regarding PTG and was reflected in overall PTG scores, however is not specifically targeted by the PTGI itself.

Temporal changes in PTG
The attempt to assess how PTG changes and evolves over time is problematic with respect to the current research literature. With only one qualitative study collecting longitudinal data; the case study by McCormack et al (122). This temporal information was clearly not able to be extrapolated to a larger population, particularly as the authors attribute the participant’s
growth to the terrorist event more than the burn injury itself. Askay et al (65) reminds us that the earlier literature (66) proposes that growth arises from distress after trauma via positive reframing, positive affect and good social support, and that this process requires time to evolve. Therefore it is important to surmise that the process of PTG should not be explored too soon after the burn as it may not be present due to the necessity of time for PTG to evolve.

The qualitative study by McLean et al (121) includes a study population who have been interviewed within 4 months of facial burn injury, thus giving a description of PTG in the early stage after burn injury. Ten cluster themes emerged within the larger emergent themes of relationship to self/other, coping and meaning-making. These themes are congruent with the construct of PTG and hence this study reveals that PTG actually can commence at early stages after injury. The quantitative study by Baillie et al. [23] reports a positive correlation between time since burn and PTG ($r=0.34, p<0.01$) further reinforcing the concept of PTG evolving over time. The various studies detailed above suggests that PTG commences early and continues to evolve over time.

Factors influencing PTG

Pre-burn factors

Both age and gender have the potential to affect posttraumatic growth but unfortunately neither age nor gender were reported within the qualitative studies in relation to PTG. In the quantitative by Rosenbach et al (124) females reported higher total PTGI scores in comparison to men ($t=2.35, df = 147, p<0.05$) and specifically for two PTGI factors; Appreciation of Life ($t=2.38, df = 147, p<0.05$) and New Possibilities ($t=235, df = 147, p<0.01$). This result was in spite of there being no documented gender differences with regard to coping support and distress (all $p≥ 2$), although women did score lower on the Mental Health domain of the SF12 quality of life assessment ($t=-2.01, df = 147, p<0.05$). Baillie et al (31) found neither age nor gender had a significant effect on PTGI scores.

The personality trait of dispositional optimism is thought to influence PTG in other areas of trauma. Most of the reviewed literature did not assess personality factors. However, dispositional optimism was explored by Baillie et al (31) via the Life Orientation Test Revised (LOT-R) and found not to be associated with PTG ($r=0.03, ns$). No other study assessed optimism as a personality trait per se, although optimism was described as an outcome or associated factor for PTG.

McLean et al (121) found that all interview participants reported previous significant trauma. This is a logical finding because burn injury is likely to be more common in those who have
other social issues or indulge in risk-taking behaviour. However, she does not report potential risk factors regarding the participant group, which could include social factors such as substance use, interpersonal violence, younger age, male gender, single relationship status, and lower education levels.

**Burn injury factors**

**Injury severity**

Burn injury severity is a potential factor that could influence PTG, however, the qualitative literature did not assess aspects of PTG in relation to injury severity. Within the quantitative literature injury severity was reported as a TBSA measurement. Rosenbach et al (72) used an independent t-test to compare total PTGI scores of those with burn injury greater than 30% TBSA with those of 30% or below, finding no significant difference. This population had a mean TBSA of 32.2%. It is possible that the 30% TBSA separation point chosen was too high, and not sensitive enough to demonstrate a difference. In contrast, Baillie et al (31) found a positive association between TBSA scores and overall PTGI scores (r=0.47, p<0.01) using a regression model for predictors (regression co-efficient $\beta = 0.132$, p=0.002). The mean TBSA for this latter population was 9.41%.

**Bodily location of burn injury**

The location of the burn on the body and its effect on psychosocial recovery has drawn mixed findings within the burn research literature (104). The qualitative studies do not report findings on bodily location of the injury, except that it was important to note that McLean’s study was focussed on those with facial injury (121). In the quantitative literature, Baillie et al (31) report that participants with visible scarring to both face and hands reported higher total mean PTGI scores (mean = 2.86, 95%CI 2.13, 3.79) than those with face not hands (mean = 1.15, 95%CI 0.45, 2.20) and those with neither face nor hands (mean = 1.01, 95%CI 0.70, 1.39) with significant differences between scores (p=0.001). Body image plays a large part in our interactions with others, and is highly likely to affect PTGI scores, particularly those in factor 1 (Relating to Others) and Factor 3 (Personal Strength).

**Sudden event**

The circumstances of the injury event were explored qualitatively by McCormack et al (122) in which the case study participant was involved in the 2005 Bali bombing. The theme of ‘violent interruption’ suggests that the sudden unexpected shock stopped his life trajectory in its tracks and caused him to take stock and reconsider his life meaning. This was supported by Martin et al (1) who reported that the impact of a sudden injury event drove greater appreciation of life.
The quantitative literature compared accidental injury, workplace injury and intentional injury and found no significant difference in PTGI scores, although numbers in the latter group were small (4% of 74 participants) and therefore these results need to be interpreted with caution.

**Postburn factors**

**Overall function and quality of life**

Overall function and quality of life was measured within the quantitative studies via questionnaires. The analysis of the PTGI scores in relation to Burns Specific Health Scale-Brief (BSHS-B) revealed that individuals whose quality of life was most impacted by their burn were more likely to report higher PTGI scores in the domains of overall function \((r=0.40, p=0.00)\), body image \((r=0.26, p=0.03)\), work \((r=0.33, p=0.00)\), hand function \((r=0.34, p=0.00)\), and heat sensitivity \((r=0.39, p=0.00)\). However, these low to moderate correlations need to be interpreted with caution (31) as Rosenbach et al (72) reported no significant association between SF12 quality of life and PTGI scores.

**Social support**

A dynamic factor which often influences PTG is the support of family, friends and significant others. In the qualitative literature the influences of social support on PTG are difficult to extract from the theme of changed relationships or the presentation of PTG itself. Seeking emotional social support was found to be an important theme of PTG in Chinese participants and was claimed to be important in cognitive construction and thus influenced the process of PTG. In addition, they believe that it is an important aspect of Chinese culture to support significant others and provide additional motivation to Chinese burn survivors (73). Long-term support based on trust and loyalty were important to effective coping (1). In the quantitative literature, the Social Support Questionnaire (F-SozU-14), a German scale which measures instrumental support, emotional support and social integration, was used to assess social support in relation to PTGI scores. In this analysis, PTG was found to be highly correlated with perceived social support \((r=0.53, p<0.01)\) (72). An analysis of the association of PTGI scores with the Multidimensional Scale of Perceived Social Support (MSPSS), a scale which assesses support by family, friends and significant others, demonstrated a low but significant positive correlation \((r=0.22, p=0.01)\) (31). The concept of peer support has been assessed in the psychosocial recovery and adjustment of burn survivors but has not been explored explicitly in relation to PTG *per se*. Askay et al (65) suggest that support from like-minded people, such as those with a similar faith, was helpful after trauma.
Optimism, hope and new opportunities

Despite the proposal that dispositional optimism was not found to be associated with PTG by Baillie et al (31), the qualitative work by McLean (121) revealed that all of her participants described feelings of optimism and hopefulness about recovery. The quantitative studies assessed optimistic and problem solving coping as part of the active coping domain of the CBQ however did not specifically assess this sub-domain as a separate entity. With respect to new possibilities, the action of returning to work is another important milestone towards establishing a new normal lifestyle but is dependent on discovering a new work-life balance dependent upon new life priorities (1). The division of time between work, leisure and choice of activity is a portion of the New Possibilities domain of the PTGI (1) with burn survivors reporting in the quantitative literature a median scores of 0-3 (1) and mean scores of 0.74 (31) and 2.77 (72) out of a range from 0 to 5 indicating that this factor accounts for a low level of growth after burn injury.

Posttraumatic stress

Posttraumatic stress and PTG occur concurrently with a curvilinear relationship demonstrated within the general trauma literature, with most PTG reported at moderate levels of distress (29, 30). The quantitative studies assessed PTG and distress; Baillie et al (31) assessed PTG against the Impact of Event Scale – Revised (IES-R), a measurement tool that captures intrusive thoughts, avoidance and arousal demonstrating a small but significant positive correlation (r=0.32, p<0.01). However, there was no evidence of a curvilinear relationship within this population. Rosenbach et al (72) assessed emotional distress via the SCL-K-9 Symptom Checklist and the mental health domain of the SF12 with findings of no association between PTG and either scale. Thus the relationship between posttraumatic growth and distress after burn is not clear or resolved in the current literature.

Incidence and clinical recommendations

Posttraumatic growth was not found to be a universal concept, and the facets of growth experienced by participants varied. In China, the theme of personal strength was predominant (in 90% of participants), however, in contrast, the theme of religious growth was minimal (10% of participants). The general trauma literature has recommended a minimum total PTGI score of 42 to indicate meaningful PTG; on the 21 item PTGI this suggests an average score of 2 out of 5 for each item. The total mean PTGI score for Rosenbach et al (72) study was 57.12, for Baillie et al (31) was 32.82 and calculated data from Martin et al (1) was 49.3. Martin et al (20] suggest a mean score of 2.5 (equivalent to a total PTGI of 52.5) could be used as a benchmark
to identify those who experience less growth and may require additional psychosocial intervention strategies to improve their PTG after burn.

Recommendations for future research in the literature

Attoe et al (104) highlight that PTG is a new consideration within the burn literature, and this is evident from the articles reviewed within this integrative review. There is a clinically important gap in the literature which reflects the necessity to develop and test intervention strategies which are designed to improve psychosocial outcomes after burn injury (1, 104). Longitudinal research is needed to explore the natural progression of PTG over time, determine which factors are most relevant at different time points, and the success of targeted interventions (1, 31, 65). It is also important to note that proxy reports of PTG from significant others could build this body of knowledge (31). Further exploration of personality factors, particularly extraversion and optimism, could be a focus of future research to assess whether the burn injury population is similar to other areas of PTG research (72). Askay et al (65) suggest that future research could involve measures that enable the exploration of negative responses, and the determination of how PTG is affected by cognitive processing style, gender, ethnicity, and culture. They also request the creation of definitions around the separate constructs of positive emotion, resilience and PTG as well as the integration of PTG into biopsychosocial models of burn recovery.

4.6 Discussion

Posttraumatic growth (PTG) is positive change which occurs beyond the pre-trauma condition. This review specifically explores how posttraumatic growth has been reported in the literature in relation to burn injury. The earliest definitive PTG literature in the burn injury population was published in 2008 (72). More recently the literature has burgeoned, however, only eight papers were in fact eligible for inclusion in this review with two of the papers secondary reviews (65, 104). In other clinical research literature concerned with psychosocial adaptation and recovery after burn injury, aspects of growth are intermingled with distress, psychopathology, quality of life and resilience (125, 126). In fact, there are important differences between the concepts of PTG and resilience (24) although the two constructs overlap. An early paper which discusses resilience after severe burn, published in 1997 (127), incorporates descriptions of growth without extracting and describing the growth as a separate construct. Posttraumatic growth has been defined as “the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma” (5) and is commonly measured by the PTGI (27).
This integration of research into posttraumatic growth after burn reveals three domains; understanding the self, understanding the world, and understanding others with each of these domains having two subdomains. In the domain of understanding the self the first sub-domain is that of personal strength. Personal strength is a newly recognised process by the burn survivor, and concurs with other psychosocial research after burn injury (128). It likely occurs because the burn survivor has no choice but to ‘sink or swim’ while they endure the challenges they face. It is also likely that they never could have imagined what these challenges would be like or that they would be theirs to manage, which concurs with the PTG literature which proposes growth as being triggered by a shattering of the worldview. Zhai (73) suggests that the realisation of strength is linked to new found self-efficacy, and the importance of self-efficacy as part of the coping response after a burn injury has been recently identified in other literature (98). The second sub-domain within understanding the self is that of reprioritising and arises as a consequence of a better understanding of personal values and the realisation that everything can change in an instant.

The second domain of understanding the world has two sub-domains; spirituality and humanity. Spirituality is related to the internal process of making meaning from the burn injury event and its consequences and how this impacts ultimately on core beliefs (129). This assists to drive the process of reprioritising, and is a result of cognitive rumination. It is unclear whether formal religious doctrines may or may not be part of this process, and are likely to be utilised as a form of coping only if this is already an integral part of life pre-burn. Indeed, social support from religious communities is likely to be helpful because it would be drawn from like-minded people. The concept of making meaning has been explored in other related burn literature (128, 130) with the understanding of humanity related to a better understanding of the outer world, and a clarity about the roller coaster nature of life, including the flaws and frailties of people which leads to a more forgiving and humane outlook (131, 132).

The sub-domains of the third domain, understanding others, are those of personal relationships and compassion/altruism. Changes in interpersonal relationships are the biggest area of change with its magnitude of importance represented by seven of the 21 items of the PTGI. Interpersonal relationship changes can be negative as well as positive (1) and this is congruent with the seminal literature (8). Compassion and altruism are reported in later research regarding PTG after other forms of trauma and are measured in a tool developed in 2013 (133) with a component regarding compassion added to the PTGI tool.

Therefore, the process of growth is an increased clarity and understanding of the self, the world and others. The various outcomes of growth include an improved quality of life with more
effective coping strategies. In fact Janoff-Bulman (17) proposed that PTG should be referred to as posttraumatic coping, and that this might be a more accurate representation of the construct. Humour has been shown to be important in other burn injury psychosocial research (86, 127) and is part of the reframing process. Reframing was identified as a process through which posttraumatic growth occurred, with gains such as gratitude, insight, self-esteem and identity (134) and positive refocussing has been shown to have a small but still negative relationship with depressive symptoms after burn (135). It has also been noted that the areas of increased clarity and understanding are influenced by other factors with these factors influencing the quality of functional coping. Pre-burn factors of age, gender, personality and previous trauma, and the circumstances of the injury event cannot ultimately be influenced postburn. However, if we learn how these factors might contribute to the risk of poor PTG and response to intervention type, then they may become important markers to identify relevant intervention strategies.

The physical characteristics of the injury can also guide postburn recovery programs to maximise overall function and return to a (new) normal life. Early psychosocial interventions for posttraumatic stress symptoms can promote functional coping. Support is paramount from family, close friends, health care practitioners, peers and the community, and its importance is demonstrated widely throughout the literature (127, 130, 136-139). Support strategies can be used to encourage hope and optimism for the future by working with the patient to set realistic goals, planning, and feedback of progress and has previously been identified as an important need (140, 141). Dispositional optimism may not be required for PTG although it has been reported elsewhere for both PTG generally and effective coping after burn (138, 142) and therefore begs the question ‘can we encourage optimistic thinking in non-optimist individuals to bring hope?’ Indeed, it might be that we can; an intervention of cognitive behavioural training was shown to increase optimism in burn survivors (143).

The relationship between growth and distress needs to be examined more closely as those with more distress postburn appear to report more growth. Studies in other types of trauma have demonstrated a curvilinear relationship, with those who have moderate levels of distress showing the greatest growth (66, 144). This relationship has not been determined or demonstrated within this review. The evolving question is whether growth buffers distress, and if so, is a tool which measures the negative aspects as well as the positive required.

Other literature has touched on the subject of positive outcomes after burn. Reeve et al (145) measured positive change after burn injury with the Benefit Finding Scale, however the authors do not discuss the details of the findings except to report that 44% reported moderate benefits
and a further 26% reported greater benefits. A report regarding changes in life 5 years after burn revealed 10-20% of 153 burn survivors reported positive change, but no specific details regarding the change are published (100).

Figure 4.2 Model of postburn growth and coping

This comprehensive synthesis of the published literature reveals an emerging model for posttraumatic growth and coping after burn (Figure 4-2). Future research to further develop or consolidate this model after burn injury is needed, together with the evaluation of other measurement tools; with the inclusion of a compassion dimension (133) or with negative and positive parameters (114). Interventions to enable burn survivors to better understand their progress should be tested. These could be either patient led, for example journaling, or could be clinician led; such as feedback on quality of life progression together with practical planning, realistic goal setting and education of the patient for potential treatments and outcomes. Realistic outcome expectations are important because acceptance is only useful if change is not possible, and determination is only useful if change is possible, and knowing what is possible will influence motivation. Information about how PTG evolves over time is lacking, although other research claims stability at 6 months post trauma (65). This may be different for burn survivors, who may continue to be engaging in treatment to restore function or scar outcome even at this time point. Longitudinal research which measures PTG after burn is needed to assess normal temporal changes and enable the various intervention programs to be assessed for effectiveness.

Limitations

There has been limited work in the area of posttraumatic growth after burn injury, and therefore a paucity of published work to synthesise. From a methodological quality viewpoint, the purely qualitative research papers (73, 121) did not mention that saturation had been
reached which may have had an impact on the depth, quality and translation of the research conducted in addition to another research article being presented as a case study (122). Burn injury is unique in terms of its physical and psychological challenges and therefore it is important to understand the ‘what’ and the ‘how’ of PTG through qualitative research without simply quantifying the various domains identified in different, diverse populations. In addition, it can be difficult to identify the cause of the PTG; whether the burn injury, other related circumstances of the event, other trauma or natural maturation. As more research is published in the area, a more complete picture will emerge, allowing for meta-analysis to be conducted.

4.7 Conclusion

The integration and synthesis of the research literature which explores posttraumatic growth after burn reveals posttraumatic growth themes and factors that influence the coping strategies of each individual. It is clear that helpful support from family, friends, the community, peers and health care professionals is paramount, and various strategies which guide the supportive network and encourage posttraumatic growth will influence the coping strategies used by burn survivors. Health care professionals have the potential to positively influence growth by ensuring maximal overall function and quality of life and the facilitation of a return to a new normal. This must be done in conjunction with recognition of progress, and clear goal planning towards realistic outcomes to enable the determination to succeed or the acceptance of limitations as appropriate for the individual burn survivor. Thus, recommendations for practice are to apply a multidisciplinary approach to care; facilitating support networks, maximising function and return to normal, until research into effective interventions has identified specific strategies that can improve PTG.
5. Quality of life and posttraumatic growth after adult burn injury: A prospective, longitudinal study

5.1 Preamble

It was exciting to see the knowledge gained from the mixed method portion of this research unite into such a strong cohesive model of postburn growth and coping. The general aspects of PTG after burn aligned with existing PTG theory, and the burn related aspects and influencing factors were unfolding. It was clear that the changes in thinking led to the changes in coping style, and that there were influences on that of social support, patient and environmental characteristics (pre-burn factors), TBSA and burn location (clinical injury factors), the degree of posttraumatic stress, and postburn quality of life and function. Therefore, the next part of the study, utilise quantitative longitudinal analysis to assess these factors.

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Keywords: Burn, posttraumatic growth, Quality of Life, depression, anxiety, psychological stress.
5.2 Abstract

**Introduction:** Posttraumatic growth is positive psychological change that occurs beyond pre-trauma levels. Understanding the relationship between growth, stress and quality of life after burn improves understanding about the nature of postburn psychological growth and associated quality of life factors. This study aimed to determine the nature of these relationships, and whether posttraumatic growth changed over time in individuals.

**Method:** Two hundred and seventeen surveys were collected from 73 adult burn patients. The Posttraumatic Growth Inventory, Depression, Anxiety and Stress Score, SF-36 quality of life and Burns Specific Health Score – Brief surveys, together with demographic and clinical information was collected over a six month period. Acute and non-acute burn injuries were equally represented.

**Results:** Growth and stress were positively correlated (p=0.004), but depression and growth had a curved relationship (p=0.050). Growth scores reduced as affect (p=0.008) and mental health improved (p<0.0001), and were highest at mid-levels of physical recovery (p=0.001).

Conclusion: This supports the concept that PTG is linked to coping as higher growth is reported with more stress, and that depression is a barrier to growth. As patients recover both physically and mentally from burn, less growth is reported. Early identification and management of depression is important to optimise growth outcomes.
5.3 Introduction

Posttraumatic growth (PTG) is the patient’s report of positive psychological change that occurs beyond pre-trauma functioning, beliefs and values. The changes relate to benefit finding in the domains of interpersonal relationships, philosophy of life and perception of self and this phenomenon has been extensively researched in areas of trauma other than burn (8, 14, 27, 34). It has been previously demonstrated that self-reported growth after burn presents in two discrete ways. Firstly by gaining a changed understanding of the self, others and the world and secondly, by the use of specific coping mechanisms and ways of thinking. These ways of thinking include the use of humour, positive reframing, downward comparison, gratefulness and meaning making [1] and other studies regarding burn injury recovery have supported these findings (86, 130). The relationship between PTG and burn injury has been moderately explored in the literature (1, 65, 73), however the relationship of PTG with stress and quality of life has not, despite having been identified as an important area of research in this field (3). It has been proposed that PTG is thought to arise from a ‘shattering’ of worldview (15) and may be triggered by deliberate rumination about the trauma (146). It is not the opposite of posttraumatic stress, and respondents have concurrently reported positive and negative effects in corresponding survey items simultaneously (53) suggesting a ‘double track’ of posttraumatic recovery (147). Stress may trigger growth through the process of reflection and rumination resulting in changes in thinking in order to make meaning from the injury event (15, 112).

The relationship between posttraumatic growth and stress has been widely explored in the non-burn literature with inconsistent findings (112). Some studies have demonstrated a curvilinear relationship between posttraumatic growth and posttraumatic stress with the majority of growth occurring at moderate levels of trauma exposure (29) and distress (30, 148), although that curvilinear pattern has not yet been identified and demonstrated after burn injury (31, 72). Recovery from burn injury can be long, and physically and psychologically arduous on both the patient and their families (86). Qualitative research into posttraumatic growth after burn has demonstrated that the consequences of this burden is a barrier to interpersonal communication within families, which is a possible barrier to PTG (1) in addition to within wider social circles (2).

Depression after general trauma has been reported in up to 42% of survivors, and can persist for many years (149). The prevalence of depression after burn injury is variable, and has been reported in up to 53% within the first month of burn, and between 13% and 35% at 12 months postburn (150) although these rates might be accounted for by pre-burn prevalence (151). Depression has been previously reported as a barrier to PTG in people affected by an
earthquake (152). Anxiety has been found to be equally common after injury and can persist in the longer term (153) and when depression, anxiety and stress were assessed via the DASS-21 outcome measure within general trauma increased scores at 3 months post injury were predictive of longer term psychopathology (149). In contrast, worse mental health outcomes do not appear to be related to burn severity (153).

There are general (global) and burn-specific health-related quality of life (HRQoL) measures that are used to assess recovery after burn injury. Routine use of these measures occur in burns units locally and internationally, and relationships between these measures and the presence or absence of posttraumatic growth could enable clinicians to identify response patterns which are early indicators of good or poor positive psychological recovery, thus enabling early investigation, intervention and referral. As patient reported HRQoL outcome measures are a burden on patients’ time, and depression, anxiety and stress are not independent of these, it is beneficial to get a more comprehensive understanding from a small number of routinely collected measures. A meta-analysis reported no association between global health-related quality of life (HRQoL) and PTG after various non-burn trauma (144). Other studies found that cancer patients reported better quality of life and less anxiety and depression with higher reports of growth (154), and that more growth was associated with better mental component scores from the SF-36 (155). However, after burn injury, no significant association was found between PTGI scores and quality of life using the SF-12 measure (72). Burn specific quality of life can be assessed with the Burn Specific Health Scale Brief (BSHS-B) (116, 156-158) and is routinely used within our clinical environment. As this HRQoL measure is specific to burn injury, and because the investigation of PTG after burn is a relatively new area of research with a minimal number of published studies, the evidence that assesses the two measures together is reduced to one published study (31). This study reported significantly higher posttraumatic growth scores for the BSHS-B subdomains of hand function (r=0.34, p<0.001), body image (r=0.26, p=0.03), heat sensitivity (r=0.39, p<0.001), work (r=0.33, p<0.001) and overall function (r=0.40, p<0.001) (31). However, this study did not report a relationship between posttraumatic growth scores and the BSHS-B subdomain of Interpersonal relationships, despite this being a key part of PTG theory (34). This might be because the two measures assess different aspects of this theme, with no other study having assessed the relationship of these two specific outcome measures together.

Temporal changes in PTG are difficult to assess due to the lack of published longitudinal studies. A 12 month longitudinal study of Taiwanese cancer survivors found four different trajectories of PTG, each having different relationships with HRQoL measures, namely, stable high, high decreasing, low increasing and low decreasing (159). There are no longitudinal studies
exploring PTG after burn injury, however a cross-sectional study suggested that a positive relationship exists between PTG and time since burn, but did not specify a time when PTG is optimal, and does not assess repeated measurements in individuals (31). It is important to identify the interrelationships between PTG and HRQoL so that we can better understand the nature of growth, what might drive and impede it and ultimately reveal potential interventions for better growth.

Thus, it is important to understand the relationships between HRQoL after burn and PTG. Understanding these relationships will help to clarify the nature of PTG after burn and may identify specific quality of life factors associated with the presence or lack of growth after burn injury. This means that it will be easier to identify those at risk of poor psychological growth after burn by the assessment of widely used assessment tools, often routinely collected in the burn outpatient clinic, and this will allow the opportunity for early intervention and referral to appropriate clinical services. The first aim of this study was to determine the nature of any significant relationships between PTG and HRQoL outcome measures after adult burn injury. The second aim was to assess whether posttraumatic growth changed significantly over time in individuals with burn injury.

5.4 Method

This research was approved by the ethics committees of Royal Perth, Fiona Stanley Hospitals and University of Western Australia. It was conducted in accordance with the guidelines and principles of Australian Code for the Responsible Conduct of Research. All patients gave written informed consent before their participation following full discussion of the study (HREC# REG 13-178).

This was a prospective, longitudinal, two-group cohort study. All participants were identified from hospital databases and were patients of the Burn Service of Western Australia. A total of 217 assessments were collected from 73 patients from two groups of participants. Group 1 were a cohort of participants with non-acute injury, more than 6 months postburn (n=34), and group 2 were a cohort of participants with acute injury, less than 6 months postburn (n=39). The median time since burn for the non-acute cohort was 36 months (IQR 75 months). The participants in the non-acute group had more severe burn injuries (TBSA p<0.0001) than those in the acute group because they required a longer period of clinical follow up. A battery of quality of life questionnaires were collected at 0, 1.5, 3 and 6 months from the non-acute cohort, and immediately after discharge, 3 and 6 months from the acute injury cohort.
Participants were included if they had been admitted to the burns unit for a burn injury which required acute wound surgery. The need for skin graft surgery to heal a burn wound is an indicator of greater burn depth, and surgery to heal burn wounds occurs if a burn is deemed not to heal within 10 – 14 days in our unit. The two features of a burn injury that are indicative of greater severity are burn depth and burn area. Thus, in this study, burn depth was used to select patients who had more significant injuries. In addition, burns deep enough to require surgery are routinely followed up in clinic for scar management. Those willing to participate were recruited following full verbal discussion and informed consent of the study. Patients were not eligible for inclusion if they were less than 18 years old at the time of injury, or if they were unable to read or understand the patient information and consent form.

Patients with acute burns were asked to participate while inpatients, and those with non-acute burns were invited by letter sent prior to an outpatients’ appointment. This allowed time for the patient to consider whether they would be willing to participate and any questions regarding the study. Paper versions of the measures were collected from patients in the outpatient clinic, and were always collected together in a single session. An online version was available as a second option for patients who were not able to attend clinic.
Demographic and clinical data

Demographic information including gender, age at injury, marital status, and country of birth (COB) was collected. Clinical information including total body surface area burnt (TBSA) and burn type was also collected. These patient characteristics are displayed in table 5-1. Congruent with our overall burn admission figures, 69% of the study population were male, with flame burns being the most common cause of injury.

Table 5-1 Demographic and clinical data

<table>
<thead>
<tr>
<th></th>
<th>Acute n = 39</th>
<th>Non-acute n = 34</th>
<th>Total n = 73</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender† – male</td>
<td>25 (64%)</td>
<td>25 (73%)</td>
<td>50 (69%)</td>
</tr>
<tr>
<td>Age at assessment† - Years</td>
<td>44.3 (13.5)</td>
<td>41.8 (14.5)</td>
<td>43.0 (14.0)</td>
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<td>Age at injury† – Years</td>
<td>43.7 (13.3)</td>
<td>36.8 (14.2)</td>
<td>40.5 (14.4)</td>
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<tr>
<td>Marital status†</td>
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<td></td>
<td></td>
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<tr>
<td>Never married</td>
<td>8 (20.5)</td>
<td>11 (32.4)</td>
<td>19 (26.0)</td>
</tr>
<tr>
<td>Married/de facto</td>
<td>26 (66.7)</td>
<td>20 (58.8)</td>
<td>46 (63.0)</td>
</tr>
<tr>
<td>Divorced/separated</td>
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<td>2 (5.9)</td>
<td>7 (9.6)</td>
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<td>Widowed</td>
<td>0 (0)</td>
<td>1 (2.9)</td>
<td>1 (1.4)</td>
</tr>
<tr>
<td>Country of birth†</td>
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<tr>
<td>Australia</td>
<td>22 (56%)</td>
<td>26 (76%)</td>
<td>48 (66%)</td>
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<tr>
<td>Elsewhere</td>
<td>17 (44%)</td>
<td>8 (24%)</td>
<td>25 (34%)</td>
</tr>
<tr>
<td>TBSA %</td>
<td>6.1 (5.9)</td>
<td>32.7 (21.2)</td>
<td>18.5 (20.1)</td>
</tr>
<tr>
<td>Burn type†</td>
<td></td>
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<td></td>
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<tr>
<td>Chemical</td>
<td>3 (7.7)</td>
<td>2 (5.9)</td>
<td>5 (6.9)</td>
</tr>
<tr>
<td>Contact</td>
<td>6 (15.4)</td>
<td>1 (2.9)</td>
<td>7 (9.6)</td>
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<td>Explosion</td>
<td>1 (2.6)</td>
<td>2 (5.9)</td>
<td>3 (4.1)</td>
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<tr>
<td>Flame</td>
<td>19 (48.7)</td>
<td>28 (82.4)</td>
<td>47 (64.4)</td>
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<td>Friction</td>
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<td>0 (0)</td>
<td>2 (2.7)</td>
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<td>Scald</td>
<td>8 (20.5)</td>
<td>1 (2.9)</td>
<td>9 (12.3)</td>
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<td>Quality of life measures*</td>
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<tr>
<td>Depression score (DASS)</td>
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<td>3.15 (3.37)</td>
<td>3.11 (3.59)</td>
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<tr>
<td>Anxiety score (DASS)</td>
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<td>2.77 (3.46)</td>
</tr>
<tr>
<td>Stress score (DASS)</td>
<td>4.69 (4.62)</td>
<td>5.12 (4.13)</td>
<td>4.91 (4.37)</td>
</tr>
<tr>
<td>Mental component score (SF-36)</td>
<td>49.52 (5.22)</td>
<td>49.02 (5.13)</td>
<td>49.30 (5.17)</td>
</tr>
<tr>
<td>Physical component score (SF-36)</td>
<td>47.38 (13.47)</td>
<td>49.23 (10.13)</td>
<td>48.31 (11.90)</td>
</tr>
<tr>
<td>BSHS-B (Total)</td>
<td>131.14 (25.13)</td>
<td>127.34 (24.39)</td>
<td>129.21 (24.77)</td>
</tr>
</tbody>
</table>

Data reported with *Mean and Standard Deviation or †Number and Percentage as indicated

Measures

Quality of life (HRQoL) measures need to be valid, reliable, sensitive to change, appropriate for purpose, and practical (160). They are important measures to assess the outcomes of health care interventions, and are used in routine clinical practice to screen and assess individual patients for psychosocial and physical problems postburn. The following measures were chosen to assess general health-related quality of life, burn-specific quality of life, and positive and negative psychological change. All measures were collected concurrently for each patient visit.
The SF-36 is a generic 36-item health-related HRQoL measure widely used in many disciplines of health care, and which has also been proved useful to assess outcome after burn. This measure is particularly sensitive to change and assesses the two broad domains of mental health and physical health, which are comprised of eight subscales (115).

The Burn Specific Health Scale – Brief (BSHS-B) is a 40-item tool which assesses recovery from burn (156). It is a valid and reliable measure which is appropriate for use in both smaller and larger total body surface area (TBSA) burns (116, 158). It assesses physical functioning, psychosocial functioning, body image and burn-related issues.

The posttraumatic growth has been extensively researched by Tedeschi and Calhoun since 1995 (7, 8, 14, 28, 34) and can be measured with their associated outcome measure, the Posttraumatic Growth Inventory (PTGI) devised to measure patient reported positive psychological change after trauma (8, 27). This is a 21-item measure, reported to be reliable and valid in 1996, that has been assessed in many areas of trauma, including burn (1). It assesses change in the areas of interpersonal relationships, new possibilities, personal strength, spiritual change and philosophy of life.

The depression, anxiety and stress scale (DASS) is a 21-item tool that assess the three subscales of depression, anxiety and stress, and correlates well with other measures of affect (161). It is easy to administer and has been validated for use in a hospital setting (149).

Calculation
This longitudinal data was analysed using Stata 12.1 (162). The primary outcome variable was total PTGI score. Mixed-effects regression modelling allows us to analyse longitudinal data across time for individuals with data at a series of time points to allow repeated measures analysis. Classifying data into panels (i.e., links the data entry points for each individual) allows a unidirectional analysis which accounts for differences in time settings and visit numbers between individuals (163, 164). The advantages of this approach include getting more information and more degrees of freedom from the sample size and it better controls for the heterogeneity of the covariates. This method is a fair and effective way of utilising all collected data for each patient. First, longitudinal regression analysis was used to assess the effects of the demographic and injury event variables on total PTGI scores. Second, Chi-square and Wilcoxon Rank Sum (Mann-Whitney) tests were done as appropriate (on the nonparametric data) to test for differences in demographic and patient characteristics between the acute and non-acute groups. Third, PTGI scores were compared for differences between the groups. If a variable showed some evidence of an effect on PTGI at the 0.05 significance level, and this
variable was different between the two groups, this variable was accounted for in the regression analysis which assessed the relationship of each HRQoL measure to total PTGI scores.

Next, the panel data was analysed using multiple linear regression analysis appropriate for repeated measures analysis to explore the relationship between SF-36, BSHS-B, and DASS scores and their factors with total PTGI scores, including quadratic relationships. If overall testing of a HRQoL measure demonstrated a significant relationship, the individual factors were tested to assess their contribution to that relationship. If overall testing did not display a significant relationship, the individual measures were not tested. A backwards elimination process was used to eliminate nonsignificant variables. This statistical approach allowed testing for, and control of, the observed differences between the two groups. $R^2$ is not reported in the output for the appropriate regression analysis for this data. The intraclass correlation is reported ($\rho$) which can be interpreted as a reliability coefficient. Finally an assessment of total PTGI across time was analysed using paired t-tests and longitudinal regression analysis, and was repeated for acute and non-acute groups while adjusting for TBSA and time since burn.

5.5 Results

PTGI scores by demographic and injury event variables

Longitudinal multiple linear regression analysis was conducted to assess if PTGI scores could be predicted from demographic or injury event details. PTGI did not differ between men and women ($\beta=2.93, \rho=0.6, \rho=0.75$), and was not affected by age at injury ($\beta=-0.15, \rho=0.3, \rho=0.75$), or time since injury ($\beta=0.04, \rho=0.3, \rho=0.75$). PTGI also did not differ with marital status ($\beta=4.1, \rho=0.09, \rho=0.75$), or between those born in Australia and those born elsewhere ($\beta=3.98, \rho=0.5, \rho=0.75$). TBSA demonstrated evidence of a small effect on PTGI scores ($\beta=0.3, \rho=0.055, \rho=0.74$) however this effect was reduced after adjustment for burn type ($\beta=0.244, \rho=0.07, \rho=0.74$).

Patient characteristics and clinical injury variables by group

The non-acute group consisted of patients with a significantly higher proportion of flame burns compared to scald burns (Chi-sq. test, $p=0.041$), bigger TBSA (Wilcoxon rank sum test, $p=0.0001$), and a slightly younger age at injury (Wilcoxon rank sum test, $p=0.0350$). There were no differences between proportions in the acute and non-acute groups for gender (Chi-sq. test, $p=0.4$), marital status (Chi-sq. test, $p=0.6$) or being Australian born (Chi-sq. test, $p=0.07$).
PTGI scores by group

After adjustment for TBSA, burn type and injury age, PTGI scores were lower in the acute group ($\beta = -2.6$) this was not statistically significant ($p=0.7$). The groups were considered homogenous and hence the full dataset was used in the analysis of total PTGI scores and other quality of life measures. The variables TBSA and group are highly correlated and thus should not both be included in the same statistical model because of collinearity. TBSA is continuous and has greater statistical power than dichotomising by group.

PTGI and DASS score analysis

TBSA demonstrated a positive effect on total PTGI scores that was close to significance ($p=0.055$). As this was the only demographic or clinical variable to show possible evidence of an effect on PTGI scores, it was controlled for in the regression analysis. After adjusting for TBSA, the effect of total DASS scores on PTGI scores showed a small positive effect which was non-significant ($\beta = 0.26$, $p = 0.068$, rho = 0.74), but when assessed for a quadratic relationship the effect was highly significant ($\beta = 1.3$, $p<0.0001$, rho 0.76) and demonstrated a curved relationship, indicating that more growth was reported at moderate levels of total DASS score.

Longitudinal analysis of the subdomains of depression, anxiety and stress are displayed in table 5-2. Backwards elimination regression analysis further assessed these, and identified a significant inverted-u type curved relationship between depression and growth, with a tipping point score of 3.99, with growth scores reducing at higher depression, and a positive straight line association between stress and growth. The results are displayed in table 5-3 and illustrated in figure 5-1.

<table>
<thead>
<tr>
<th></th>
<th>Linear</th>
<th></th>
<th>Quadratic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$p$ value</td>
<td>$\beta$</td>
<td>$p$ value</td>
</tr>
<tr>
<td>Depression</td>
<td>0.744</td>
<td>0.068</td>
<td>2.798-0.181*</td>
<td>0.0082</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.583</td>
<td>0.049</td>
<td>1.381-0.044*</td>
<td>0.0544</td>
</tr>
<tr>
<td>Stress</td>
<td>1.105</td>
<td>0.0012</td>
<td>2.743-0.120*</td>
<td>0.0002</td>
</tr>
<tr>
<td>Total DASS score</td>
<td>0.255</td>
<td>0.068</td>
<td>1.304-0.025*</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

* $p$ value < 0.05  ** $p$ value < 0.01
### Table 5-3 Backwards Elimination Analysis for PTGI scores and DASS domain scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Co-efficient</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Depression score</td>
<td>0.714</td>
<td>1.290</td>
<td>-1.81,3.24</td>
<td>0.580</td>
</tr>
<tr>
<td></td>
<td>Depression score *</td>
<td>-0.079</td>
<td>0.096</td>
<td>-0.27,0.11</td>
<td>0.410</td>
</tr>
<tr>
<td></td>
<td>Anxiety score</td>
<td>0.251</td>
<td>1.056</td>
<td>-1.82,2.32</td>
<td>0.821</td>
</tr>
<tr>
<td></td>
<td>Anxiety score *</td>
<td>0.000</td>
<td>0.037</td>
<td>-0.78,0.07</td>
<td>0.100</td>
</tr>
<tr>
<td></td>
<td>Stress score</td>
<td>2.484</td>
<td>0.969</td>
<td>0.58,4.38</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>Stress score *</td>
<td>-0.099</td>
<td>0.057</td>
<td>-0.21,0.13</td>
<td>0.095</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.238</td>
<td>1.82</td>
<td>-0.02,0.49</td>
<td>0.069</td>
</tr>
<tr>
<td>2</td>
<td>Depression score</td>
<td>0.185</td>
<td>0.698</td>
<td>-1.18,1.55</td>
<td>0.791</td>
</tr>
<tr>
<td></td>
<td>Depression score *</td>
<td>-0.323</td>
<td>0.018</td>
<td>-0.07,0.003</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>Anxiety score</td>
<td>0.327</td>
<td>0.438</td>
<td>-0.53,1.20</td>
<td>0.456</td>
</tr>
<tr>
<td></td>
<td>Stress score</td>
<td>2.531</td>
<td>0.862</td>
<td>0.80,4.17</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Stress score *</td>
<td>-0.105</td>
<td>0.567</td>
<td>-0.22,0.18</td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.236</td>
<td>0.131</td>
<td>-0.02,0.49</td>
<td>0.073</td>
</tr>
<tr>
<td>3</td>
<td>Depression score</td>
<td>0.258</td>
<td>0.629</td>
<td>-1.09,1.61</td>
<td>0.710</td>
</tr>
<tr>
<td></td>
<td>Depression score *</td>
<td>-0.033</td>
<td>0.018</td>
<td>-0.69,0.003</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>Stress score</td>
<td>2.529</td>
<td>0.863</td>
<td>0.84,4.22</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Stress score *</td>
<td>-0.090</td>
<td>0.056</td>
<td>-0.20,0.02</td>
<td>0.081</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.238</td>
<td>0.131</td>
<td>-0.02,0.49</td>
<td>0.071</td>
</tr>
<tr>
<td>4</td>
<td>Depression score</td>
<td>0.286</td>
<td>0.699</td>
<td>-1.08,1.66</td>
<td>0.682</td>
</tr>
<tr>
<td></td>
<td>Depression score *</td>
<td>-0.036</td>
<td>0.019</td>
<td>-0.07,0.00</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td>Stress score</td>
<td>1.242</td>
<td>0.454</td>
<td>0.41,2.21</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.259</td>
<td>0.130</td>
<td>0.00,0.51</td>
<td>0.047</td>
</tr>
</tbody>
</table>

Figure 5-1 Association between significant total and domain DASS scores and PTGI scores from linear regression analysis
PTGI and BSHS-B analysis

After adjusting for TBSA, the effect of total BSHS-B scores on PTGI scores was negligible ($\beta = -0.09$) and non-significant ($p=0.156$) until assessed for curvature which showed a significant inverted u-shaped relationship ($\beta_1 = 1.06$, $\beta_2 =-0.005$, $p= 0.034$, $\rho = 0.73$). PTGI scores were greater at mid-levels of overall burn-specific health related quality of life. Table 5-4 shows the association of PTGI scores and BSHS-B scores. Each subdomain was assessed with adjustment for TBSA, and those found to have a significant effect were used in the backwards elimination regression.

Table 5-4 Longitudinal regression analysis results for the association of PTGI and BSHS-B domains

<table>
<thead>
<tr>
<th>BSHS-B sub domain</th>
<th>Linear</th>
<th>p value</th>
<th>Quadratic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affect</td>
<td>0.35</td>
<td>0.310</td>
<td>5.35-0.12*</td>
<td>0.018*</td>
</tr>
<tr>
<td>Body Image</td>
<td>0.05</td>
<td>0.900</td>
<td>0.78-0.04*</td>
<td>0.569</td>
</tr>
<tr>
<td>Hand function</td>
<td>-0.59</td>
<td>0.095</td>
<td>2.43-0.11*</td>
<td>0.169</td>
</tr>
<tr>
<td>Heat sensitivity</td>
<td>-0.46</td>
<td>0.092</td>
<td>-0.8+0.2*</td>
<td>0.340</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>-0.084</td>
<td>0.922</td>
<td>16.04-0.66*</td>
<td>0.006**</td>
</tr>
<tr>
<td>relationships</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexuality</td>
<td>0.58</td>
<td>0.442</td>
<td>4.57-0.24*</td>
<td>0.252</td>
</tr>
<tr>
<td>Simple abilities</td>
<td>-1.25</td>
<td>0.018*</td>
<td>1.35-0.16*</td>
<td>0.644</td>
</tr>
<tr>
<td>Treatment regime</td>
<td>-0.08</td>
<td>0.820</td>
<td>0.53-0.25*</td>
<td>0.606</td>
</tr>
<tr>
<td>Work</td>
<td>-0.34</td>
<td>0.020*</td>
<td>0.59-0.09*</td>
<td>0.335</td>
</tr>
</tbody>
</table>

*p value < 0.05  **p value < 0.01
Table 5-5 Backwards Elimination Analysis for significant BSHS-B domain scores and PTGI scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Co-efficient</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Affect</td>
<td>4.033</td>
<td>2.295</td>
<td>-0.46, 8.53</td>
<td>0.079</td>
</tr>
<tr>
<td></td>
<td>Affect(^2)</td>
<td>-0.723</td>
<td>0.054</td>
<td>-0.18, 0.03</td>
<td>0.179</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships</td>
<td>11.65</td>
<td>6.363</td>
<td>-0.822, 24.12</td>
<td>0.067</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships(^2)</td>
<td>-0.532</td>
<td>0.256</td>
<td>-1.035, -0.030</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>Simple abilities</td>
<td>-0.407</td>
<td>0.598</td>
<td>-1.579, 0.766</td>
<td>0.496</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>-0.589</td>
<td>0.312</td>
<td>-1.20, 0.023</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.225</td>
<td>0.139</td>
<td>-0.482, 0.499</td>
<td>0.106</td>
</tr>
<tr>
<td>2</td>
<td>Affect</td>
<td>4.114</td>
<td>2.297</td>
<td>-0.387, 8.616</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
<td>Affect(^2)</td>
<td>-0.073</td>
<td>0.054</td>
<td>-0.179, 0.032</td>
<td>0.173</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships</td>
<td>12.293</td>
<td>6.306</td>
<td>-0.067, 24.65</td>
<td>0.051</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships(^2)</td>
<td>-0.559</td>
<td>0.254</td>
<td>-1.056, -0.061</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>-0.699</td>
<td>0.267</td>
<td>-1.22, -0.174</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.219</td>
<td>0.139</td>
<td>-0.054, 0.491</td>
<td>0.116</td>
</tr>
<tr>
<td>3</td>
<td>Affect</td>
<td>1.029</td>
<td>0.400</td>
<td>0.244, 1.814</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships</td>
<td>15.95</td>
<td>5.739</td>
<td>4.704, 27.20</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships(^2)</td>
<td>-0.697</td>
<td>0.234</td>
<td>-1.156, -0.237</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>-0.726</td>
<td>0.268</td>
<td>-1.25, -0.201</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.236</td>
<td>0.138</td>
<td>-0.034, 0.506</td>
<td>0.87</td>
</tr>
<tr>
<td>4</td>
<td>Final Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Affect</td>
<td>1.061</td>
<td>0.400</td>
<td>0.277, 1.846</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships</td>
<td>15.45</td>
<td>5.747</td>
<td>4.188, 26.718</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships(^2)</td>
<td>-0.681</td>
<td>0.235</td>
<td>-1.141, -0.221</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>-0.775</td>
<td>0.268</td>
<td>-1.299, -0.250</td>
<td>0.004</td>
</tr>
</tbody>
</table>
PTGI and SF-36 analysis

After adjusting for TBSA, the effect of the Mental Component Scores of the SF-36 on total PTGI scores was highly significant for straight line regression ($\beta = -0.932, p<0.0001, \rho = 0.75$) but was not significant for quadratic regression ($p=0.4$). The effect of the Physical Component score of the SF-36 on total PTGI scores was highly significant for straight line regression ($\beta = -0.298, p=0.003, \rho = 0.76$) and also significant for quadratic regression ($\beta = 1.818-0.024^2, p=0.001, \rho = 0.77$). Backwards elimination results are displayed in table 6 and illustrated in figure 5-3 with a model of straight line regression for both mental and physical component scores to assess the suitability for practical clinical use.
### Table 5-6 Backwards Elimination Analysis for SF-36 PCS and MCS scores and PTGI scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Co-efficient</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial model</td>
<td><strong>MCS</strong></td>
<td>1.483</td>
<td>1.869</td>
<td>-2.18, 5.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MCS^2</strong></td>
<td>-0.026</td>
<td>0.020</td>
<td>-0.07, 0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PCS</strong></td>
<td>1.494</td>
<td>0.628</td>
<td>0.26, 2.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PCS^2</strong></td>
<td>-0.022</td>
<td>0.007</td>
<td>-0.36, -0.008</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TBSA</strong></td>
<td>0.198</td>
<td>0.184</td>
<td>-0.26, 2.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Acute</strong></td>
<td>-4.00</td>
<td>7.403</td>
<td>-18.51, 10.51</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td><strong>MCS</strong></td>
<td>1.484</td>
<td>1.869</td>
<td>-2.18, 5.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MCS^2</strong></td>
<td>-0.026</td>
<td>0.020</td>
<td>-0.07, 0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PCS</strong></td>
<td>1.502</td>
<td>0.628</td>
<td>0.27, 2.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PCS^2</strong></td>
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</tr>
<tr>
<td></td>
<td></td>
<td><strong>TBSA</strong></td>
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<td>0.136</td>
<td>-0.00, 0.53</td>
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<td>3</td>
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<td>-0.359, -0.008</td>
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<td>-0.005, 0.524</td>
</tr>
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<td>-0.913</td>
<td>0.212</td>
<td>0.398, 2.875</td>
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<tr>
<td></td>
<td></td>
<td><strong>PCS</strong></td>
<td>1.636</td>
<td>0.632</td>
<td>-3.96, 2.875</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PCS^2</strong></td>
<td>-0.229</td>
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<td>-0.370, -0.009</td>
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<td>Alternative Model</td>
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<td>-0.967</td>
<td>0.218</td>
<td>-1.392, -0.538</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PCS</strong></td>
<td>-0.349</td>
<td>0.097</td>
<td>-0.539, -0.159</td>
</tr>
</tbody>
</table>

### PTGI changes over time

Comparing acute and non-acute burn patients, had no impact on PTGI scores overall. However, the cohorts displayed different patterns of change in PTGI across visits and is displayed in figure 5-4. The difference between the two groups is not significant, however, paired sample t-test analysis revealed a significant drop in total scores between baseline and 3 months for the acute group (t=2.95, p=0.0058) but not the non-acute group (t= 1.67, p=0.11). Similar analysis of total PTGI between 3 months and 6 months showed no change for either group (non-acute group: p=0.3, acute group: p=0.6). Supporting this, longitudinal regression analysis showed the impact...
of time since injury (in days) on PTGI scores was not significant (p=0.7) and that both TBSA (p=0.3) and number of days since injury (p=0.7) had no effect.

![Total PTGI scores across time](image)

**Figure 5-4** Total PTGI scores over time for acute and non-acute burn

### 5.6 Discussion

In this population of acute and non-acute burn injury participants, there were higher self-reported levels of growth with higher levels of stress, and there were lower levels of growth as mental health and affect improved. The curved relationship with respect to depression is clinically significant and suggests that very low levels of depressive symptoms have a minimal effect on growth, but as depressive symptoms increase with scores above 4, self-reported posttraumatic growth scores drop further. This curvilinear relationship concurs with other non-burn studies (30, 148) that assess PTG and depression and is the first study to demonstrate this relationship after burn. In addition, more severe burn injuries have an increased effect on growth in its relationship with depression and stress. The results suggests that the presence of depression is an important barrier to growth, that even low levels of depression can prevent growth, and that high levels of depression also have a great impact on growth. This is a key finding that impacts on clinical practice, especially due to the high prevalence of depression after burn (150, 151) and demonstrates the importance of early recognition of depression with appropriate referral to psychological services and support for timely treatment.

These results support the concept that changes in worldview and changes in thinking styles are integral to the elements of posttraumatic growth after burn and might be used to cope with stress, whilst depression may inhibit the ability to employ these thinking styles, reduce motivation and disrupt the capacity to cope. As mental health improves, the need to use PTG
related coping styles are no longer necessary, and thus evidence of PTG in the form of PTGI scores decrease.

Similarly, poor physical health after burn, which is typified with pain, itch, restricted movement and poor function, might overwhelm the ability to employ useful thinking patterns associated with growth. In this study, more severe burns, as measured by TBSA, impacted on the relationship of growth and depression and stress. However, this study did not demonstrate a relationship between growth and the BSHS-B subdomains of heat sensitivity, hand function and body image, and therefore does not support the findings in the study by Baillie et al (31). As physical recovery occurs and total burn-specific health scores improve generally, growth scores are highest at moderate levels of recovery, then reduce again as burn survivors return to work and resume everyday life. The finding that returning to work is significant in psychological recovery after burn injury supports other studies which have emphasised the importance of this milestone (104, 145), and concurs with the study by Baillie et al (31). Final PTGI scores were higher than initial scores, indicating an ongoing benefit to the patient. It may be that good physical health renders a high level of coping as unnecessary, and as this study population only assesses patients with burn which require surgery, a population of patients with burns which heal without the need for surgery may report less posttraumatic growth overall.

The curved association of interpersonal relationships as measured by the BSHS-B with total PTGI scores is interesting. Lower interpersonal relationship scores recorded on the BSHS-B represent greater disconnection and loneliness, and higher scores represent a lack of difficulties with relationships. The interpersonal relationship items in the PTGI assess greater effort, better connection, and increased understanding of others which reinforce more harmonious, supportive relationships. Thus the BSHS-B assesses unfavourable aspects of relationships and the PTGI assesses favourable aspects of relationships. As they measure different continuums of relationships we may not expect a linear relationship between the interpersonal relationship domain of the BSHS-B and the overall PTGI scores despite the interpersonal relationship domain of the PTGI accounting for one-third of the overall score. Just as posttraumatic growth and posttraumatic stress may occur concurrently [2], so might helpful and unhelpful relationship characteristics. The results demonstrated within this study indicate that patients who reported higher overall growth reflected moderate levels of social disconnection, whilst those who reported a great deal of loneliness and disconnection or no relationship problems, reported less growth. The presence of depressive symptoms may impact on interpersonal connection and relationships, and thus these factors are interrelated. Social support is important for recovery from burn and for posttraumatic growth, however as burn survivors strive to regain
some form of normality and independence, the support from others may be welcomed even though the dependence on others may be frustrating. It is likely that as health returns and independence is regained, that relationships may improve [22].

Overall, burn survivors reported no change in posttraumatic growth over time. Those in the non-acute group may have reached a status quo in their physical and mental health. In contrast those in the acute group reported significantly lower growth at three months postburn compared to self-reported growth immediately post discharge, with growth scores remaining significantly lower at 6 months compared to discharge. This remained significant after adjustment for days since burn and burn severity. If PTG scores are lower when levels of stress are lower, and when physical and mental health is better this supports the above proposed findings that this burn injury cohort appears to be returning to a new normalised life. The finding suggest that by three years postburn growth levels have stabilised for those with severe burns, and by physical recovery for those whose burns are less severe.

Individually, studies have demonstrated inconsistent findings regarding the relationship between growth and stress (147). Collectively, a meta-analysis suggests that there is a positive relationship between PTG and PTSD symptoms, which might be linear overall, and curvilinear for PTG factors, with the various associations and patterns varying for different types of stressful events [7]. This study adds to the literature, and is the first study to closely examine the relationship between HRQoL and PTG after burn. This study supports the concept that PTG and PTS are not extremes on a spectrum but are related concepts which may occur concurrently and can be understood as a “double track” of separate experiences (147).

Consistent with PTG theory [14], the results indicate that most growth is reported when high levels of coping are required, which is when stress levels are high and physical and mental function are low. It is also consistent with Lazarus’ theory about stress and coping which describes a stressful set of environmental conditions as those which exceed personal coping resources (165). Thus, growth occurs when a highly stressful situation instigates a person to ‘dig deep’ into their personal resources to find previously unrecognised or unused coping methods; hence realising ‘they were stronger than they thought’ (1, 8). As depression worsens, growth drops, which could be explained by a lack of motivation and the feeling that personal coping resources may become overwhelmed. Also as recovery occurs, high levels of coping are no longer required, and self-reported growth is lower.

If depression is a barrier to growth and coping, then routine, early screening of patients to identify and treat depression is important. This will not only lessen depressive symptoms, but will improve growth and coping to aid recovery. In addition, education to inform patients about
normal trajectories of depression, stress, growth and coping will reassure them about their progress. In addition, future research could include screening, early identification and treatment of depression to assess with PTG outcomes are improved.

This study is limited by a modest sample size, low recruitment rate and short follow up period. The two group design may be a further limitation, although burn severity did not appear to significantly influence PTGI scores in this population, the trajectories were different in the acute group until initial recovery had occurred. Future research could use a larger population of burn patients from multiple sites who are followed up for 12 months or more to explore this further.

5.7 Conclusion

The relationship between posttraumatic growth, stress and quality of life after burn reveals information about the nature of growth itself. It is not the opposite of stress, and it occurs when stress levels are high, and when high levels of effective coping are required and utilised. Depressive symptoms are a barrier to growth, with the greater the depression, the greater the impact on growth making early diagnosis and treatment of depression essential. As affect and mental health improves, growth scores reduce with growth levels higher at mid-levels of physical recovery, and reduce as physical recovery occurs, with return to work recognised as a significant milestone. This is important information for health care practitioners as it might help to explain that recovery motivation may be initially be low, improve mid recovery then decline again.
6. Memory training, neuroplasticity and recovery after burn injury

6.1 Preamble

It has been empirically observed by the burn team that patients frequently complain of having poor memory or a ‘foggy’ brain after burn injury, and often this complaint is sustained over time. If these symptoms could be improved by the use of a self-directed cognitive memory training program then there is potentially a great benefit for both patient and clinician. This cognitive rehabilitation program could benefit the patient by concurrently improving their psychological recovery, and also benefit the clinician and the providing burn service by being a time-effective and cost-effective intervention. The hypothesis that we could improve PTG and QoL after burn by using a cognitive training program was not proven in this study. The results appeared very conclusive that there was absolutely no effect on either growth or QoL by using this specific program and were disappointing. However, this did mean that we were able to use the follow up data in the analysis of growth and QoL in the previous chapter. Our acceptance of the negative result for the Cogmed training intervention meant that we could refocus our attention onto the recruitment to the quality of life study and were able to obtain robust data for that portion analysis.
6.2 Abstract

*Introduction*: The chronic stress that follows burn injury has the potential to remodel areas of the brain and it is not uncommon for patients to complain about memory deficit after burn. The aim of this study was to assess whether improving neural pathways with a memory training program might improve these symptoms, and in addition improve PTG and overall QoL.

*Method*: A randomised, placebo-controlled, crossover, exploratory design was used to assess whether an intensive brain training program could improve PTG or QoL scores, or markers of thinking, emotion or self-regulation.

*Results*: The analysis demonstrated no benefit from the cognitive training program to any of these measures.

*Conclusion*: This short training program did not improve growth or quality of life in this small cohort of patients.
6.3 Introduction

Burn injury is highly stressful and the prevalence of acute stress disorder (ASD) and posttraumatic stress disorder (PTSD) are commonly reported in the literature (166). Chronic stress is known to remodel specific areas of the brain, in particular the prefrontal cortex, the amygdala and the hippocampus (167). The left prefrontal cortex is understood to be the area of the brain responsible for higher level executive function, attention, planning and decision making (168). The amygdala is the area responsible for basic emotional processing such as fear conditioning, threat detection and emotional face recognition. The hippocampus is the area for situational awareness, and is important in specific memory formation and adaptation to stressful environmental situations (169). It has been documented that people who have a high degree of situational awareness have greater hippocampal volume such as London taxi drivers who are required to remember complex and vast city road layouts before being granted a taxi licence (170). The interconnection between the amygdala and hippocampus is strong (169). In PTSD, and moderate to severe stress, the hippocampal volume is reduced with structural remodelling documented in the amygdala and reduced activity in the PFC (171-173). In the empirical experiences of the clinicians in our burn service it is not uncommon for patients to complain of memory deficit after burn injury. This is a problem that patients can find distressing and frustrating, and it was proposed that improvement may occur with a cognitive memory training program by improving neural pathways.

Neuroplasticity is the ability of the nervous system “to make structural and functional adaptation in response to sensory experience” (174). Neuroplastic change can be positive, when new neurons and circuitry forms, or negative, when functions or processes are lost (175) and neuroplasticity theory suggests that repetitive stimulation of neurones encourages cell replication and growth though a number of mechanisms (176, 177). Emotional memory is linked to PTSD and both are characterised by neuroplastic change (178). The link between cognitive function, especially working memory and attention, and emotion is recognised (179, 180). It has long been acknowledged that increased negative emotion, arousal and anxiety causes less breadth of attention and more attentional selectivity (181). Conversely, positive emotion was associated with better attentional breadth and flexibility (182). Attention scope and thought action repertoires were broadened in positive emotional states compared to neutral ones (183) and performance is affected by the ratio of positive to negative affect (184). Working memory helps to transfer physiologically based emotions to psychologically based feelings (185) and mediates the effect of emotion on performance (181). Recent studies using functional magnetic resonance imaging (fMRI) have demonstrated that working memory uses several brain regions that are common to other cognitive processes and that working memory
and long term memory areas overlap (186). Cognitive training therapies have been identified as promising therapies to enable neuroplastic change (187). Therefore, we postulate that positive neuroplastic change through cognitive training has the potential to improve posttraumatic growth and general quality of life.

Aims

The research question: Can a short term cognitive training program improve posttraumatic growth or other quality of life measures in burn-injured patients?

6.4 Method

This research was approved by the ethics committees of Royal Perth, Fiona Stanley Hospitals and University of Western Australia. It was conducted in accordance with the guidelines and principles of Australian Code for the Responsible Conduct of Research. All patients gave written informed consent before their participation following full discussion of the study (HREC# REG 13-178).

This was an exploratory study to assess the effect of a cognitive training intervention on PTG, QoL and social and cognitive function in patients with burn injury greater than 10% TBSA and more than 1 year after their injury.

Study Design

This study was a randomised, placebo-controlled, crossover, exploratory study to assess whether cognitive training might improve patient outcomes after burn injury. This is a simple two-period, two-treatment crossover trial, denoted by AB/BA, where A represents the intervention and B represents the rest period. Participants were randomised to receive A then B or B then A. Randomisation was achieved using computerised random number generation with 1:1 randomisation in blocks of six. Fully opaque envelopes were prepared by an independent party, labelled with patient ID and opened by the patient at the first research study visit. Patients in arm 1 completed 30 sessions over 6 weeks of intense cognitive training, followed by 6 weeks of no training. Patients in arm 2 had no training for 6 weeks, then 30 sessions of intensive cognitive training program over 6 weeks. A full battery of assessment measures were taken at baseline, then at 6 and 12 weeks. A final set of quality of life assessments were taken at 6 months. The crossover method allowed all participants to undertake the training.
Figure 6-1 Consort diagram
Measures

Quality of life

Quality of life (QoL) measures need to be valid, reliable, sensitive to change, appropriate for purpose, and practical (160). They are important measures to assess the outcomes of health care interventions, and are used in routine clinical practice to screen and assess individual patients for psychosocial and physical problems postburn in our environment.

The Burn Specific Health Scale – Brief (BSHS-B) is a 40-item tool which assesses overall recovery from burn. It is a valid and reliable measure which is appropriate for use in both smaller and larger total body surface area (TBSA) burns has proven test-retest reliability, and is suitable for research purposes (115, 116, 188). It assesses physical functioning, psychosocial functioning, body image and burn-related issues.
The SF-36 is a generic 36-item QoL measure widely used in health care which has proven to be useful to assess outcome after burn and is more sensitive to change than the BSHS-B (115). It assesses two broad domains, namely, mental and physical health, which are comprised of a total of eight subscales.

The posttraumatic growth inventory (PTGI) measures positive psychological change after trauma (8, 27). This is a 21-item measure that has been assessed in many areas of trauma, including burn (1) and has been shown to be valid and reliable with good test-retest reliability (27) it assesses change in the areas of interpersonal relationships, new possibilities, personal strength, spiritual change and philosophy of life.

Neurocognition
General cognitive ability was measured via the Webneuro assessment. This is a comprehensive online cognitive assessment which assesses markers of thinking and emotion. The thinking markers that are assessed are response speed, impulsivity, attention and concentration, information processing, memory and executive function through a series of tasks. The assessed markers of emotion are emotion identification and emotion bias. The thinking task measures have good internal consistency (Cronbach’s alpha 0.73-0.89) as have the emotional task measures (Cronbach’s alpha 0.72-0.79). Principal components analysis derived factor coefficients and a core set of markers, which have since been validated against brain structure and function (189, 190).

Self-regulation
Self-regulation can be assessed with The Brief Risk-resilience Index for SCreening (BRISC) questionnaire (191), which was administered in conjunction with the Webneuro. This is a normed and validated tool which incorporates the DASS questionnaire that assesses self-regulation via three domains of social cognitive function; namely, negativity bias, emotional resilience and social skills (192, 193).

Negativity bias is the inclination to have a negative view of the self and the world and is associated with stress sensitivity. Emotional resilience is a marker of adaptive coping which reflects confidence in self and capacity to cope with the challenges of life. Emotional resilience is related to self-efficacy, self-esteem and self-assurance and indicates the ability to self-monitor and regulate emotion (191). Social skills are the capacity for building and maintaining relationships, developing empathy and expressing emotional intelligence. The BRISC assesses social functioning via behavioural, empathetic and temperamental measures (192).
The BRISC has good internal consistency for all domains (Cronbach’s Alpha is 0.57-0.86 and good test-retest reliability (Cronbach’s Alpha is 0.82-0.89). Content validity has been established using principal content analysis (189) and has been validated against corresponding items in similar measures (194).

Intervention
The Cogmed training program is an evidence based, scientifically determined computerised training program which has been demonstrated to improve working memory capacity after an intensive course of thirty 40-minute sessions in normative and clinical populations (195, 196). The training consists of a number of online games and exercises that stretch visual-spatial and verbal memory skills. It has an adaptive program that increases in difficulty in accordance with correct responses from the participant to improve both working and short term memory. Working memory is critical for focussing, appropriately shutting out distractions and complex thinking. The effects have been shown to last following program completion (195) and cognitive difficulties have been shown to decrease, and daily activities of life improve (197). The brain has been shown to reorganize itself and change in response to mental exercise. This reality has large implications for how people approach deficits in learning, communication, social skills, and overall poor cognitive functioning.

Inclusion criteria and recruitment strategy
Thirty patients with a burn of 10% TBSA or greater were recruited into the study. All participants had sustained their burn more than six months previously to allow some time for physical recovery. All participants were English speaking, willing and able to attend for three assessment visits and willing to complete 30 sessions of intensive online cognitive training. Participants were identified through a hospital database and invited to participate when attending outpatients for routine follow up or via invitation letter. Full written and verbal information was given, and patients were given ample time to consider their decision to participate.

Sample size analysis
The original sample size analysis was based on other published papers that have used the posttraumatic growth inventory. This calculated that a two-group design with 25 subjects each would achieve 99% power to test differences between groups and 77% power to test differences within groups (to significance levels of p<0.05) with an actual effect standard deviation of 2.33. However, this estimation of sample sizes did not allow for the crossover study design. Crossover studies require smaller sample sizes than parallel studies because the participant serves as their own control. This means that confounding variables are fully
controlled for, and reduces between-subject variability. Thus, the risk for Type I and Type II errors is smaller. However, the purpose of power calculation is to assess study feasibility before commencement and the necessity to perform post hoc sample size analysis is negated because once the results of the study have been obtained, the power is indicated by the confidence intervals (198). Thus, a post hoc reassessment of sample size has not been completed with a 95% confidence intervals retained in the data analysis presentation. However the reporting of sample size calculation is important for the identification of recruitment and adherence issues, in addition to illustrating that the primary aim for the research analysis has been held constant from study conception to reporting the outcomes. Hence the original calculation indicated that 50 participants would be required.

Recruitment and retention

Unfortunately recruitment was slower than anticipated due to a number of factors. The program was found to be particularly time consuming for participants and required a high level of commitment on their part. The eligibility criteria, especially in combination (TBSA>10%, able to attend for 3 research appointments, the provision of 40 minutes per session for participants to complete online training, no pre-existing cognitive impairment), narrowed the number of potential participants significantly and proved to be a barrier to recruitment, and compliance. In order to retain the integrity of the randomisation, analysis has been conducted with the intention-to-treat principle. The intention to treat principle means that the participant is analysed in the randomised group regardless of protocol violation or drop out. This reduces bias and creates the most reliable clinical results (199).

Procedures

The first researcher identified potential patients from the relevant hospital databases. Letters of invitation and patient information sheets were sent by post to potential participants, with a return slip and stamped addressed envelope so that they could indicate whether or not they were interested to participate. Other potential participants were given the information to take home from the outpatient clinic for consideration. If the patients indicated they would like to take part, the first researcher phoned the patient to discuss further. Fully informed consent was obtained in accordance with Good Research Practice recommendations.

The patients were seen at baseline (Visit 1), at week 6 (Visit 2), week 12 (Visit 3) and at six months (Visit 4) by the first researcher. All assessments were completed in the outpatient clinic with the first researcher. The questionnaires were completed first by the patient in the order PTGI, DASS21, SF36, and finally the BSHS-B. The patients then completed the online assessment. The randomisation occurred at Visit 1, with the participant opening the opaque
randomisation envelope themselves in the presence of the first researcher. Group 1 started the training the same day, and group 2 started the training following visit 2. Full instruction was given regarding the training, the online login was set up, and the participants were given the personal contact details of the first researcher for practical support purposes. There was no remuneration for participation.

Analysis
Data analysis is based on the comparison of the two groups to which participants have been randomly assigned. Statistical analysis was conducted to assess baseline values of participant characteristics, quality of life and cognitive function and how these trended across the course of the study for each study arm. Baseline data is reported to compare any differences between the two groups at the start of the study with means and standard deviation (SD) for continuous variables and number (percent) for categorical variables. The statistical test of interest is the within-subject analysis of difference in outcome between the two study periods. This can be achieved with t-tests and specialised ANOVA analysis using specific analytical techniques for cross-over analysis described by Bland (200, 201). Analysis has been conducted using Stata 12.1 software (162).

The primary objective is to compare changes in PTG, as measured by the PTGI, at the immediate conclusion of the intensive cognitive training to those who have not partaken in the training. If the differences in PTGI for the treatment period (denoted by PTGI_{tx}) and for the rest period (denoted by PTGI_{rest}) are calculated for each participant we can compare these differences via a paired t-test. The null hypothesis that PTGI_{tx} = PTGI_{rest} is tested via t-test analysis with a statistical significance level of 0.05. Specialised ANOVA analysis (pkcross) has been used to confirm these results. The latter analysis will reflect comparable but not identical results because the calculations are slightly different. The secondary objectives are to compare changes in other QoL measures, as measured by the SF-36 (PCS and MCS), the BSHS-B, the BRISC and the Webneuro at the conclusion of the cognitive training to those who have rested. This is done in a similar manner to the above description for PTG.
6.5 Results

Baseline comparison between groups

Baseline data shows that the groups were not different for demographic and clinical characteristics when the study commenced (Table 6-1). Table 6-2 shows that the baseline scores for the quality of life measures for the two groups were not different to each other. Tables 6-3 to 6-5 show the baseline scores for thinking, self-regulation and emotion respectively. The test results in bold are the overall domain scores. The subsequent tests are for each relevant subdomain. The overall tests show that the two groups are not different to each other at the start of the study for self-regulation and emotion. They do show a difference between each other for the overall test for thinking ($p=0.0295$ [CI 4.64, 5.20]). Overall thinking is an aggregate of the scores for response speed, impulsivity, attention, information processing, verbal memory, working memory, and executive function. This difference can then be identified in the subdomain Attention ($p=0.0017$ [CI 3.65, 4.93]), where mean scores are higher for group 1. The $p$ values in these tables were obtained via $t$-tests with variances not assumed to be equal because of the small sample sizes. All other $p$ values are so far from significance that it is reasonable to assume there is no difference in baseline data despite the small sample sizes.

Table 6-1 Patient demographic and clinical characteristics

<table>
<thead>
<tr>
<th></th>
<th>Group 1 n= 15</th>
<th>Group 2 n= 15</th>
<th>All n=30</th>
<th>$p$ value* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years): Mean (SD)</td>
<td>37.1 (14.1)</td>
<td>45 (15.1)</td>
<td>41.1 (14.9)</td>
<td>0.1517 (35.50, 46.63)</td>
</tr>
<tr>
<td>Gender: Males: count (%)</td>
<td>10 (66.7)</td>
<td>12 (80)</td>
<td>20 (66.6)</td>
<td>0.409 (-1.79, 0.45)</td>
</tr>
<tr>
<td>TBSA: Mean (SD)</td>
<td>32.6 (22.5)</td>
<td>33.1 (22.4)</td>
<td>32.8 (22.0)</td>
<td>0.955 (24.06, 41.06)</td>
</tr>
<tr>
<td>Age at injury (Yrs): Mean (SD)</td>
<td>30.9 (10.4)</td>
<td>40.2 (15.4)</td>
<td>35.6 (13.7)</td>
<td>0.066 (30.42, 40.69)</td>
</tr>
<tr>
<td>Time since burn (Yrs): Mean (SD)</td>
<td>5.7 (4.9)</td>
<td>4.5 (7.9)</td>
<td>5.2 (6.5)</td>
<td>0.6228 (2.75, 7.62)</td>
</tr>
<tr>
<td>Years of education: Mean (SD)</td>
<td>13.5 (2.2)</td>
<td>12.5 (1.8)</td>
<td>13.0 (2.1)</td>
<td>0.2119 (12.21, 13.79)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation; TBSA = Total Body Surface Area burned.

*p values from $t$-test with unequal variances
**Quality of Life scores at baseline**

Table 6-2 Baseline scores (Quality of Life)

<table>
<thead>
<tr>
<th></th>
<th>Group 1 n= 15</th>
<th>Group 2 n= 15</th>
<th>All n=30</th>
<th>p value* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTGI Overall: Mean (SD)</td>
<td>58.3 (23.08)</td>
<td>56.6 (21.16)</td>
<td>57.4 (21.78)</td>
<td>0.84 (49.30, 65.56)</td>
</tr>
<tr>
<td>PTGI Factor 1: Mean (SD)</td>
<td>21.8 (8.38)</td>
<td>21.3 (7.68)</td>
<td>21.53 (7.90)</td>
<td>0.86 (18.58, 24.48)</td>
</tr>
<tr>
<td>PTGI Factor 2: Mean (SD)</td>
<td>12.13 (6.51)</td>
<td>11.13 (5.96)</td>
<td>11.63 (6.16)</td>
<td>0.64 (9.33, 13.93)</td>
</tr>
<tr>
<td>PTGI Factor 3: Mean (SD)</td>
<td>11.33 (4.85)</td>
<td>11.66 (4.25)</td>
<td>11.5 (9.83)</td>
<td>0.85 (9.82, 13.17)</td>
</tr>
<tr>
<td>PTGI Factor 4: Mean (SD)</td>
<td>2.93 (2.78)</td>
<td>2.67 (2.66)</td>
<td>2.8 (2.78)</td>
<td>0.79 (1.76, 3.84)</td>
</tr>
<tr>
<td>PTGI Factor 5: Mean (SD)</td>
<td>10.07 (2.84)</td>
<td>9.87 (3.14)</td>
<td>9.97 (2.94)</td>
<td>0.86 (8.87, 11.07)</td>
</tr>
<tr>
<td>SF-36 MCS: Mean (SD)</td>
<td>48.77 (4.25)</td>
<td>48.33 (3.98)</td>
<td>48.54 (4.05)</td>
<td>0.77 (47.03, 50.06)</td>
</tr>
<tr>
<td>SF-36 PCS: Mean (SD)</td>
<td>47.94 (12.46)</td>
<td>48.40 (11.03)</td>
<td>48.17 (11.57)</td>
<td>0.92 (43.85, 52.49)</td>
</tr>
<tr>
<td>BSHS-B Total: Mean (SD)</td>
<td>119.6 (26.91)</td>
<td>124.2 (26.39)</td>
<td>121.9 (26.29)</td>
<td>0.64 (112.08, 131.72)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation; *p values from t-test with unequal variances

Pre and post-test analysis has been completed with the intention-to-treat principle. The mean number of sessions completed was 21.8 (95%CI 18.7-24.9), and the mean number of weekly sessions was 5.2 (95%CI 4.8-5.7). Patient #23 was excluded from the intervention following initial visit and referred for appropriate psychosocial support. Thus his results are not collected for the Webneuro assessment and Cogmed training scores.
### Neurocognition baseline scores

**Table 6-3 Baseline cognitive function scores (Webneuro tests)**

<table>
<thead>
<tr>
<th></th>
<th>Group 1 n= 15</th>
<th>Group 2 n= 14</th>
<th>All n=29</th>
<th>p value* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall thinking Sten score: Mean (SD)</td>
<td>5.50 (1.07)</td>
<td>4.61 (1.02)</td>
<td>5.07 (1.12)</td>
<td>0.0295 (4.64, 5.20)</td>
</tr>
<tr>
<td>Response speed Sten Score: Mean (SD)</td>
<td>6.13 (2.26)</td>
<td>5.46 (0.54)</td>
<td>5.81 (2.13)</td>
<td>0.41 (4.31, 6.62)</td>
</tr>
<tr>
<td>Memory Sten Score: Mean (SD)</td>
<td>4.93 (1.84)</td>
<td>5.25 (1.86)</td>
<td>5.09 (1.82)</td>
<td>0.65 (4.39,5.78)</td>
</tr>
<tr>
<td>Impulsivity Sten score: Mean (SD)</td>
<td>6.5 (1.68)</td>
<td>5.3 (1.91)</td>
<td>5.91 (1.87)</td>
<td>0.08 (5.20, 6.62)</td>
</tr>
<tr>
<td>Attention Sten score: Mean (SD)</td>
<td>5.2 (1.19)</td>
<td>3.32 (1.62)</td>
<td>4.29 (1.69)</td>
<td>0.0017 (3.65, 4.93)</td>
</tr>
<tr>
<td>Information processing Sten score: Mean (SD)</td>
<td>4.27 (1.56)</td>
<td>4.0 (2.12)</td>
<td>4.14 (1.82)</td>
<td>0.70 (3.44, 4.83)</td>
</tr>
<tr>
<td>Executive Functioning Sten score: Mean (SD)</td>
<td>5.17 (1.90)</td>
<td>4.57 (1.59)</td>
<td>4.88 (1.75)</td>
<td>0.37 (4.21, 5.55)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation; *p values from t-test with unequal variances, ‡Webneuro assessment

**Table 6-4 Baseline Emotional Marker Scores (Webneuro tests)**

<table>
<thead>
<tr>
<th></th>
<th>Group 1 n= 15</th>
<th>Group 2 n= 14</th>
<th>All n=29</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall emotion Sten score: Mean (SD)</td>
<td>3.93 (2.12)</td>
<td>3.21 (1.90)</td>
<td>3.59 (2.01)</td>
<td>0.34 (2.82, 4.35)</td>
</tr>
<tr>
<td>Emotion Identification Sten score: Mean (SD)</td>
<td>3.57 (2.07)</td>
<td>3.07 (1.83)</td>
<td>3.28 (1.94)</td>
<td>0.49 (2.59, 4.06)</td>
</tr>
<tr>
<td>Emotional Bias Sten Score: Mean (SD)</td>
<td>4.43 (2.44)</td>
<td>3.29 (2.11)</td>
<td>3.88 (2.32)</td>
<td>0.19 (2.99, 4.76)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation; *p values from t-test with unequal variances, (CI not reported as all non-significant) †Cogmed assessment; ‡Webneuro assessment
Self-regulation baseline scores

Table 6-5 Baseline Self-Regulation scores (BRISC tests)

<table>
<thead>
<tr>
<th></th>
<th>Group 1 n = 15</th>
<th>Group 2 n = 14</th>
<th>All n = 29</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall self-regulation Sten score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>4.50 (1.32)</td>
<td>4.36 (1.71)</td>
<td>4.31 (1.50)</td>
<td>0.80</td>
</tr>
<tr>
<td>Negativity bias score: Mean (SD)</td>
<td>4.33 (2.61)</td>
<td>3.71 (2.23)</td>
<td>4.03 (2.41)</td>
<td>0.49</td>
</tr>
<tr>
<td>Emotional resilience Sten Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>5.63 (1.94)</td>
<td>5.18 (1.76)</td>
<td>5.41 (4.71)</td>
<td>0.51</td>
</tr>
<tr>
<td>Social skills Sten score: Mean (SD)</td>
<td>3.97 (1.67)</td>
<td>4.04 (1.91)</td>
<td>4.00 (1.60)</td>
<td>0.92</td>
</tr>
</tbody>
</table>

SD = Standard Deviation; *p values from t-test with unequal variances, (CI not reported as all non-significant)
‡Webneuro assessment

Thus we can see that there is no real difference between the two groups at baseline, apart from the subdomain of Attention. In this subdomain, group 1 means are higher than group 2 means, with a significant difference of 1.88 points, and a statistical significance of $p = 0.0017$. 
Within-subject analyses for PTGI scores

Visual assessment of these graphs suggest that mean PTG scores decrease over time, with a greater decrease for the rest period than the treatment period for both study arms. The distribution of the difference shows slight negative skew (-0.3). The mean scores for total PTGI score and its factors are shown in table 6-6, and the ttest analyses for treatment and period effects are shown in Table 6-7.
Table 6-6 Posttraumatic growth inventory mean scores by study arm and period

<table>
<thead>
<tr>
<th>Variable</th>
<th>Arm 1</th>
<th></th>
<th>Arm 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment score</td>
<td>Rest score</td>
<td>Treatment score</td>
<td>Rest score</td>
</tr>
<tr>
<td></td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
</tr>
<tr>
<td>PTGI - Total</td>
<td>57.0 (8.2)</td>
<td>52.5 (8.2)</td>
<td>55.2 (3.9)</td>
<td>54.4 (4.2)</td>
</tr>
<tr>
<td>PTGI - Factor 1</td>
<td>20.6 (3.2)</td>
<td>19.6 (3.1)</td>
<td>20.6 (1.5)</td>
<td>20.1 (1.8)</td>
</tr>
<tr>
<td>PTGI - Factor 2</td>
<td>12.6 (2.0)</td>
<td>11.0 (2.1)</td>
<td>11.4 (1.4)</td>
<td>10.9 (1.3)</td>
</tr>
<tr>
<td>PTGI - Factor 3</td>
<td>11.4 (1.5)</td>
<td>10.4 (1.3)</td>
<td>12.1 (0.9)</td>
<td>12.0 (0.9)</td>
</tr>
<tr>
<td>PTGI - Factor 4</td>
<td>3.0 (1.0)</td>
<td>3.0 (1.0)</td>
<td>2.2 (0.6)</td>
<td>2.4 (0.5)</td>
</tr>
<tr>
<td>PTGI - Factor 5</td>
<td>9.4 (1.3)</td>
<td>8.5 (1.3)</td>
<td>8.9 (0.8)</td>
<td>9.1 (0.7)</td>
</tr>
</tbody>
</table>

Table 6-7 PTGI scores: Treatment, period and crossover analysis by ttest

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment effect</th>
<th>Period effect</th>
<th>CROS effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean change (SE)</td>
<td>Mean change (SE)</td>
<td>Mean change (SE)</td>
</tr>
<tr>
<td></td>
<td>pvalue (95% CI)</td>
<td>pvalue (95% CI)</td>
<td>pvalue (95% CI)</td>
</tr>
<tr>
<td>PTGI - Total</td>
<td>1.7 (1.9)</td>
<td>5.3 (3.7)</td>
<td>3.7 (3.7)</td>
</tr>
<tr>
<td></td>
<td>p=0.4 (-2.2-5.5)</td>
<td>p=0.2 (-2.3-12.8)</td>
<td>p=0.3 (-3.8-11.2)</td>
</tr>
<tr>
<td>PTGI - Factor 1</td>
<td>0.2 (0.6)</td>
<td>1.6 (1.3)</td>
<td>0.4 (1.3)</td>
</tr>
<tr>
<td></td>
<td>p=0.8 (-1.2-1.5)</td>
<td>p=0.2 (-1.1-4.2)</td>
<td>p=0.7 (-2.2-3.1)</td>
</tr>
<tr>
<td>PTGI - Factor 2</td>
<td>0.5 (0.8)</td>
<td>2.1 (1.7)</td>
<td>1.1 (1.7)</td>
</tr>
<tr>
<td></td>
<td>p=0.6 (-1.3-2.2)</td>
<td>p=0.2 (-1.4-5.5)</td>
<td>p=0.5 (-2.4-4.6)</td>
</tr>
<tr>
<td>PTGI - Factor 3</td>
<td>0.4 (0.5)</td>
<td>1.1 (1.0)</td>
<td>0.9 (1.0)</td>
</tr>
<tr>
<td></td>
<td>p=0.5 (-0.7-1.4)</td>
<td>p=0.3 (-1.0-3.3)</td>
<td>p=0.4 (-1.3-2.9)</td>
</tr>
<tr>
<td>PTGI - Factor 4</td>
<td>0.1 (0.2)</td>
<td>-2.1 (0.5)</td>
<td>0.2 (0.5)</td>
</tr>
<tr>
<td></td>
<td>p=0.6 (-0.4-0.6)</td>
<td>p=0.7 (-1.2-0.8)</td>
<td>p=0.6 (-0.8-1.2)</td>
</tr>
<tr>
<td>PTGI - Factor 5</td>
<td>0.5 (0.5)</td>
<td>0.7 (0.9)</td>
<td>1.1 (1.0)</td>
</tr>
<tr>
<td></td>
<td>p=0.3 (-0.4-1.5)</td>
<td>p=0.5 (-1.3-2.7)</td>
<td>p=0.3 (-0.9-3.1)</td>
</tr>
</tbody>
</table>

The ttest analysis shows that the intervention does not affect posttraumatic growth scores or other quality of life measures, for either treatment or period, and this is supported by the CROS analysis (Tables 6-6 to 6-9). An ANOVA pkcross analysis in STATA supports this finding with inter-subject analysis: p=0.9; and an intra-subject analysis: treatment effect p=0.32, period effect p=0.16.
Within-subject analyses for other QoL measures

![Graphs showing Quality of Life scores (means) by study arm and period](image)

**Figure 6-5** Quality of Life scores (means) by study arm and period

Table 6-8 Other QoL measure mean scores by study arm and period
### Variable

<table>
<thead>
<tr>
<th></th>
<th>Arm 1</th>
<th></th>
<th>Arm 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment score</td>
<td>Rest score</td>
<td>Treatment score</td>
<td>Rest score</td>
</tr>
<tr>
<td></td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
</tr>
<tr>
<td>BSHS</td>
<td>123.9 (8.1)</td>
<td>126.0 (7.9)</td>
<td>132.4 (6.1)</td>
<td>133.7 (5.5)</td>
</tr>
<tr>
<td>SF36-MCS</td>
<td>50.4 (1.1)</td>
<td>49.9 (1.6)</td>
<td>48.3 (0.9)</td>
<td>47.8 (1.5)</td>
</tr>
<tr>
<td>SF36-PCS</td>
<td>47.8 (3.0)</td>
<td>49.0 (2.9)</td>
<td>50.3 (2.7)</td>
<td>50.7 (2.5)</td>
</tr>
<tr>
<td>Self-regulation</td>
<td>4.6 (0.3)</td>
<td>4.9 (0.4)</td>
<td>4.6 (0.6)</td>
<td>4.4 (0.5)</td>
</tr>
<tr>
<td>Thinking</td>
<td>5.9 (0.3)</td>
<td>5.3 (0.3)</td>
<td>5.2 (0.4)</td>
<td>5.2 (0.4)</td>
</tr>
<tr>
<td>Emotion</td>
<td>4.7 (0.6)</td>
<td>4.6 (0.6)</td>
<td>3.2 (0.5)</td>
<td>3.7 (0.6)</td>
</tr>
</tbody>
</table>

### Table 6-9 Other QoL measure scores: Treatment, period and crossover analysis by ttest

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment effect</th>
<th>Period effect</th>
<th>CROS effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean change (SE)</td>
<td>Mean change (SE)</td>
<td>pvalue (95% CI)</td>
</tr>
<tr>
<td>BSHS</td>
<td>-0.3 (1.6)</td>
<td>-3.4 (3.2)</td>
<td>-0.9 (3.2)</td>
</tr>
<tr>
<td>SF36-MCS</td>
<td>-0.1 (1.0)</td>
<td>0.8 (2.1)</td>
<td>-0.2 (2.1)</td>
</tr>
<tr>
<td>SF36-PCS</td>
<td>-0.3 (0.9)</td>
<td>-1.2 (1.7)</td>
<td>-0.8 (1.7)</td>
</tr>
<tr>
<td>Self-regulation</td>
<td>-0.3 (0.1)</td>
<td>-0.1 (0.3)</td>
<td>-0.5 (0.3)</td>
</tr>
<tr>
<td>Thinking</td>
<td>0.2 (0.2)</td>
<td>0.5 (0.3)</td>
<td>0.3 (0.3)</td>
</tr>
<tr>
<td>Emotion</td>
<td>0.3 (-0.3)</td>
<td>-0.3 (0.6)</td>
<td>0.5 (0.6)</td>
</tr>
</tbody>
</table>
6.6 Discussion

There are a number of reasons why burn injury may cause morphological changes in the brain. Acutely, pain alters cortical mapping, and these changes are sensitive to short-term change and circadian fluctuation (202). The release of norepinephrine and glucocorticoids due to physiological stress alters the amygdala-hippocampi-PFC circuitry; these hormones modulate learning, memory consolidation and plasticity (167). Chronically, pain and itch can continue to act upon the cortical map (177, 203, 204), and PTSD may continue to act upon the morphological structures of the amygdala, hippocampi and PFC (172). In the experience of the author, anecdotally, patients complain of a ‘foggy’ brain postburn, and we postulate that the physiological stress response, less diverse social interaction whilst in hospital and during the early rehabilitation phase, and fewer mental problem solving activities due to a break in employment could contribute to this phenomena. Some patients were keen to participate because of these ‘foggy’ brain issues.

Seeking methods to reverse these changes is a novel approach to solving these problems. If hippocampal volume reduces with PTSD, and increases with visual spatial memory improvements (juggling, chess playing, taxi driving), it is feasible that intensive memory training that uses visual spatial exercises as a core part of its program could positively affect this area. In addition, memory training has the potential to increase neuronal circuitry in the PFC as executive function improves.

This exploratory study failed to demonstrate an improvement in quality of life using the measurement tools of the SF-36, BSHS-B, and PTGI. In addition, these tools are affected by other factors unrelated to psychological measurement, however, the mental component score of the global SF36 remained unchanged. Investigation of morphological neurological changes via fMRI would be beneficial to the body of knowledge, however that was outside of the scope of this study. In addition, although hippocampal size has been proven to vary in the above groups, changes within individuals has not been proven. Further, the link between morphological changes have not been proven to translate to clinical changes.

The lack of power, as indicated by the 95% confidence intervals, despite the cross-over design means that these study results may not be definitively negative (205, 206). However, the $p$-values indicate that the intervention has no evidence of an effect on PTGI scores, therefore it would be reasonable to conclude that this short, intensive memory training program does not provide enough cognitive training to improve postburn quality of life. It is unlikely that a per-protocol analysis would have altered these negative results, and would have lost the benefit of
randomisation. Cross-over studies are known to have issues with carry-over effect from period 1 to period 2. Carry-over was found not to be significant in this study, however, due to the lack of effect of intervention on outcomes, this is not an issue. In fact, it would have been relevant for treatment arm 1 only as period 1 for treatment arm 2 was ‘rest’ or no treatment (205, 207). Future research may require the utilisation of a longer duration of this cognitive training program, for example shorter daily sessions, but over a longer time period. Participation in this study was impacted by the high level of time commitment required for this intervention, thus this approach, together with the use of more engaging interventions need to be developed and tested by harnessing advances in technology such as game incentivised cognitive training or virtual reality technology. Public and patient involvement to develop and pilot test potential interventions might help to keep future programs acceptable and feasible to the participants, thus improving compliance with their use for evaluation of effectiveness.

6.7 Conclusion

Intensive memory training has not been shown to improve quality of life after burn injury in this study, and it appears that either the intervention chosen does not trigger neuroplastic change, or that neuroplastic change does not influence posttraumatic growth scores as measured by the PTGI after burn injury. However, the importance of addressing neurological change after burn injury remains, and further research is necessary to explore different treatments to restore pre-burn neurological health. This might include a program to improve memory or mental agility that is more manageable for the participant on a practical basis; shorter sessions over a longer time period and in conjunction with systematic face-to-face support. A bigger sample, with a greater overall ‘dose’ of training, and a study design better engineered to allow group by time analysis is required to support or refute these findings.
7. Discussion

7.1 Introduction to final discussion

This mixed-method, 3 phase study into PTG investigated how PTG presents in a burn population, whether it can be adequately measured using the PTGI, what factors influence PTG and whether it could be influenced by a cognitive training program. This final discussion is not intended to restate the earlier chapter discussions but to bring the findings of all three phases into a cohesive whole, and to suggest strategies to take this concept into the future.

7.2 Expansion of the theory of posttraumatic growth: postburn growth and coping

The qualitative part of this study, phase 1, explored the presentation and process of PTG specific to burn, and is detailed in Chapters 2, 3 and 4. Chapter 2 revealed that psychological change after burn can be triggered by the realisation that life is short, transient and can change forever at a time when change is least expected. This is highly stressful and triggers rumination, which if engaged in deliberately can be constructive, and can result in changes in perspective that can enable better coping. This chapter revealed the process and presentation of growth after burn in our cohort, and how there are similarities and differences between growth after burn and growth after other trauma types. It added context and identified barriers to growth. An important barrier to relating to others, which is one of the biggest influences on growth, is that of visible scarring. The impact of this was worthy of particular attention, and is explored in Chapter 3. Chapter 4 integrated all current published research about PTG-related concepts after burn, including the authors’ initial papers, together into a unified model of postburn growth and coping. The following synopsis about stress, growth, resilience and changed perspectives explains this further and develops the discussion about the general theory of growth and the relationship of growth and stress as introduced in the first chapter of this thesis.

Stress, growth, resilience and changing perspectives

A trauma is a disturbing experience that results in intense disruptive feelings (18) and thus is by definition stressful. Burn trauma has many physical and psychological challenges that are very stressful. Stress results in rumination or obsessional thinking about the trauma including the events that led to it, the trauma itself, and the aftermath. Rumination takes two forms, namely, intrusive rumination that is commonly discussed in the literature and deliberate rumination which involves invited purposeful engagement with event-related thoughts. Intrusive rumination may be a stressful and expected outcome of trauma, whereas deliberate rumination...
occurs less often, is not necessarily anticipated and has been shown to be associated with posttraumatic growth (146).

This study has shown that posttraumatic growth after burn is characterised by changes in perception and understanding of the self, others and the world, and with these new perceptions comes new ways of coping. This new model of postburn growth and coping depicts the changes in perception of the internal and external world, and distinguishes them from the resultant coping component of growth and the influencing factors. This is important as it builds clarity (figure7-1) (3). It is thought that this results from deliberate rumination arising from stress, which triggers meaning making through a changed perspective, and results in the reorganisation, reconceptualisation and redefining of worldview to allow the event to fit within new personal philosophies and values. This concurs with Mahoney’s view of human change process (10) and a recent discussion by Tedeschi and Blevins (146), but suggests that change is deeply internal and occurs over time, which is in contrast to the views of Miller and C’deBaca who propose that this clarity is external, sudden and can be pinpointed in time. This explanation of the process of PTG explains why some are able to experience growth, and some are not, because not everyone is able to engage in the deliberate rumination that is required to find meaning and achieve clarity from the chaos previously suggested by Hager (11). This study shows that stress and growth are concurrent phenomena and that stress and growth have a positive correlation, with more growth occurring at higher levels of stress (4). It is likely that stress initially precedes and triggers growth and that stress is necessary for growth to occur. Thus, the relationship between stress, rumination and growth are interrelated concepts.
It has been proposed within the research literature that posttraumatic growth fundamentally differs to resilience (24) although definitions vary and concepts overlap (23). Growth involves a changing worldview, is dynamic and arises from deliberate rumination which focuses on the event with the purpose of making some sense of event. Alternatively, resilience involves little change to worldview, is static and involves a focus on the future because the event is already understandable (24). The Sense of Coherence Theory of resilience states that to enable resilient response to trauma the traumatic stimuli need to be comprehensible, meaningful and manageable. This relates directly to the theory of Posttraumatic Growth but this relationship has not been explicitly described in the literature (21). A conceptual framework of their interaction evolves and is summarised in figure 7-2.
The Sense of Coherence Theory of resilience (SOC) [13] states that events need to be comprehensible, meaningful and understandable for an individual to develop resilience to the circumstances of that particular event. Thus resilience requires the events to be already meaningful, already understandable and able to be integrated into an existing personal philosophy, whereas growth involves new understanding in order to integrate the events into newly adjusted personal philosophies. This highlights the similarities and differences between resilience and growth. Resilience requires events to be already meaningful, whereas growth involves a process of meaning making. Resilience requires events to be already manageable, whereas growth involves the creation of new processes to manage and cope with the event. A high Sense of Coherence has been linked with better physical and mental health outcomes in many areas of health disorders across a variety of demographic groups and cultures (208). Thus, this study has proposed an expansion of the PTG process theory that can be extrapolated back to the general trauma population.
Therefore, combining the two concepts of 1) relationships between stress, growth and rumination and 2) growth and SOC it is proposed that posttraumatic growth is a **process** that leads to greater resilience. Therefore we can propose a new definition of PTG after burn:

**Postburn psychological growth is helpful changes to personal thinking patterns about ourselves, others, and the world (our worldview) that arise from deliberate rumination, and occur as a result of the burn trauma, which allows us to cope better with the current trauma and leads to greater resilience for future trauma.** Thus it is reasonable to conclude that resilience is more stable than PTG, but is not immutable. This then supports the inoculation and steeling theories of resilience as described in chapter 1 (19, 20). The process of PTG in coping and resilience are depicted in figure 7-3.

![Diagram](image_url)

*Figure 7-3 The process of posttraumatic growth and resilience*
This study has shown that changes in thinking and perspective that are integral to posttraumatic growth after burn involve changes in understanding about the self, others and the world, with each of these areas of life has two themes (3). These changes in perspective are congruent with the literature with respect to the mechanisms of posttraumatic growth as a result of other forms of trauma (14, 34). Cognitive reprocessing and rebuilding core beliefs are central to the concept of PTG, and three explanatory processes of change have been suggested, namely, strength through suffering, psychological preparedness and existential re-evaluation (17). The process of PTG described here concurs with all three of Janoff-Bulman’s pathways. Her first pathway ‘strength through suffering’ proposed that trauma boosts personal resources for better coping in the future. Her second pathway is ‘psychological preparedness’ proposes that trauma exposure makes future trauma less unexpected and therefore less traumatising. Both concepts are similar to inoculation (19) and steeling theories (20) and these all also concur with the explanation illustrated in the PTG-resilience wheel model (figure 7.2). Janoff-Bulman’s finally suggests that ‘existential re-evaluation’ or the reprioritising of values is the third pathway. We would like to suggest a minor reinterpretation of these three ‘pathways’ and suggest that these are not pathways to PTG, but that they are PTG, and that they are in fact pathways to resilience. This needs to be considered in the interpretation of PTGI scores. Low scores might indicate low levels of helpful coping strategies when resilience requires boosting, or might be reflective that the person is already adequately resilient.

However, although these changes drive specific coping strategies that are essential to better outcomes, it is clear that not all patients experience these changes after burn injury and we would be naïve to think otherwise. It is important to recognise that individual patients have individual experiences, that perspective changes comes from introspection, and that resulting motivation is intrinsic to the person. However, as health care practitioners who want the best outcome for our patients, and therefore encouraging positive behavioural changes that will elicit beneficial health and recovery outcomes are a priority.
7.3 Measuring postburn growth and coping

The PTGI is the most common method of measuring posttraumatic growth, and this study has demonstrated that PTGI scores reported by burn patients adequately reflect patient experiences of growth. The study has suggested that a mean PTGI score of 2.5 represents meaningful change for the patient, although it is recognised that this cut-off should be verified in a larger patient population. However, the benefits of the mixed method approach is highlighted, as wider growth experiences have been reported by patients and identified as important in the final model of postburn growth and coping. It was important to allow the interviews laterality to explore each of the areas of the PTGI. Thus, whereas the interview questions were guided by the five factors of the inventory, the conversation was allowed to flow and develop outwards from these starting points. This allowed the similarities to be identified through the deductive approach to the analysis and the differences identified through the inductive, exploratory approach to the analysis.

The similarities in the presentation of posttraumatic growth after burn broadly fitted the PTGI structure, with the main exception being lack of growth reported by our burn cohort in factor 4, spiritual change. This might be reflective of different religious and spiritual perceptions between the Australian culture and the North American culture in which the PTGI was developed and validated. The Chinese study (73) also identified different findings for this factor, supporting the premise that responses to the items in this factor are sensitive to culturally differences. In our study, some patient experiences reflected changes that were either negative (anger with God), or a move towards deterministic or fatalistic thinking patterns that were not necessarily recognised by the patient as being part of spiritual change. In general, patient reported scores were low, and it was only those who had an existing, active faith who reported positive change for this factor. The interviews revealed that this might be linked to the social community support that accompanies an active faith. This example highlights the issue of not having a negative scale for response.

The differences to the presentation of posttraumatic growth after burn are in the areas of changed behaviours and activities due to scarring and related skin problems. The influence of scarring on growth has several features that might influence PTGI scores; scarring can be stressful psychologically and physically; we have shown that stress and growth are related, and that stress is a likely precursor to growth. The integrative review revealed that overall function, hand function, heat sensitivity and body image are associated with higher PTGI scores, and that it is likely that those who had a greater burn TBSA also have higher PTGI scores. All these findings support the premise that more severe the injury, the greater the growth reported, and
the more that daily life and activities have been impacted through the sequelae of the burn. For example, fragility, dryness, itch and tightness of the skin, heat intolerance and difficulties with sun exposure all meant that extra care and time had to be given to daily skincare routines, such as moisturising and protection, and with that an inability to play sports and activities that were enjoyed pre-burn. Therefore, some changes are enforced as new activities are taken up because they are manageable. The interviews also revealed the role of visible scarring as a barrier to interpersonal connection, and as the physical environment in Western Australia is sunny and hot for much of the year, the option of covering up with clothing to hide burn scars is hot, uncomfortable, not the social norm, and ironically can also draw attention. Thus, all scarring, visible or not, has its challenges and burn scar specific quality of life has been identified as an important area that impacts recovery after burn and has led to the development of a burn scar HRQoL measure by Tyack et al (209).

The interviews shed light on the existing areas of the PTGI tool that need greater understanding or need to be attributed with more importance when used for burn survivors. For example, the area of compassion is a theme identified in the interviews that is addressed in only one of the 21 items ‘I have more compassion for others’. In addition to the lack of emphasis on the theme of compassion, some patients reflected that a negative response was appropriate to this item, whereas other respondents answered positively. The interviews gave context around this, and those who answered positively were those who also reflected self-compassion in their interviews. The Perceived Benefit Scale recognises compassion as a more significant contributor to the construct of growth (40), and this has been regarded as an area of weakness in the PTGI (133).

Further, one of the greatest areas of benefit was in the appreciation of life factor of the PTGI, “I have a greater appreciation of my own life” and “I better appreciate each day”. However, it took the interviews to reveal that these positive changes are a result of the sudden realisation that life is fragile, that our days are numbered, and sudden events can occur that might take it all away. In addition, the high scores for “I changed my priorities about what is important in life” does not elaborate on the changes themselves; Life, Well-being, New normality, Present moment and Relationships. Thus wellbeing and health is important, finding a new normal is important, and relationships are important. By prioritising their own well-being and health they start to demonstrate self-compassion, by prioritising their independence they develop the determination to achieve it, and by prioritising their relationships they draw upon the social support necessary for recovery. These new priorities then become more about the process by which posttraumatic growth occurs as people live to these new values. This demonstrates the interrelated nature of process and presentation that are inherent in the PTGI factors.
This leads to a critical appraisal of the PTGI itself. Firstly, the factors are unequally distributed in the tool with relating to others accounting for seven of the 21 items, new possibilities accounts for five items, personal strength accounts for four items, appreciation for life accounts for three items and spiritual change for two items (table 7-1). It is possible that this imbalance might result in misleading scores. The short form of the PTGI (48), is more balanced as it contains 10 items equally distributed between the five factors, and might be more appropriate for future research if a unitary score is required.

In addition, the interrelationships are complex. For example, individuals who have a good social support network might draw on this more to cope, whereas those who are managing alone, or who have poorer quality relationships, might develop their own personal strengths more greatly. The items for factor 3, personal strength, are related to coping, self-efficacy, and self-reliance. This is in contrast to some of the items in factor 1, relating to others. Those who believe in themselves and become more self-reliant are less likely to rely on others, and vice versa. Therefore lower scores might occur in factor 1 and with higher scores in factor 3, or the opposite might occur.

The responses to the items in factor 2, new possibilities, could result in higher self-reported scores as enforced change can occur due to a time availability, financial pressures, essential tasks for self-care of the burn and physical function, and the loss of previously enjoyed activities due to burn related challenges. Taking care of a burn is time consuming, with the required physiotherapy, scar management and multidisciplinary appointments, and in addition there are financial impacts to these requirements, that come at a time when income is reduced. Return to work is often delayed meaning financial pressures, loss of community support from friends and colleagues and other psychosocial changes. Thus “I developed new interests”, “I established a new path for my life” and “New opportunities are available which wouldn’t have been otherwise” are all changes that have occurred but might not be regarded as positive change per se. For example, one participant could no longer pursue her beloved sport of surfing after her burn, because she could no longer tolerate the sun, therefore she sought other activities. Thus, it must be asked whether these changes are really regarded as ‘positive’ or whether they are neutral, negative or simply better described as adaptive.

For Factor 4, spiritual change, the participants responded with ‘no change’ and expressed the desire to answer negatively. The overall very low scores given were in contrast to the much higher scores for factor 5, appreciation for life. If the three higher order domains are used to group responses, the factors of appreciation for life and spiritual change are combined to one domain. The combination of these two factors would be appropriate at face value, however it
is interesting to note that in this study population, the very low scores reported for spiritual change would negate the high scores for appreciation of life. Thus to score them together would mask the benefits felt by our patients in the latter area.

As with any self-reported outcome measure there is the question of the thought processes behind the given answers. Patients might report little change reasoning that “I have always felt this way” or “another trauma had already caused this change”. Items can be interpreted differently, for example the theme of emotional transparency varied from more verbal expression of love to bottling up emotions and bashing down doors. Both scenarios have the potential to score highly for the item “I am more willing to express my emotions” but these two patients are reflecting very different fundamental outlooks on life.
Table 7-1 PTGi items by factor

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I more clearly see that I can count on people in times of trouble.</td>
<td>1</td>
</tr>
<tr>
<td>8. I have a greater sense of closeness with others.</td>
<td>1</td>
</tr>
<tr>
<td>9. I am more willing to express my emotions.</td>
<td>1</td>
</tr>
<tr>
<td>15. I have more compassion for others.</td>
<td>1</td>
</tr>
<tr>
<td>16. I put more effort into my relationships.</td>
<td>1</td>
</tr>
<tr>
<td>20. I learned a great deal about how wonderful people are.</td>
<td>1</td>
</tr>
<tr>
<td>21. I better accept needing others.</td>
<td>1</td>
</tr>
<tr>
<td>3. I developed new interests.</td>
<td>2</td>
</tr>
<tr>
<td>7. I established a new path for my life.</td>
<td>2</td>
</tr>
<tr>
<td>11. I am able to do better things with my life.</td>
<td>2</td>
</tr>
<tr>
<td>14. New opportunities are available which wouldn't have been otherwise.</td>
<td>2</td>
</tr>
<tr>
<td>17. I am more likely to try to change things which need changing.</td>
<td>2</td>
</tr>
<tr>
<td>4. I have a greater feeling of self-reliance.</td>
<td>3</td>
</tr>
<tr>
<td>10. I know better that I can handle difficulties.</td>
<td>3</td>
</tr>
<tr>
<td>12. I am better able to accept the way things work out.</td>
<td>3</td>
</tr>
<tr>
<td>19. I discovered that I’m stronger than I thought I was.</td>
<td>3</td>
</tr>
<tr>
<td>5. I have a better understanding of spiritual matters.</td>
<td>4</td>
</tr>
<tr>
<td>18. I have a stronger religious faith.</td>
<td>4</td>
</tr>
<tr>
<td>1. I changed my priorities about what is important in life.</td>
<td>5</td>
</tr>
<tr>
<td>2. I have a greater appreciation for the value of my own life.</td>
<td>5</td>
</tr>
<tr>
<td>13. I can better appreciate each day.</td>
<td>5</td>
</tr>
</tbody>
</table>

We have shown that coping is deeply integrated with PTG, but the types of coping strategies that are associated with growth, such as acceptance, humour, gratefulness, determination, positive reframing and downward comparison are not assessed by the PTGI and highlights the benefits of adding context through the analysis of supportive qualitative data. However, despite these inherent problems, this study has assessed that posttraumatic growth after burn can be measured by the PTGI, with additional specific context in relation to burn injury.
7.4 Clinical and quality of life factors that influence postburn growth and coping

The model of postburn growth and coping developed in Chapter 4 states that the factors that influence PTG are preburn factors such as age and gender, injury event factors such as TBSA and bodily location of the burn, and postburn factors such as the level of distress, the impact on function and quality of life, thus quality of psychosocial support, and optimism, hope and new possibilities for the future. These factors guide the following discussion.

As discussed in Chapter 1, the demographic factors of gender and age, and the burn injury factor of TBSA might influence PTG but there have been mixed findings in the previous literature. Older age and female gender were associated with higher PTGI scores by Rosenbach and Renneberg but not by Baillie et al. However, our study did not find an association between PTG and either age or gender. Greater burn severity as measured by the total body surface area burned (TBSA) has been linked to higher PTGI scores by Baillie et al but not by Rosenbach and Renneberg (31, 72). However, when we assessed PTG in all our admissions regardless of size of injury, it did appear that worse burn severity had an effect on PTG, especially with respect to the relationship of PTG with stress and depression. It is likely that those with bigger injuries have endured more acute pain, more rehabilitation and greater challenges in their physical and psychological recovery and have needed to find more effective ways of coping, thus reporting more PTG. This finding supports our initial approach of exploring this phenomenon in those with bigger injury.

Other burn-specific influences on growth included factors that blocked interpersonal connection. Thus scarring to visible body areas such as the hands and face reduced normal non-verbal interaction with others in casual social situations for fear of sparking a conversation about the injury event and potentially triggering deep emotions, intrusive thoughts and feelings of self-consciousness or embarrassment. When asked about the scarring, patients felt an obligation to explain, the strength of this obligation depended on who asked, how they asked and the social setting. Further to this, interpersonal connection with close family and friends could be blocked if the patient feels guilty for laying the emotional burden at the feet of the people they love which impacted significantly on the interpersonal relationship domain.

This study showed that PTG scores were positively correlated with stress, but depression was found to be a barrier to growth and coping, indeed the greater the depression, the greater the influence on lack of growth. It was demonstrated that as affect and mental health improved, PTG levels dropped. As physical recovery progressed, PTGI scores displayed an inverted U
shape, with highest levels mid recovery, and final scores remaining higher than baseline (4). If the purpose of PTG is to enable better coping then these findings are consistent with the theory. The greater the challenge, the more the need to find inner coping resources, however in the presence of depression those resources are overwhelmed and therefore coping, and ‘growth’, does not occur. These quantitative findings from Chapter 5 concur with Janoff-Bulman’s observation that PTG should be more accurately described as posttraumatic coping (17), and support the findings of the integrative review. However, Janoff-Bulman dismisses the importance of this distinction, but given the psychologically challenging area of burn recovery there are two reasons why this distinction may be important. First, it makes the concept easier to understand that posttraumatic growth is the changes in perspective and thinking after a trauma that enable us to cope with it better, and to cope better with future trauma. Second, if PTG is understood in this way then the exploration of PTG will become easier to manage because patients are likely to misconstrue the term ‘growth’ which can seem insensitive to a person who is deeply stressed and trying to deal with many challenges during their recovery.

To summarise these findings, this study strengthens the evidence that TBSA and bodily location of the burn, the level of distress and depression, and function and quality of life are related to PTG. It does not support the finding that age and gender are related to self-reported PTG scores after burn, but a larger study with more statistical power might find otherwise. Further research is needed and suggestions are made in section 8.2.
7.5 The qualities of growth-related coping

The findings from the overall study help us to propose the qualities of growth-related postburn coping. The helpful changes in thinking patterns and perspective are the foundations which lead to better coping methods, and therefore there are core messages that can be derived from these changes (table 7-2). The qualities of growth-related coping are discussed in relation to the Model of Postburn Growth and Coping.

**Personal strength**

The first quality of growth-related coping after burn is acceptance of the occurrence of the injury event and that life has changed unexpectedly, instantly and dramatically but with no acceptance that this will limit future independence. There is an acceptance that future life might be different to what had previously been imagined, with a determination to evolve to (a new) normal stage of being i.e. “You can’t change your past, but you can change your future”. The second quality is a newfound belief in the self which results from the capacity to reflect and appreciate personal progress with pride and recognition of personal strength. This enables hope for the future because of the belief that future challenges are manageable, but realistic goal planning is required to maintain self-belief i.e. “You are stronger than you thought and you can get through this.”

**Reprioritising**

The reprioritising of values included a renewed focus on own health and well-being, less materialism and a return to family values. This can help patients to feel more grateful for the non-materialistic aspects of everyday life, and to seek experiences, learning and connection with others. Understanding one’s own true values, and being able to live consistent with those values, is important to each individual and can bring changes towards the things that are good for you and gratitude for those things that are good in your life. Gratitude is associated with better health and well-being, and is part of a broader tendency to notice the positive aspects of the world. Gratitude interventions have been shown to be effective in improving well-being (210). This study reported that positive reframing was an important quality of growth-related coping, and this can lead to the use of humour through the benefits of a new view of situations and experiences and has been shown to be an important factor in burn recovery (86). It is important that our patients use value driven goals to motivate their recovery, and this is preceded by them working out the things that are most important to them.
Spirituality and humanity

A further quality is the understanding that deliberate rumination is important to enable useful reflection and to help find new ways of viewing the world. It enables meaning making, and can add to the development of specific growth-related coping strategies such as the use of humour, downward comparison and gratefulness. In addition, intermittent denial can be useful to pace recovery, but is not useful if used as a permanent strategy. The burn trauma can result in a reassessment of our view of the nature of other people and the communities in which we live and interact. The understanding that people are just people, that we are all imperfect, and that we all make mistakes leads to greater compassion for the self and others. A better understanding of the roller-coaster nature of life, and the transition from asking ‘why me?’ to ‘why not me?’ led to the need to find something personally meaningful in the experience. Again this promotes the concept that “deliberate reflection helps recovery”.

Altruism and compassion

A desire to help others learn from the experience, or pay back to the community for acts of kindness was a feature of growth after burn. Greater compassion for others was another feature of growth but depended on social comparison. If social comparison was ‘downward’, specifically when people felt grateful that their problems could be worse by comparing their situation favourably with others, this is a helpful quality of coping. If social comparison was such that they felt that other people had no idea what a real challenge might be in comparison to their own experiences, then compassion for others was reduced. Downward social comparison is a type of gratitude, which is good for personal well-being. This leads to compassion for the self and explains the association between self-compassion and other-compassion. It is important that patients recognise that progress trajectories are individual. i.e. “be kind to yourself, recovery is a journey and setbacks are normal.”

Changed relationships

Support from others is one of the most important aspects of recovery, and in particular, for dealing with setbacks. Another quality of growth-related coping is the ability to seek help from trusted family and long-term friends, together with fellowship and support from peers and professionals. Companionship can bring significant comfort, and professional psychology clinicians who can offer expertise in facilitating growth have labelled themselves as ‘expert companions’, although it would be unusual for clients to attend in order to seek growth, but more likely to seek relief from distress (71). Another related quality is the need for effective communication and emotional management skills, because it is important to ask for help when it is required, but also explain their feelings of the need for independence with the amount and
type of help required will fluctuating from day to day, moment to moment. Emotional regulation is necessary to manage distress to enable rumination to change from intrusive to deliberate (71). This leads to two main messages for patients: “You are not alone” and “Understand what you feel, say what you feel.”

Thus, there are a number of qualities of growth-related coping strategies, all of which require deliberate rumination to identify, understand and express the changes that happen within, in order to assimilate the event into your life story, identify and express feelings, communicate with others and seek support when needed. These important qualities are acceptance, self-belief, self-compassion, determination, management, and support from others and can be regarded as six ‘pillars’ of growth-related coping which help to create hope from deliberate rumination processes (figure 7-4). These qualities can lead to planning for recovery, positive reframing and use of humour, resulting in a more manageable journey to recovery. These qualities, which have been derived directly from the findings of this study, correspond with the adaptive coping reactions described by Carver (102) and which have been used to assess coping after burn in a brief version of Carver’s inventory, the BCOPE (211).

Table 7-2 Postburn growth-related coping and the A-F of core messages

<table>
<thead>
<tr>
<th>Quality of growth-related coping</th>
<th>Core message</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Acceptance</td>
<td>You can’t change your past but you can change your future.</td>
</tr>
<tr>
<td>B Belief in self</td>
<td>You are stronger than you thought.</td>
</tr>
<tr>
<td>C Compassion for self</td>
<td>Be kind to yourself. Recovery is a journey, setbacks are normal.</td>
</tr>
<tr>
<td>D Determination</td>
<td>You can get through this.</td>
</tr>
<tr>
<td>E Emotional management</td>
<td>Understand what you feel, say what you feel.</td>
</tr>
<tr>
<td>F Family, friends and social support</td>
<td>You are not alone.</td>
</tr>
</tbody>
</table>
Figure 7-4 Pillars of growth-related postburn coping
7.6 Patient resource

Rationale behind the resource

A patient resource has been developed to communicate helpful recovery strategies after burn based on the model of postburn growth and coping, the qualities of growth-related coping and the core messages identified in this study. The rationale behind this resource is based on a number of presuppositions; firstly, we can only facilitate change, not create it, and we need to choose our words carefully for fear of causing offence (71), secondly, with that in mind, we can educate patients on some of the factors that have helped other patients after burn as reported by them and from their own experiences of their burn injury. Thirdly, we need to remind patients that everyone is an individual with individual circumstances and that not everyone finds it possible to embrace all strategies. Next, we need to inform that these internal changes happen as a result of careful consideration of the stressful situation and finally that change and recovery takes time and that recovery trajectories are different. The most important thing for the clinician to remember is that these strategies are not necessarily adopted as a conscious direct decision, but as a result of internal changes that align with the core messages.

Motivating the self to adopt helpful health behaviours is important for patients to maximise recovery outcomes. Self-determination theory (SDT) (212) is a key motivational theory for behaviour change for optimal recovery after physical illness and trauma (213) and incorporates the constructs of self-efficacy (123, 214) and self-regulation (215). Better PTG after burn injury has been linked to increased self-efficacy (73). Self-efficacy is a key component of all major health behaviour theories (213), it entails having the confidence in one’s ability to effect change and is a strong predictor of behavioural change, i.e. belief in the self. It has been demonstrated to be important in coping with stress and recovery from poor health and illness (216). Self-regulation is an important part of both self-efficacy and self-determination theory and involves behavioural control of the self by the self through monitoring the determinants and effects of one’s own behaviour, and judging it in relation to personal standards and circumstances, and gauging the response of your behavioural choices on the resultant feelings (18, 217).

We propose that the examination of SDT in relation to the qualities of growth-related postburn coping reveals conceptual links between the two. Self-determination theory posits that competence, relatedness and autonomy are central to motivation (218). Competence relates to the experience of mastery of an optimal challenge, goal or activity by active engagement with it, and the ability to exert control over life, change behaviour or adapt to circumstance (Belief in
Self, Determination). Relatedness involves seeking attachments and feeling secure, integrated and intimate with other people (Emotional Management, Family, Friends and Social Support). Autonomy is related to independence, the experience of acting from choice and is regarded as a fundamental psychological need that predicts well-being (Acceptance, Determination, Belief in Self) (18, 212).

Integral to the whole concept of posttraumatic growth is that changes in thinking become an internalised source of behaviour change, and is therefore a type of intrinsic or integrated motivation. Self-determination theory examines intrinsic or extrinsic motivation types in the success of goal attainment. Intrinsic, or want-to, motivation is associated with better goal outcomes and better affect, greater determination and improved wellbeing. Intrinsic motivation comes from internal forces, and is internally regulated. In contrast, extrinsic, or have-to, motivation has four categories of regulation; external, introspected, identified and integrated. These areas are presented as a continuum of regulatory mechanisms, from the least beneficial (external) to the most beneficial (integrated). The more integrated and internalised the behaviour, the less that future challenges are regarded as obstacles to success, whereas the more externally controlled the behaviour, the more that future challenges are regarded as obstacles to success (219). This then clarifies that the changes in thinking that arise in postburn growth are helpful to recovery motivation.

In summary, this explains the theoretical mapping of the self-determination theory of motivation and the theory of posttraumatic growth after adult burn. There are a number of core messages which underpin the qualities of growth-related coping strategies used after burn. These provide a solid, theory-based rationale for the patient education information leaflet and associated infographic that can be made available to patients recovering from burn injury. Further research into the acceptability and usefulness of this information with a new cohort of burn patients is now required to explore this further (see section 8.4). A poster detailing these can be found in Appendix VI. The patient resource is shown in Figure 7-5 below.
6 HELPFUL STRATEGIES USED BY BURN SURVIVORS

THEY ACCEPT THE PAST, NOT THE FUTURE
They accept the injury, not the limitations. They accept help, but strive for independence. They accept life is different, but will be normal again. They focus on the future.

THEY BELIEVE IN THEMSELVES
They identify personally important values. They set realistic goals. They see how far they have come with pride. They realise they are stronger than they thought and that they can cope.

THEY ARE KIND TO THEMSELVES
They know that recovery is a journey. Their know that feelings ebb and flow. They know that setbacks happen. They know that progress differs for different people.

THEY ARE DETERMINED TO BE BETTER
They try to live to their values. They positively reframe their thoughts. They use humour and gratefulness to cope. They seek meaning in survival. They are determined and they plan each goal.

THEY TALK ABOUT THEIR EMOTIONS
They can identify their own emotions. They try to communicate their feelings calmly. They ask for help when they need it. They find ways to answer unwanted questions.

THEY SEEK FAMILY AND FRIENDS’ SUPPORT
They accept help from family and friends. They find a trusted confidante. They seek support from loyal, long-term friends. They know that friendships change.

MORE HELP
- Your GP can give support and can also refer you to psychological services under Medicare agreements
- Phone helplines (see below)
- Books and magazines
- Online resources
- Experts & professionals – the burns team, psychologists, counselors, ministers,

Feeling depressed or anxious?
Call beyondblue Support Service 1300 22 4636
Support Advice: Action
Call Lifeline on 13 11 14 if you need crisis support or visit www.lifeline.org.au to find a range of self-help resources and information

Figure 7-5 Patient resource: Six helpful strategies used by burn survivors
7.7 Limitation of this research

This research was undertaken in a small population of Caucasian and English-speaking burn survivors in a high income country, and generalisability of findings might be limited. The mixed method component was completed in a clinical environment with mostly quantitative research experience, and thus could have been influenced by an associated positivist paradigm for data evaluation. The inclusion criteria of needing to be at least two years post burn was used because it was felt that often people who had endured larger burns were often still going through reconstruction surgery until this time point. Therefore, we were keen for participants to be far enough through their journey of physical rehabilitation and reconstruction to have made some mental adjustments around the new life that had become normal for them, Thus, participants were needing to recall whether a change had been due to the burn trauma, or whether it was the result of another trauma, or simply due to natural maturation and personal growth that would have occurred regardless of major life events. Further quantitative studies of a larger, multicultural burn population would support all components of this area of research.
8. Conclusion

8.1 A review of the hypotheses

Essentially, growth after burn are dependent on two important processes, namely, new ways of thinking which give way to new ways of coping. These two processes are positively related to stress, inhibited by depression, and may become either normal or obsolete after recovery. Meaning making from deliberate rumination is a key part of the process and positive reframing results in a new outlook on life and its challenges. The process of growth adds new ways of coping to the arsenal of personal resources commonly regarded as resilience, so the outcome is beneficial, but as a process is arduous. There are some specific coping strategies that are related to postburn growth; acceptance, self-belief, self-compassion, determination for recovery, emotional management, psychosocial support and gratitude.

The papers in this study come together to a cohesive whole to address the hypotheses put forward at the start of this project. To remind the reader of these:

Hypotheses

1. We hypothesise that the Posttraumatic Growth Inventory is a valid tool for measuring positive psychological change after major burn injury in an Australian population.
2. We hypothesise that specific factors that can be identified at the time of injury will be associated with posttraumatic growth.
3. We hypothesise that improving cognitive function with a cognitive training program will enable posttraumatic growth through neuroplastic change.

Firstly, the first paper addressed the process and presentation of PTG after burn in an Australian population. It assessed the lived experience of growth for these patients, and assessed these experiences against the PTGI scores to conclude that postburn growth could be adequately measured in this way. It then proposed that a mean score less than 2.5 could be indicative of low growth in this population of severe burn survivors. The benefit of qualitative research added rich data that identified burn-specific influences on growth, and burn-specific barriers to growth. The interviews added details about the nature of the priorities, the types of activity changes that had been made and the reasons for those changes. The interviews revealed the importance of the impact of visible burn scarring on interpersonal communication, and led to further exploration of this in the second paper. The third paper then integrated all of the available published research, including the first two papers from this project, and generated the Model of Postburn Growth and Coping. This was important as it separated the concept of
changes in thinking, coping and influencing factors, therefore paving the way to explore the elements of growth-related coping, and also explore the relevant influencing factors. Next came the quantitative analysis of the quality of life and demographic factors, revealing that gender, age and time since injury did not affect growth scores, however the more severe the injury, as measured by TBSA, did have an effect on increasing scores. Very importantly, we discovered that growth was positively related to stress, and that depression had a profoundly negative effect on scores, in fact any score greater than 4 out of 21 as measured by the DASS21 tool, would impact on growth. This is clinically important because it highlights the need for awareness of the psychological state of the patient, and early referral and treatment of depression. Screening patients for depression is a 5 minute task that could be routinely undertaken in the outpatient clinic waiting area and assessed in clinic. Finally, it is interesting to note that the intensive cognitive training program did not impact on growth scores or other quality of life measures, and this will be published in the near future. In addition, the consideration of the wider theories of posttraumatic growth and resilience have been integrated into one coherent theory that link PTG and SOC for the first time in the literature. The relationship between changes in perception and better coping can assist us to identify future strategies that might improve burn recovery. There are potential gateways to growth through emotional management programs, social skills training, and peer support programs. Education about growth might help patients to be more compassionate to themselves and reassure patients about their own progress.

It appears that outcomes of growth after burn has the effect of boosting future resilience and aiding current recovery by buffering stress and therefore growth is desirable. However, we perhaps need to be careful about identifying growth scores without assessing for stress, and high scores could be regarded as a warning sign for underlying stress. The more we can assist our patients to reach the helpful thought processes that accompany the qualities of growth-related coping, the better outcomes will be observed.
8.2 A summary of the implications for practice

This is the first study to solely assess posttraumatic growth after burn injury. PTG affects personal strength, reprioritising, spirituality, humanity, relationships, and compassion. It is closely linked to coping styles of humour, gratefulness and planning. Social support is very important. Understanding the core messages of the six pillars of growth-related coping can guide interactions between clinician and patient. The clinician needs to understand the importance of the recognition of progress by the burn survivor, and the feeling of achievement that arises from that. Therefore, the clinician needs to be aware of the need for realistic goal setting and planning to achieve goals that are manageable and value-driven for the individual patient.

Burn survivors with visible scars accumulate bad experiences of social interaction. Inquisitive questions, comments and stares are often encountered and emotional and situational barriers reduce interpersonal connection. Responses to questions, comments and stares depend upon who asked, how they asked and the social situation. Humour, gratefulness, self-compassion and social support will help burn patients to cope with this. The provision of information to patients and families, support and education is necessary. Psychosocial training for all staff who interact with patients who have visible scars from their burn injury is important.

It is very important for the clinician to be aware that as stress levels increase, self-reported posttraumatic growth (PTG) levels increase and as mental health improves, PTG levels reduce. Clinicians must be aware of the influence of depression on growth and routine screening can be used for this in the outpatient department. If using the DASS-21 screening tool, any scores over 4 for the depression component can reduce the ability to cope under stress, and these patients need early referral for psychological assessment and support. The PTGI is a five minute screening tool that adequately identifies the degree of PTG in burn survivors in Western Australia and is a quick and easy tool to use to identify the need for clinical intervention and evaluate the effectiveness of strategies designed to target PTG. A mean score of 2.5 can be used by clinicians as a threshold to guide intervention strategy, but scores are dependent on burn related factors such as TBSA and the impacts of scarring and skin problems.
8.3 Addition to the literature

This study has added contextual information about the process and presentation of PTG after burn injury, and has clarified the relationship that PTG plays with stress, resilience and coping for the general literature. The study suggests that PTG occurs alongside stress and that the process of growth occurs through deliberate rumination. It has proposed the conceptual link between PTG and the sense of coherence theory of resilience and although these ideas have previously been connected, the direct mapping of the elements of the two constructs has not been explicitly described in the literature, to the knowledge of the authors. Thus it offers an explanation of how PTG could be the path to greater resilience, a premise which is supported by other ideas about resilience, such as inoculation and ‘steeling’ theories.

This study adds clarity around PTG after burn by separating the two elements of growth and coping. This study leads us to redefine growth as ‘Postburn psychological growth is helpful changes to our worldview that arise from deliberate rumination, and occur as a result of the burn trauma, which allows us to cope better with the current trauma and leads to greater resilience for future trauma’. It has identified six messages that are associated with the changes in thinking that are useful to drive changes that move towards helpful coping, and has used these as a framework for the patient education resource. It has identified that the useful coping mechanisms associated with growth are the use of humour, gratefulness, downward comparison, and realistic planning and goal-setting. In addition, it identifies the factors that affect growth and coping, including psychosocial support. It is the first study to assess PTGI and QoL factors in a longitudinal study after burn injury, and to identify that depression is a significant barrier to growth and requires early detection and intervention to enable more growth and hence enable better coping. The study has not proved that improving cognitive function through a training program is able to improve PTG. This is an important finding, and we plan to publish this in the near future, as the idea that improving neural pathways as a pathway to improving emotional thought pathways is conceptually plausible, and thus the negative results are useful to share to prevent the repetition of similar projects in the future.

In summary, this important piece of work has resulted in four academic journal publications, with the added potential of further published work about cognitive training. It has resulted in five oral conference presentations, and four conference posters nationally and internationally, and has substantially added to the body of research about PTG and psychological recovery after burn.
8.4 Potential interventions and future research

Further validation of the PTGI for use with adults with burn could use qualitative or quantitative methods. Qualitative methods could use interviews techniques that involve participants thinking aloud to assess question interpretation, or appropriate wording in the Australian context. Quantitative methods could use larger patient populations at different stages of recovery from different cultures and with broad demographic and cultural backgrounds to assess these findings further. Further studies designed to specifically analyse repeated measures data to evaluate sensitivity to change would add value to these findings. This would add to the strength of our findings for future use in intervention assessment.

The design used for mixed method research designs should be carefully considered, as the order of qualitative and quantitative elements and the importance placed on each, will affect the interpretation of the results. Mixed method research can be sequential or concurrent, embedded or complex, and a well thought out study designs is paramount to the trustworthiness of the findings. In addition, the quantitative and qualitative elements should be published together to make it easier for the reader to locate the related articles and information (220).

Potential interventions

There are a number of strategies that can be considered for useful intervention, these can be led by the patient, the burn clinician or the psychologist, depending on the chosen intervention. We have discussed the need to identify and treat depression early. In addition, we should be aware of elevated stress levels, which are likely to be indicative that internal rumination processes are occurring. The assessment of whether rumination is solely intrusive or whether it contains elements of deliberate rumination is important at times of high stress, and might require psychological support. The use of a quick and easy screening tool such as the DASS could be a useful strategy, and we have shown here that any depression score higher than 4 (out of 21) is predictive of low levels of PTG. Future study designs and data analysis should adjust for depression as a potential confounding variable if depression is not the outcome of interest.

The relationship between resilience and growth should be explored further. If PTGI scores are low, it is important to establish whether this is because resilience is adequate for that trauma, or if helpful changes in thinking and coping are not occurring when resilience is low. A thorough investigation of appropriate resilience measures, and their relationship to growth measures would help to expand the understanding of this area. Working backwards, if resilience is boosted by PTG, which is a process that comprises of greater use of helpful coping
strategies, which in turn arise from specific changes in thinking style, then we have the
opportunity to influence this pathway in a number of ways. First, we can trial interventions that
have the potential to encourage and ease the process of deliberate rumination. This could
include journaling or gratitude journaling interventions or personal blogs. Indeed blogs have
been analysed as a source of longitudinal qualitative data after burn, with similar findings of
personal growth (ref Garbett). Other interventions such as expert companionship, cognitive
behavioural therapies (CBT), or emotional management and regulation techniques such as
meditation, mindfulness, or cognitive defusion techniques might help burn survivors have a
metal shift in their thinking through deliberate rumination. Secondly, we can assess techniques
targeted at improving personal social support networks and quality relationships such as peer
support groups, conjoint couples CBT, or social skills training. Thirdly, we can use strategies in
our clinical practice that encourage hope and optimism for the future, such as value driven goal
setting techniques, conversational reframing techniques and patient education about useful
coping techniques. Acceptance and commitment therapies may be a good fit for an
intervention as it targets future action based on personal values. The infographic produced as
an educational resource for burn patients could be tested for its suitability for patients and its
impact for helping burn recovery. Similar resources could be developed for partners and
families, and clinical staff and programs devised to assess their benefit.

Other suggestions for future research interventions
The exploration of other factors that might influence PTG is an area for future research. For
example, it is thought that specific personality factors such as openness, extraversion and
optimism have a positive influence on PTG in the general population. However, we also know
that the personality type is a factor in the causation of burn injury, and this would be a
confounding factor. A second factor that might influence PTG is that of socioeconomic status
and the association of PTG after burn and SES is another potential area for research. Then
again, the pattern of SES in burn patients differs to the non-burn population. Further research
into the influence of age and gender in a larger cohort of patients would help to build the body
of knowledge about patient characteristics and postburn growth and coping. The influence of
PTSD on PTG after burn injury would be interesting to assess, and in extension to this, the
relationship between diagnoses of clinical PTSD, individual clusters of PTSD symptoms, and
subclinical PTSD presentations could be assessed for their influences on PTG. Additionally, the
relationship of PTG with specific measures of humour, gratefulness and positive reframing is an
interesting concept for exploration. Finally, further research could involve the development
and testing of a burn-specific measurement tool for PTG based on the Model of Postburn
Growth and Coping.
In summary, there are a number of potential ways we could improve postburn growth and coping. The potential interventions that have the potential to promote growth, improve coping and facilitate better recovery can be either patient-led, clinician-led, or psychology-led. A poster detailing these has been accepted for display and presentation at the Australian and New Zealand Burn Association Conference in October 2017 (Appendix VII).
5. References


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6. Appendices


Appendix I

EVALUATION OF THE POSTTRAUMATIC GROWTH INVENTORY AFTER SEVERE BURN INJURY IN WESTERN AUSTRALIA: CLINICAL IMPLICATIONS FOR USE.

Martin L, Byrnes M, McGarry S, Rea S, Wood F.
Evaluation of the posttraumatic growth inventory after severe burn injury in Western Australia: clinical implications for use

Lisa Martin, Michelle Byrnes, Sarah McGarry, Suzanne Rea & Fiona Wood

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Evaluation of the posttraumatic growth inventory after severe burn injury in Western Australia: clinical implications for use

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ABSTRACT

Purpose Posttraumatic growth (PTG) is "the subjective experience of positive psychological change reported as a result of the struggle with trauma." Very few studies have explored PTG after burn injury. The Posttraumatic Growth Inventory (PTGI) is a 25-item questionnaire which assesses five domains in which PTG has been found. The aim of this study was to assess how PTG presented after a severe burn, and second, whether it could be measured by the PTGI in Australian burn survivors. Methods A mixed method approach was used. Seventeen patients who had a severe burn injury at least 2 years previously were interviewed and completed the PTGI. The interviews were analyzed, then compared to the PTGI responses. Results PTG in burn survivors had similarities to PTGI arising from other trauma. Burn-specific context such as heat intolerance and functional problems influenced the type of changes made. Barriers to PTG in relationships were related to guilt burden and visible scarring. Conclusion PTG presents similarly after burn to other trauma types, but has other features to consider when devising intervention strategies. The PTGI is a 5-min screening tool that adequately identifies the presence or absence of PTG in burn survivors in Western Australia, and can guide intervention.

IMPLICATIONS FOR REHABILITATION:

- The Posttraumatic Growth Inventory is a 5-min screening tool that adequately identifies the degree of PTG in burn survivors in Western Australia.
- It is a quick and easy tool to use to identify the need for clinical intervention.
- It will also evaluate the effectiveness of strategies designed to target PTG.
- A mean score of 2.5 can be used as a threshold to guide intervention strategy.

Introduction

Posttraumatic growth (PTG) is "the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma."[1] It is growth because it describes development that has occurred beyond pre-trauma psychological functioning. Thus, it differs from resilience, which suggests the return to a previous state. PTG is thought to arise from a "shattering of an individual's worldview," which is shaped by culture and related aspects.[2] Rumination about the trauma might initiate and be related to the amount of PTG experienced.[3] Posttraumatic stress symptoms can occur concurrently with PTG as one is not considered to be the opposite of the other.[4]

Posttraumatic growth was first described by O'Leary and Ickovics.[5] in relation to women's vulnerability. Further exploration led to the development of the Posttraumatic Growth Inventory (PTGI).[5] This tool identifies beneficial psychosocial changes that occur after trauma. PTG has been explored after traumatic events, e.g., in cancer survivors, in war veterans, after myocardial infarction and after domestic violence.[6–10] There are few studies that explore PTG after burn injury. A literature review which assessed religiosity found that North American burn survivors suggested that spiritual beliefs used as a coping strategy might improve PTG scores overall[11]. A qualitative study[12] investigated PTG in Chinese burn survivors; they found little change in spiritual growth but claimed differences in other factors such as motivation borne of their obligation and gratefulness to loved ones. The study helped to validate the use of the PTGI in the burn survivor population; however, diverse cultural contexts must be considered when generalizing research findings and it is likely that PTG would present differently in different cultures.

Two studies used the PTGI as an outcome measure after burn injury. In Germany, a study investigating PTG after severe burn injury (mean total body surface area burn TBSA 32%, mean PTGI score 3.19).[13] assessed factors hypothesized to be associated with positive posttraumatic growth. Those who used active coping and had better social support achieved more PTG. Whereas the second study from the United Kingdom assessed PTG after smaller burn injuries (mean TBSA 9.4%), and reported a mean PTGI of 1.26.[14] In this study, higher PTG scores correlated with worse burn severity, better social support and coping.[14] However, evaluation of the PTGI itself has not been explored for use in burn survivors, and this needs to be assessed to enable the interpretation of PTG scores in research. Additionally, recommendations for score...
interpretation have not been suggested for this population in the literature.

It is important to understand the positive psychological outcomes that are realistic and achievable following a severe burn injury. A tool which accurately measures posttraumatic growth after burn injury is required to identify those who do not experience PTG and to enable the implementation and effectiveness of interventions.

The first aim of the study was to assess how PTG presented after severe burn injury. The second aim was to assess whether the PTG reflected the lived experience of PTG in those burn survivors; whether it measured PTG adequately, captured all the elements of PTG and if elements included are not relevant. Overall, the aim was to assess whether the PTG is a valuable tool for use in the Australian burn survivor population.

Methods

A mixed method approach was used to allow detailed understanding of the topic. Qualitative interviews explored the subjective lived experience of burn survivors’ PTG and were compared against their objective PTGI scores. This qualitative approach put context around the quantitative variables and allowed the shift of “expert” from the clinician to the patient.[15] If the PTG is to be used as a valuable outcome measure after burn injury, we expect that the coding from the interviews will corroborate with the self-reported scores on the PTGI. The interviews also help to reveal difficulties in item interpretation, and differences in interpretation between respondents. In addition, the interviews allowed the identification of burn-specific challenges which affect PTG. Thus, this final comparison of qualitative and quantitative results is described as a convergent parallel mixed method approach.[16]

Ethical approval was obtained from the institutional Human Research Ethics Committee (HREC 12-178). Adults who had experienced a burn injury over 1% BSA or severe burn injury (TBSA >15%), more than 2 years previously were approached to participate and were identified from hospital databases. Twenty-nine patients who met the inclusion criteria were invited to participate by letter; five declined, seven did not respond. Thus, 17 were recruited. Following informed consent patients completed the posttraumatic growth inventory screening tool. The PTGI has an overall internal consistency of r = 0.90 and a test-retest reliability of r = 0.71.[17] This is a tool that takes 5 min to complete. Participants were asked to carefully consider their responses and were aware that these would be discussed in the interview that followed. Each participant was interviewed by the primary author to explore experiences within each area of PTG. The questions related to the PTGI items but were composed in a neutral format, allowing positive or negative responses equally (Appendix 1). The five factors were explored in a semi-structured recorded interview, using both direct questioning and flow. The interviews followed a conversational format that explored each factor. In turn, ensuing discussion around each of the 21 inventory items. Participants were able to expand on ideas and to contribute new information to the area of psychological growth in the context of burn injury.

Analysis

The screening tool has five factors relating to others, new possibilities, personal strengths, spiritual change, and appreciation of life. These factors were analyzed and assessed for interrelationships. The factors in the screening tool are not represented equally; therefore, the median score of each was assessed as total scores are difficult to interpret.

The interviews were transcribed verbatim by the first researcher, each interview listened to, and read, at least twice. Coding was completed using deductive and inductive thematic analysis using Tesch’s eight-step method.[16] NVivo software version 10 (QSR International, VIC, Australia) was used for data analysis. Saturation point, which is when there is no new information arising, was reached by 15 interviews. A further two interviews were conducted and analyzed to confirm saturations.[18]

Thematic analysis was performed on the qualitative interview data in two ways.[18] First, because the analysis of data draws on the existing literature, PTGI scores were used for deductive analysis. Second, the data was explored for other themes that related to positive psychological change arising from the context of the burn injury. This required an exploratory approach where the themes were drawn from the individual experiences as identified from the interview data. Therefore, stage one of the analysis used a confirmatory and hypothesis-driven approach.[18] Second, the data was explored for other themes that related to positive psychological change arising from the context of the burn injury. This required an exploratory approach where the themes were drawn from the individual experiences as identified from the interview data. Therefore, stage two of the analysis used an exploratory and content-driven approach.[20] PTGI median scores for each factor (Tables 1–4) and mean total scores (Table 6) were calculated and compared to the interview data. This was the first interaction of the qualitative and quantitative analysis.

Bigor or trustworthiness was ensured by the following means: triangulation of data from several sources or references within a source was used to draw conclusions; member checks were performed with a sample of the participants; conflicting information was presented and considered; and all members of the research team had relevant experience and verification of the analysis was performed by researchers experienced with the methods. An audit trail was created and a reflective journal was kept by the first researcher.[16,21]

Demographics

Seventeen participants (11 males, 6 females) were interviewed, this gender ratio (64% males) is representative of the hospitalized burn population in Western Australia (67% males).[22] The median age was 48 years (range 21–75 years), and participants were a median of 8 years post-burn (range 2–33 years) with a median TBSA of 30% (range 15–85%) (Table 7).

Findings

Interpersonal relationships (PTGI factor 1)

The following themes arose from the interviews in response to the questions about interpersonal relationships, and their relationship to the corresponding items in the PTGI is shown in Table 1.

Trust and loyalty The theme of trust was essential to maintaining relationships and defined the breadth of their close network. For example, Julie reflected “I just don’t tell my brother as much as I used to... I don’t trust him as much”. She continued “I put more of an effort into Chris’s (partner) relationship... and mine and my mum’s”. Relationships with those outside this close network of confidantes were lost, through the actions or inactions of either party, highlighting the importance of loyalty. A common theme of loyalty was reflected by Andrew “You get to know who your real
Table 1. Factor 1 PTGI scores and corresponding themes.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>N</th>
<th>Median</th>
<th>IQR</th>
<th>Scale</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>I more clearly see that I can count on people in times of trouble</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>0-5</td>
<td>Independence versus dependence</td>
</tr>
<tr>
<td>8</td>
<td>I have a greater sense of closeness with others</td>
<td>17</td>
<td>3</td>
<td>4</td>
<td>0-5</td>
<td>Trust and loyalty</td>
</tr>
<tr>
<td>9</td>
<td>I am more willing to express my emotions</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Long-term support</td>
</tr>
<tr>
<td>15</td>
<td>I have more compassion for others</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>0-5</td>
<td>Emotional transparency</td>
</tr>
<tr>
<td>16</td>
<td>I put more effort into my relationships</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Trust and loyalty</td>
</tr>
<tr>
<td>20</td>
<td>I learned a great deal about how wonderful people are</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Community</td>
</tr>
<tr>
<td>21</td>
<td>I better accept needing others</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Independence versus dependence</td>
</tr>
</tbody>
</table>

Table 2. Factor 2 PTGI scores and corresponding themes.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>N</th>
<th>Median</th>
<th>IQR</th>
<th>Scale</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>I developed new interests</td>
<td>17</td>
<td>0</td>
<td>3</td>
<td>0-5</td>
<td>Work-life balance</td>
</tr>
<tr>
<td>7</td>
<td>I established a new path for my life</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Recreation and leisure</td>
</tr>
<tr>
<td>11</td>
<td>I am able to do better things with my life</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>0-5</td>
<td>Work-life balance</td>
</tr>
<tr>
<td>14</td>
<td>New opportunities are available which wouldn’t have been otherwise</td>
<td>17</td>
<td>0</td>
<td>3</td>
<td>0-5</td>
<td>Recreation and leisure</td>
</tr>
<tr>
<td>17</td>
<td>I am more likely to try to change things which need changing</td>
<td>17</td>
<td>3</td>
<td>2</td>
<td>0-5</td>
<td>Citizenship</td>
</tr>
</tbody>
</table>

Table 3. Factor 3 PTGI scores with corresponding themes.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>N</th>
<th>Median</th>
<th>IQR</th>
<th>Scale</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>I have a greater feeling of self-reliance</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>0-5</td>
<td>Strength determination</td>
</tr>
<tr>
<td>10</td>
<td>I know better that I can handle difficulties</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Coping strength</td>
</tr>
<tr>
<td>12</td>
<td>I am better able to accept the way things work out</td>
<td>17</td>
<td>2</td>
<td>2</td>
<td>0-5</td>
<td>Coping strength acceptance</td>
</tr>
<tr>
<td>19</td>
<td>I discovered that I’m stronger than I thought I was</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>0-5</td>
<td>Coping strength</td>
</tr>
</tbody>
</table>

Table 4. Factor 4 PTGI scores and corresponding themes.

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<tr>
<th>Item #</th>
<th>Item</th>
<th>N</th>
<th>Median</th>
<th>IQR</th>
<th>Scale</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>I have a better understanding of spiritual matters</td>
<td>17</td>
<td>1</td>
<td>3</td>
<td>0-5</td>
<td>Spiritual change</td>
</tr>
<tr>
<td>13</td>
<td>I have a stronger religious faith</td>
<td>17</td>
<td>0</td>
<td>1</td>
<td>0-5</td>
<td>Spiritual change</td>
</tr>
</tbody>
</table>

Table 5. Factor 5 PTGI scores and corresponding themes.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>N</th>
<th>Median</th>
<th>IQR</th>
<th>Scale</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I changed my priorities about what is important in life</td>
<td>17</td>
<td>3</td>
<td>2</td>
<td>0-5</td>
<td>Life</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>Well-being</td>
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<td></td>
<td>New normalcy</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Present moment relationships</td>
</tr>
<tr>
<td>2</td>
<td>I have a greater appreciation for the value of my own life</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>0-5</td>
<td>Life</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Well-being</td>
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friends are... the ones that will hang around and help you and the ones who aren’t your real friends, they sort of disappear”. These themes produced relationships which were closer, smaller and stronger with a better understanding of the value of those relationships.

Long-term support. What appeared consistently was that long-term support was often valued and an important dynamic for growth. Those close, supportive relationships were particularly important from family and friends who were present before the burn injury, as they knew the person before the injury and understood their journey since the burn injury with less explanation about the challenges they had faced. Shelley explained about her sister: “She’s been there from day one whereas my friends have been there half way through”, explaining that her friends “are there for like a few months and then they are like ‘oh, this is too hard, I can’t handle...”
It’s "amazing" by the ongoing support from friends and family many years after her accident.

Emotional transparency. Transparency of emotions and the willingness to feel and process emotions were important to posttraumatic growth. Some participants demonstrated openness and accepting experiences of emotion, whilst others reflected emotional suppression. Vicki said that she expresses her love for people more deeply because of a heightened awareness of how quickly someone can be lost “now I will say ‘see you later, I love you’”. Whilst other participants expressed an inability to freely access and process their varied emotions as reflected by Julie “sometimes I bottle it up and then it gets too much” resulting in her breaking a few doors, whereas before “I would have just raised my voice”.

Independence versus dependence. Early after the injury, participants were forced to rely on others for physical, emotional and financial support. This was often “frustrating”, “annoying” and hard to accept. The determination to become independent motivated some participants and assisted them to realize their own personal strengths. The transition from dependence to independence occurred over time, and recognizing milestones, both small and large, was extremely important. Mark’s posttraumatic growth enabled a new level of understanding other people “I’m probably more accepting because I understand a bit more, now I am past that event. They just want to be able to provide some help...and be able to do something for me”.

Compensation. Those who demonstrated self-compensation also reflected compassion for others. Hannah, who attributed her burn to “a silly mistake” was more forgiving of herself and others. She described “shock” at how deeply she felt compassion for others after her burn. The experience of surviving a burn injury gave the participants a new point of reference to assess the severity of others’ experiences. In contrast, Max reflected that his feelings of compassion for others had “disappeared” because the trauma had been so profound; he revealed that “you start seeing anything else happening to other people as less” and that other people should “get on with it”. Hannah described a level of “insensitivity” to those “playing to a sick role” claiming that “you’re not sick until your legs are falling off”. Peter reflected that “bad things” happen to everyone but you can only compare it to “the worst thing that has happened to you”. His demonstrated further insight when he continued to reflect that compassion is difficult because “I haven’t experienced your worst thing and to you, your worst thing is your worst thing”.

Community. Several burns survivors reflected that support from the wider community was valued, and it was recognized that other people wanted to help. The support from the community was described as “amazing” and “stunning”. This “unexpected” community response caused “delight”, and “helped with healing”. Shelley said it was a “good feeling” that they wanted to help. Peter stated that little thoughtful acts of other people assisted him to feel and heal better. He believed that people wanted to help and that they “do what they can”. He gave the example of his boss’s wife who cooked meals for his family whilst he was in the hospital. Shelley agreed with her reflection that “the community, they have been amazing...they did a quiet night and the ladies, they did a garage sale and like a bake-off, and so many people did so many things”.

Burden. Several participants felt that they were a physical and psychological burden to their loved ones, with their feelings of guilt causing barriers to their relationships. Walter commented that it is also “about the effect it causes on your family and friends”. Shelley felt stressed not wanting to “burden” her Mum saying that it is hard to “open up” to her family because of causing them stress “I’d rather keep that load on me and you know express it in playing netball”. Similarly, she did not want to “push the limits” of her friendships. A combination of admiration and guilt came from Max with respect to his wife “she’s a strong woman, she’s borne the cost of it all as well unfortunately. It’s worn her down a bit”.

New possibilities (PTGI factor 2).

Within the concept of “new possibilities” there appeared to be three drivers to change. First, some participants had more time available as a result of being unable to work due to the burn injury. Second, the burn necessitated that certain activities had to be undertaken and were a priority whilst other activities were not. Burn-related factors included the avoidance of heat and sun exposure, cautiousness due to skin fragility, restrictions in physical function and the need to complete time-consuming burns care regimes. Third, there was a change in activity due to the creation of new priorities and important values. The following themes arose from the interviews in response to the questions around new possibilities, and their relationship to the corresponding items in the PTGI are shown in Table 2.
Work-life balance. Several participants reflected that work became a lesser priority, and with that came the need to create time for activities wide to them. Hannah said the injury gave her "enough of a wobble to make me contemplate things that I perhaps wouldn't have contemplated". She left her job as a Registered Nurse for 2 years to study Animation Studies. Andrew considered "what's life all about? He wanted to "make a positive contribution to society" and changed career from Fleet Controlling to Occupational Health and Safety. Chloe is now less career-focused and is "trying to find the meaning" in her work role. She has made various changes to enable her to work closer to home and to her family. Gabriella found it took a few years to get back into the flow of work in the cool early mornings so she can manage her burn-related intolerance to heat. Others have reduced their hours at work because of functional limitations, or have been close to retirement age and not returned.

Recreation and leisure

The maintenance of physical health was a new priority but required new methodologies to achieve. Chloe previously enjoyed surfing but can no longer enjoy surfing because of the need to avoid the sun. Shelley has continued to play netball but is "scared" when she plays the sport because her skin is more fragile. Vicki's new hobby is gardening, and she likes to socialize, but only when temperatures are cool. Others tinker with cars, travel the "lup" of Australia, walk the Bilby/Sharan track and go camping. Travel and family holidays appear important; however, can be limited by the sequelae of consequences of the burn. Chloe chose Alaska over California for travel, choosing the cold climate because of heat intolerance. Phobias about flying and claustrophobias influenced Vicki; she said "the thought of being stuck on the tarmac for an hour because of whatever" would give her "a complete meltdown".

Citizenship. Finding ways to contribute to the community was important to some, and was found to help with healing. Andrew said his life was "enriched" through involvement in a community activity that arose as a result of his injury. Others have been involved in peer support groups for burn injury, often with the desire to help others. Craig, badly burnt at 18, attended a retreat to be a "role model" to enable and empower him to "benefit someone by talking to them" but instead made new friends and gained new experiences himself. Vicki has gained the confidence to speak in front of others about her burn. Sheley agreed "I've been wanting to do motivational speaking or going to primary schools... just to help people with fire safety, you know what happens when you do get burnt".

PTGI items for factor 3. Participants perceived that some of their changes were not due to their burn injury, more to a resurgence of previous interests. However, those who reported a change in the interview reflected this in the PTGI (Table 2).

Personal strength (PTGI factor 3)

The following themes arose from the interviews in response to the questions about personal strengths, and their relationship to the corresponding items in the PTGI is shown in Table 3.

Coping

Gratification, planning and humour were strategies used to cope. Craig was grateful that his injury was not worse. He said, "there are always people out there who are a lot worse off than I am so that lifts your spirits up". Rachel agreed "be happy with what you are, you know, you could be a lot worse". Max wanted to "map out" the things he needed to do to recover, and meeting milestones was important. Vicki said of an inappropriate comment about her injury "I was speechless, and then I had this irresistible urge to laugh".

Strength

Feelings of increased personal strength and pride in oneself were distinct themes. Shelley feels "a lot stronger since the accident". Hannah was "impressed with herself" and Rachel was "proud" of her progress. Julie explained, "I've made it three years, I can make it another three". Failure was daunting for Hannah who said the injury had "opened her eyes"; she was "more willing to take a plunge" and felt "less frightened of difficult things".

Determination

The determined drive for mastery or independence, return to normal function, activity, and work was a revealed strength. Rachel's "determination kicked in rapidly" to be able to walk again and dress herself. She said that she hated relying on others and "wasn't going to be that person". Craig was reluctant to accept help "she'd just ask if I needed a hand and I would be no, I'm alright". Julie did not see her determination to be self-reliant as new "I always did everything myself, I still do everything myself".

Walter said, "I took the attitude that to make myself better there was only one person who was going to do it".

Acceptance

The injury was generally accepted and described as "old news" and participants "just learnt to live around it". A deterministic view was expressed by David who said that "everything happens for a reason" and reflected by Andrew, who was injured in a terrorist attack "you couldn't avoid it because it was just something that happened". The sequelae of the injury was harder to accept. Max said "I lost my hands, I lost my face. Losing your face, I don't think you ever come to terms with that".

Spiritual change (PTGI factor 4)

There was a deeper understanding that life experiences are both negative and positive. Peter stated that "bad things have happened to everyone... good things have happened to everyone". Andrew reflected this and said that things happen as "part and parcel of life" and it was necessary to "ride the cycle of life". He believed "there is a reason for things".

The use of existing faith as a support was applied to just three participants. Participants described "deeper awareness" of spirituality and that their faith had "helped". Mark had become more "engaged" in the local Catholic community which thereby provided an extended social support network. Chloe said her faith was stronger and that she felt a greater desire to be true to herself and tell others "I always know God was there, but now I'm willing to talk to people about it because it is who I am".

Others found no change in the type or depth of their religious beliefs. Vicki felt anger towards people who thought she should be happy that "God had saved her... because I think hang on, that God that saved me took my husband, took my children's father". She went on to say that "nature" was her "spiritual guide". Hannah said she believed that all things were "connected" but didn't know how. The relationship to the PTGI is shown in Table 4.

Appreciation of life (PTGI factor 5)

The realization that life can change instantly dramatically and unexpectedly underpinned though "Everything can change in the blink of an eye, so if you don't do it now, you may never do
Survival: The theme of gratefulness for survival and having a second chance at life was evident. This was regardless of the severity of the burn injury. When asked what she appreciated about her life, Julie responded simply “That I’m actually alive.” This was reiterated by Shelley who described her “second chance at life” as “a huge, huge thing.” Adrian described finding his “true order” because before the injury he would “say a prayer and ask for something” but after the accident he would “pray that I’m not going to die.” Despite the severity of their injuries, medical intervention and adaption to life were interdependent. Suddenness and severity of injury changed perspective. Understanding the transience of life led to a greater appreciation of living and appreciation of survival was universal despite extraordinary difficulties. Changes were driven by a realization of genuine priorities and values, and the desire to live to those.

Well-being: Health became a priority for participants, both physically and emotionally, particularly in managing the difficulties of burn injury. Physically, this related to the management of heat intolerance, sun avoidance and reduced function related to the management of fragile scarred skin. This led to the adoption of protective behaviours on a daily basis that changed the way activities were approached and ultimately restricted activity. Shelley said, “I’ve changed the way I play netball and picking stuff up and bending down and I don’t use the bottom drawer.” Mentally, this related to coping with the psychological effects, changes in appearance and the memories of the injury event. The link between physical and mental health was recognized “I know that if I am physically active I’m more mentally better. I appreciate things better when I’m more mentally in a good space” (Hannah). Happiness was a new priority, revealing an increase in self-compassion; for example, Hannah’s main priority had shifted to seeking her own happiness, with the happiness of others coming a close second. Vicki said, “I’m happy, I’ve got my family, my friends”.

New normal: Accepting a new normal was an important theme. Resuming normal life and return to work was a priority for Julie. The determination was a quality that came to the fore in order to overcome both acute and chronic challenges of injury in order to achieve this. Shifts in thinking enabled the acceptance of a new normal “I’ve got a very happy life, you know, it’s not what I would have thought I would have at this stage” (Vicky).

Present moment: Realizing the value of life changed priorities and led to changes in how time was spent. The focus had “shifted” from material possessions to family and friends. Peter explained, “there is no point in being the richest man in the cemetery.” New experiences became important such as travel and learning. Shelley “can’t wait” to travel. Hannah appreciated her days more and makes the most of having the time and opportunity to do things she previously did not make time for such as walking and camping. As mentioned previously, less focus on work and more focus on improving work-life balance was a theme from the interviews.

Relationships: Realizing the value of significant relationships drove the changes in factor 1. Often this was not seen as a new priority, but one that had been intensified by the experience of burn trauma. Vicki attributes her will to survive the acute stages of the burn injury to her desire to see her children grow up and be happy, and for her to see her future grandchildren. She said “I think you’ve got to have a reason to survive when it’s so severe and mine was always my children. I always wanted to see them happy … and grandchildren, so that really gave me something, and I’ve seen all that now.”

Discussion: The aim to evaluate how PTG presented in a burn survivor population was achieved. Understanding potential positive outcomes and growth after burn injury is important so that we can use effective interventions to improve the quality of life towards realistic, achievable goals. The components of PTG revealed in the interviews were interdependent. Suddenness and severity of injury changed perspective. Understanding the transience of life led to a greater appreciation of living and appreciation of survival was universal despite extraordinary difficulties. Changes were driven by a realization of genuine priorities and values, and the desire to live to those.

People were more aware of the value of good relationships, and put more effort into those that were important. Burn survivors retreated into smaller, closer networks dependent on trust, with a realization of finding out who were true friends. These findings are consistent with PTG after other trauma.[3] Additionally, after burn injury, loyalty and long-term support from their significant others were important. Those who had been present and supportive for the long-term understood the full context of the overall situation of the burn injury for that person, without the need for explanation by the burn survivor.

A determination for independence, an increased priority for their own well-being and the need to establish a new normality pushed against the forced dependence they experienced early after their injury. Taking ownership and planning strategies to recover helped. As independence was gained, and improvements were seen, a feeling of greater inner strength and pride in their progress developed. It has been postulated that PTG might be a component of self-determination theory[23] and that higher levels of PTG drive motivation.

Those who revealed self-compasstion also expressed compasstion for others, especially those who had sustained a similar injury. The injury brought a new perspective and coping was helped if they could compare their circumstances favourably to others, allowing gratefulness and enabling acceptance. Humour was found to be a useful coping strategy, and this finding supports other research in burn trauma.[24] The fact that life can change so quickly motivated people to do things today because otherwise the opportunity might be lost and to try new things. Less focus on finance and work, more on learning and travel, led to a desire to obtain a healthy work-life balance. This is supported by work of the original authors.[25]

Burn-specific drivers to change were difficulties with heat tolerance and sun exposure, altered behaviours because of skin fragility and tightness, and the constant reminder of visible scarring resulting in the need to explain the injury. These physical restrictions are frustrating and extra determination is needed to overcome or accept these limitations, consistent with other literature.[26] These factors often defined the type and detail of change made to work and leisure. A desire to find meaning was clear; both the wish to give back to the community or to use newfound knowledge about burn injury to prevent others from the same misfortune.

Emotional transparency was influenced by two opposing factors. Feelings of guilt about being alive and feeling that new priorities of recovery were barriers to communication because
Disclosure was perceived as an extra emotional burden on them. Conflicting to this was to live true to values, part of which is to be able to express feelings.

Overall, there was little change in spiritual or religious views, consistent with the PTG after burning in the study from China [12] and other studies that assess PTG and spirituality [11,27]. Changes were occasionally negative feelings of an unfaithful God, and occasionally positive; strength drawn from an existing, active faith. There appeared a shift of paradigm from individualistic to collective thinking; the awareness that evil or bad things occurs and that life is a "roller-coaster", the recognition of greater interpersonnal connections, and insight into the importance of community, and Nature, sunsets and simple pleasures were important sources of spiritual support.

It may be important to note that this was a qualitative study in a specific population of Caucasian and English-speaking individuals and generalisability of the findings may be limited. Participants relied on recall to complete the PTGI. Burn injury had not been their only trauma and participants considered whether changes occurred from the burn injury, other traumas or natural maturational processes. For example, Peter's responses to the PTGI were marked lower because he attributed some growth to the diagnosis of multiple sclerosis. Other traumas included the death of a loved one and diagnoses such as cancer or diabetes.

The second aim was to assess whether the PTGI screening tool measures this in a Western Australian severe burn population. A useful tool to measure PTGI is important to assess the effectiveness of interventions for research and clinical use. The comparison of the interview findings to the PTGI items were adequately equivalent and the answers given by respondents reflected the interview themes. The mean total scores ranged from 3.6 to 3.9 (possible scores 0-3) and represented overall growth. Cluster analysis demonstrated that eight participants scored less than 2.5 and nine scores above 2.5. Therefore, it is possible to divide participants into two categories with a mean score of 2.5 at the dividing point. False low scores were possible if PTGI was attributed to other trauma or lack of insight. The researchers suggest that those with a total mean score of less than 2.5 may benefit from interventions to improve PTG outcomes.

The current quality of life assessments is designed to identify and resolve difficulties. The PTGI allows us to measure and potentially facilitate growth. The use of the PTGI is important in clinical care to identify those with low posttraumatic growth scores so that interventions can be suggested for improvement. Additionally, the use of the PTGI in research is important to assess the effectiveness of interventions. Future research should encompass the testing of interventions to improve posttraumatic growth.

Conclusion

Severe burn injury is a major trauma which can result in PTG. Burn survivors had similar experiences of PTG to that arising from other trauma. Burn-specific context of heat intolerance and functional problems influenced the type of changes made. Barriers to PTG in relationships were related to guilt burden and visible scarring. The PTGI is a 5-min screening tool that adequately identifies the degree of PTG in burn survivors in Western Australia. Therefore, it is an easy and valuable tool to use to identify the need for intervention and to evaluate the effectiveness of strategies designed to target PTG. A mean score of 2.5 can be used as a threshold to guide intervention strategy. Although all who have survived a severe burn could benefit from interventions to improve PTG, those with a lower mean score can be identified for more intensive intervention programs. Potential further research could assess appropriate interventions to improve PTG as measured by the PTGI, and potential interventions can be derived from the themes emergent in this paper. This is the first study to assess PTG and to suggest parameters for clinical use in a population of burn survivors in Western Australia.

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Disclosure statement

The authors report no declarations of interest.

References

Appendix 1: Interview questions

These exploratory questions relate to the PTGI items and are composed in a neutral format, allowing positive or negative responses equally, since your burn injury...

Factor I: Relating to others
What are your personal relationships changed? In what ways do you approach your relationships differently? In what ways has your reliance on other people changed? Are there people you feel closer to? In what ways? Do you express your emotions differently? In what ways? Do you see people differently? How? What have you learnt about others? Do you think you need people more? How? What are the important traits you see in your friends? What have you learnt about friendship? Factor II: New possibilities
What new activities have you developed? (hobbies, sports and others)
What opportunities do you think have arisen that might not have been there otherwise? In what ways do you do things differently? How much do you feel you have established a new path in life?
In what ways have your openness to new experience changed? How has work changed for you? Factor III: Personal strength
How have your feelings of inner strength changed? Do you handle difficult situations differently? How has your confidence in your own ability been affected? Factor IV: Spiritual change
Do you have a faith? Have your religious/spiritual beliefs changed? Factor V: Appreciation of life
What is important to you in your life? Are these things different for you? Has the appreciation of your own life changed? How? Has the appreciation of your days changed? How?
Appendix II

SOCIAL CHALLENGES OF VISIBLE SCARRING AFTER SEVERE BURN: A QUALITATIVE ANALYSIS.

Social challenges of visible scarring after severe burn: A qualitative analysis

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A B S T R A C T

Introduction: Visible scarring after burn causes social challenges which impact on interpersonal connections. These have health impacts which may worsen outcomes for burn patients and reduce the potential for posttraumatic growth (PTG).

Aim: The aim of the study was to investigate adult burn survivors’ experiences of interpersonal relationships as potential barriers to posttraumatic recovery following hand or face burns.

Method: This qualitative study explored patient experiences of interpersonal situations. A purposive sample of 16 who had visible burn scarring were interviewed more than two years after their burn.

Results: Emotional barriers included the fear of rejection, feelings of self-consciousness, embarrassment and humiliation. Situational barriers included inquisitive questions, comments and behaviours of others. Responses depended on the relationship with the person, how they were asked and the social situation. Active coping strategies included positive reframing, humour, changing the soft, and pre-empting questions. Avoidant coping strategies included avoidance of eye contact, closed body language, hiding scars, and learning to shut down conversations.

Conclusion: Emotional and situational barriers reduced social connection and avoidant coping strategies reduced the interaction of people with burns with others. Active coping strategies need to be taught to assist with social reintegration. This highlights the need for peer support, family support and education, and social skills training.

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1. Introduction

Visible scarring to the hands or face is common following a burn. In Australia, there is a lack of involvement in 29.6% of patients and hand involvement in 34.3% of patients admitted due to burn [1]. The incidence of scarring after burn has been reported to be between 22% and 72% [2] and thus, by combining these figures, we suggest that the likelihood of scarring to the face or hand after burn could potentially lie between 10 and 25% of burn admissions. Scarring after a burn is dependent on patient characteristics such as female gender, young age, genetic factors, and individual physiological response to injury, as well as the depth, size and clinical details of the wound itself [7-9]. Social challenges arise from the presence of visible scarring which have the potential to affect interpersonal relationships and social connection [10].

Social isolation is described as “the distancing of a person from their network of desired or needed relationships with others” [10] and adversely affects physical and mental health [6]. It has been reported that physically, increased levels of stress hormones can cause immune dysfunction, cardiovascular dysfunction and hypertension [7,8]. In addition, mentally, social isolation is associated with higher levels of clinical depression and suicidal ideation [9]. In addition to the recognised risk of Post-Traumatic Stress Disorder (PTSD) [10,11] following burn, those who have visible scarring are at greater risk of depression [12], distress and of becoming socially isolated [13] including associated adverse health sequelae.

Within our society, individuals use different strategies to cope with various traumatic life events. Curvers et al. [14] describe 14 different coping strategies and these have been broadly classified into approach and avoidant focussed strategies [15]. Approach strategies are believed to be adaptive and more effective for the resolution of stress in the long-term; these involve active coping, planning, seeking instrumental support, seeking emotional support, religion, venting, positive reframing, humour, and acceptance. Avoidant strategies are believed to reduce distress in the short-term, but ineffective in the long-term; these involve self-blame, self-distraction, denial, behavioural disengagement, and substance use. In order to promote optimal recovery, it is important to understand the relationship between coping, interpersonal connection and how this impacts on the potential for posttraumatic growth (PTG) after a burn which results in visible scarring.

Posttraumatic growth is ‘the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma’ [16]. Posttraumatic growth after burn is largely congruent with PTG after other types of trauma [11], and is culturally specific [18]. A major component of PTG are the strengths of interpersonal relationships and social connections. If these interpersonal connections are impacted significantly then the potential for PTG may also be impacted. It has been documented that interpersonal connect- 

ion after burn is dependent on trust and loyalty, long-term support, emotional transparency, the drive for independence, compassion and community response. Some friendships break down as trust is breached, however valued relationships survive and core support networks become smaller, closer and stronger [17]. Interpersonal considerations of psychosocial adjustment and PTG have both been identified as an area for further research in a recent literature review [19].

The aim of the study was to investigate adult burn survivors’ experiences of interpersonal and social relationships as potential barriers to PTG after visible scarring to either hands and/or face from severe burn.

2. Method

A phenomenological qualitative approach was used to facilitate the interpretation and exploration of meanings and assess the lived experience of burn survivors in relation to their interpersonal relationships. This approach uses thick descriptions to understand the phenomenon of interest. The philosophy of this is that the consciousness of human experience determines what this means to an individual, and was therefore the most suitable to investigate this research area. This was part of a larger mixed methods study which explored PTG after burn. Those who had sustained burn (>15% total body surface area) at least two years previously were invited to participate for an interview by letter. Their responses to questions about interpersonal relationships in relation to difficult social encounters are reported here.

To increase the trustworthiness and credibility of the information, multiple strategies were used. The interviews were initially audiotaped, then transcribed verbatim by the first researcher, with each interview listened to and read several times. Thematic analysis was conducted by the first researcher and confirmed by the second researcher using Tesch’s eight steps of coding (Table 1). Member checks were completed to

Table 1: Tesch’s eight steps of coding.

1. Get a sense of the whole: read all transcripts carefully. Get down ideas as you read.
2. Pick one document (interview) go through thinking “what is this about?” Write thoughts about the underlying meaning in the margin.
3. Complete (or several) participants.
4. List all topics and distill into similar topics. Form into columns such as – major, unique, left over (is this relevant, not relevant, other)
5. Take lat and return to data. Alleviate topics as codes and write next to appropriate sections of text. Organize to see if new categories or codes emerge.
6. Find the most descriptive wording for your topics and turn them into categories. Look for ways of reducing your total list by grouping topics that relate to each other. Perhaps draw lines to show interrelationships.
7. Make a final decision on the abbreviation for each category and alphabetize
8. Assemble the data material belonging to each category in place and perform a preliminary data analysis
9. If necessary record your existing data.
confirm the accuracy of the findings and an audit trail recorded coding decisions, data analysis and the critical thinking process [20] NVivo software Version 10 (QSR International, Victoria, Australia) aided data analysis. Data saturation is when no new information is gleaned from the interviews when the data is coded. For this study a further interview was completed to confirm saturation. Ethical approval was obtained from the institutional hospital ethics committee and all patients were recruited from the Burn Service of Western Australia (Human Research EC Approval # REG 13-178).

3. Results

The semi-structured interviews explored the lived experience of PTG and the influences of social challenges on interpersonal interaction caused by visible scarring are reported here. Of the 17 interviewed, 16 had visible scarring (6 females, 10 males). Thirteen patients had scarring to both hands and face, the remaining three patients had scarring to either the hands or face. Data saturation was reached by completion of 15 interviews. The patients had a mean age of 46 years (SD 16.7; range 18-61 years), and a mean total body surface area burned (TBSA) of 39.6 (SD 20.3; range 15-45%).

The interpersonal connections and relationships of adults with burns are a major component of the PTG experienced after a burn and accounts for seven out of the 21 items in the posttraumatic growth inventory (PTGI), an assessment tool which measures PTG after trauma [17,21,22]. It is feasible that the influences on interpersonal connection therefore may impact on the amount and type of PTG experienced by adults with visible scarring to either hands and/or face after severe burn. The participants in the study reported emotional and situational processes which altered their interpersonal behaviours and the key coping mechanisms that they utilised in their PTG and recovery process.

3.1. Emotional barriers to growth

Ten participants (5 male, 5 female) expressed feelings about fear of rejection, self-consciousness, and embarrassment or humiliation in their interviews which could be potential barriers to PTG.

3.1.1. Fear of rejection

A new understanding of their friendships emerged and participants reflected that their burn had polarised their friends into those who were supportive and those who distanced themselves at a time when supportive friendships were of paramount importance. Participants reflected that rejection by those former friends had been difficult to handle and led to the fear of rejection by other individuals that they interacted with. Thus loyalty and long term support were important qualities in friendships, and the remaining friendships were based on a foundation of trust. There was a sense of finding out who their ‘real’ friends were because they would "hang around and help" compared to those who were "faking" their friendships. There was also a sense of shock that their perception of their previous friendship group was incorrect and that the presence and support of their friends was not maintained long term as reflected by “all the friends I thought I had, they all disappeared” (#11). The fear of rejection was also a barrier to social interaction because it led to a reluctance to voice their feelings in case friends saw them differently, and rejected their friendship as a result. This was reflected in the quote “I’ve lost so many friends from it... I don’t want that to happen #8 neither have they think I’m OK” (#6).

3.1.2. Self-consciousness

Feelings of self-consciousness arose because of scarring, pressure garments and other burn sequelae, such as itch. One participant expressed the feeling of demonisation by others when she explained that “Burns patients are not normal in society’s eyes” and many participants reflected that there was the constant feeling that other people “are looking” when they are out in public. Pressure garments also drew attention such as wearing complete pressure suits in hot weather which encouraged other people to think you are “strange because you’ve got all these clothes on” (#6). Patient 6 was “upset” by the fact that other people would not understand her problem with itch and worried that other people might assume she was “on drugs” when they see her scratching her facial scars. This phenomenon demonstrates that her worries were coloured by her own worldview and shows difficulty in perspective-taking. Patient 8 reflected that “Now other people see you are important!”. Feelings of self-consciousness were a barrier to social interaction and led to closed body language by patient 4 who stated “I used to walk with my head down because I didn’t want people to look at my face.”

3.1.3. Embarrassment and humiliation

The concept of public humiliation was a significant issue for some patients. Patient 3 felt “shocked” when a stranger approached her in a waiting room and expected her to discuss her situation in front of other strangers. She reflected that the potential to be embarrassed or humiliated was increased when in a social situation with friends. On another occasion, the same patient was acutely aware of her friends’ embarrassment when another stranger invited himself to sit at their coffee table and offer self-help advice such as “you know I don’t feel sorry for you”. Several patients reflected that time assisted them to learn to “handle” themselves and their reactions, and decide what was “appropriate”. If the approach or interaction was deemed inappropriate then there was a conscious choice to not respond to the comments and questions from others which illustrates a third mechanism which results in reduced interpersonal interaction.

3.2. Situational barriers to growth

Types of social situations encountered are many and varied, however worries about them were centred on two specific themes. Firstly, worry about linguistic questions about scarring, and secondly, worry about behavioural reaction of others to scarring. All but two participants expressed that questions were asked by others. Within the first theme, three continua regarding the situations themselves and the interaction were important including stranger-friend, hostile-friendly, and brief - protracted factors. These factors determined the response given by the participant at the time (#3).

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3.2.1. Inquisitive questions
Several patients realised and reflected that questions were the inevitable consequence of visible scarring and were always aware of “what people see . . . and the questions you are going to get asked”. Patient 13 recognised that people asked questions to comprehend a situation which was beyond comprehension without personal experience: “I hurt my finger and I couldn’t even imagine what you went through”. The type of response provided by the patient to questions depended on whether they were asked by strangers or friends, the social context and the manner in which they were asked.

3.3. Stranger-friend continuum
The degree to which the inquirer was considered a friend was important because the less known the inquirer was to the participant, the easier it was to decline to answer. It was often reflected that the questions asked by total strangers were particularly intrusive and unwanted. The use of closed body language, lack of eye contact, and verbal strategies were used to close conversations down rapidly. Patient 8 would close conversations by answering with “I had a car accident. I don’t remember most of it.” Questions from friends were hard because greater explanation was expected. Patient 9 found that catching up with old friends was difficult because deeper discussion was expected: “I did find that catching up with really old friends I didn’t want to go through the explanation of what had happened. I just seemed to have such fabulously prompt scars”. 

3.4. Hostile-friendly continuum
Patient 6 reflected that she would be cautious when asked “what happened” and her response would depend upon the manner in which the question was asked by the stranger. If the question came up suddenly or abruptly from a stranger then she would often respond to the question with “none of your business”. However, if she was asked in kind and compassionate conversation, then she would explain her situation in more detail however she would still be “very careful”. Patient 3, who had sustained a severe burn in an aircraft accident, reflected that she had learnt to minimise her response to reduce the amount of questioning. She explained that as soon as “you mention the word ‘aircraft’ people want to know more. So I learnt to say ‘I was in an accident’ . . . which is ridiculous because it’s quite clinical”.

3.5. Brief-protracted continuum
Patient 2 stated that transient social situations were less of a problem compared to those which are prolonged: “If you’re not at the shops it’s quick and it’s gone”. If a social situation was prolonged, such as a dinner party, then he would not wear his pressure gloves as he felt that, out of politeness, people were less likely to ask about his scars compared to his gloves. Only once patient (#3), reflected that he did not mind the question “I can show people and let them know”. Patient 12 reflected that he wanted people to know his story “because I’m conscious of the pretty appearance and therefore would preempt the inevitable questions with an explanation (#12).”

These three continua were factors in the breadth and depth of answers that the participants felt were expected or felt inclined to give. The participants reflected the importance of creating a balance between answering the questions minimally but without causing offence. Patient 8 described that it was “difficult” to answer other people’s questions when she wanted to be left alone. The balance between needing to explain the incident and the desire not to explain for fear of offensive improved over time, and with increasing self-compensation, as Patient 3 reflected “before I would have felt that to be polite I would have had to explain . . . I thought ‘no’ that’s not appropriate”.

3.6. Behavioural barriers to growth

3.6.1. Reactions of others
A further theme was their worry about other people’s reactions as they became aware of the extent of the scarring. This worry regarding intimacy was a barrier to new relationships. Patient 5, now 22 years old, described that when you tell someone new about the burn “you can feel the change in them”, that they “don’t know how to react and they back off”. Knowing how much to tell strangers was particularly hard to judge and small talk was difficult as any conversation had the potential to lead to further questioning. Because burn scars are time-consuming to manage, chatting about the things that occupy your time results in questions about appointments, massage and exercises. Patient 8 commented that the application of cream and massage of the skin is very time consuming: “the creaming alone is 6 hours a day, and I’m still as dry as hell”. It was reflected that others think the massage “sounds really fun” when “it’s not fun at all, it hurts” (#6). In addition participants reflected that new opportunities for intimacy with others often led to “icky-high” feelings of self-consciousness and feeling “awkward” and “nervous”. It was reflected that enduring certain social situations were evident but a personal challenge: “I always put on a brave face on and face the world as you always do” (#6).
3.6.2. Pressure garments
Some participants preferred to wear pressure garments because “people don’t look at your burns. Like I wouldn’t walk out... without my garments” [P 4]. Patient 8 agreed “at first I found it very constraining, but I found that it also hid your scars and I felt better in some way”. Others preferred not to wear them: “I was supposed to wear one on my ear but I looked like a bank robber so I didn’t” [P 7]. Patient 2 found that wearing them encouraged questions such as “people will tend not to comment on scars... but they comment on glasses”. He continued with the statement that “I’ve never liked being centre of attention, wearing these pressure gloves is not good”. Patient 14 thought they helped him manage questions and accept his injury with “the only thing you get all the time was ‘oh what happened?’ I said that ‘it’s probably a good thing because you learn to deal with it’. I just say look this is what happened and move on”. Acceptance of things that cannot be changed is an important milestone in the recovery journey.

3.7. Coping strategies and styles
Most participants used a combination of avoidant and active coping strategies; eight participants (three male, five female)29 conveyed avoidant coping techniques and eleven (eight male, three female) conveyed active coping strategies.

3.7.1. Avoidant coping
Several patients reflected that engagement with strangers was inhibited via the avoidance of eye contact and the utilization of closed body language and closed posture. This form of behavioral disengagement was a common strategy used to avoid negative interaction with people. If interaction occurred which was unwanted and uninitiated by the respondent, then various strategies were used to close the conversation and minimize the interaction.

Engagement with friends was inhibited as repeated accounts were tiresome for the patient reflecting “I don’t like going over it again and again and again” [P 3]. Additionally, these interactions stir up unwanted emotions and often result in the recollection of the burn event when others asked questions. Patient 1 reflected that he was forced to “break down and cry”. He was very anxious that others might think “it was an act”. Seeking emotional support from close friends and family was sometimes hindered by their worries about maintaining long term relationships and inhibited due to feelings of guilt. Patient 4 worried about burdening her Mum if she opened up to her and Patient 13 agreed, saying “it’s about the effect it causes on your family and friends”. Perception gaps between the reality of the situation as experienced by the respondent and the misconceptions held by the other people often remained unexplained by respondents in a social situation. Patient 6 removed her pressure glove because it was wet and then described her shock and disbelief when she was asked “did you drop your hand in acid or something?”. Instead of explaining her injury she immediately put the wet glove on again “because who else is going to say something to me?” She was worried that others thought she wanted to be “the centre of attention”. Patient 6 expressed disbelief, saying “some people have no idea” after being asked if her scarring was a “nash” and said “Are you kidding? Can a rash really be this bad?”

3.7.2. Active coping
Several respondents reflected that they used active coping strategies such as changing themselves. Patient 9 suggested that if people want to look at her facial scarring they might as well have something interesting to look at and “I died my hair bright while on this side... and I had a bit of a blue streak going for a while”. Patient 3 reflected that humour assisted to mitigate negative feelings when she was told “I bet you wish you were dead” by a taxi driver, and after her initial shock and disbelief suddenly found the situation funny when she thought to herself “Thank God you’re not my husband, or I would be dead”. In addition, gratitude that the injury was not worse helped maintain perspective. In a discussion about burn severity and TBSA in relation to other burn survivors known to the patient, another participant reflected “I wish I was only 20 (percent TBSA). Sixty-one is a bit of a difference! But then I look at people like XXXX and I am completely blessed in the fact that I still have a face” (Patient 8). The understanding that other people “find it hard to see scars” came from the partner of Patient 16, and illustrated the importance of personal supportive relationships.

4. Discussion
Visible scarring is the external and public manifestation of an internal and personal struggle and is a reminder of the injury that cannot be avoided. Social challenges faced every day by adults with visible scarring from burns creates emotional barriers to interpersonal connection, and affects their behaviour in common social situations. Interpersonal connection between the person with a burn and others is a key component of PFG [23] and thus these factors may affect the potential for PFG.

The various emotional and situational barriers create a vicious circle of impaired functioning. This study has demonstrated that feelings of embarrassment and self-consciousness reduced interactions with strangers and acquaintances; fear of losing friends reduced interactions with friends; and feelings of guilt related to the burdening of loved ones reduced the interactions with close friends and family. Fear of public humiliation due to other people’s questions and behaviours led to worries about social situations. The findings from this research show that an accumulation of difficult situations experienced increased negative feelings. This helps to explain why social reintegration has been found to be difficult for those with visible scarring [12] and why trust, loyalty and long-term support are such important key components of successful relationships after burn [17,21,24]. Self-esteem and patient rated near assessments for facial burns were not related in the first few months after burn in a German Study [25] but it is important to repeat this investigation at two or more years after injury to assess whether the accumulation of negative experiences has had a negative effect. The comment that others think they are not normal members of society is a dehumanising belief. If others display dehumanising behaviour towards them, it will reinforce this view of themselves and may promote social isolation [26].

If a burn survivor has intrusive unhelpful thoughts, then social avoidance might occur if triggered by intrusive
questionings. The specific circumstances and context of the social situation often determined the response and the three continua described in this study are logical if the person is anxious about causing offence. For example, if a stranger asked inquisitive questions, the prospect of causing offence was less important than if the person was a friend, although this could be augmented if the questions were asked in a hostile manner. In contrast, when the approach was more conversational, and the closer the friendship, the more open the responses were when given by the participant. This corresponds with early work published in the area of social phobia by Forgas [27] which describes the dimensions of social situations and his later body of work which determined that the manner in which someone asks the questions is important [28]. In addition, the concept of self-compassion enabled the person to politely decline to answer, by elevating their own personal needs above those of others who were asking the questions. It also explains why humour is so important to positively reframe the situation and interaction and manage the feelings which evolved. The ability to see things from a different perspective or to use quick wit to respond were both valuable techniques to increase self-confidence to manage awkward social situations. This is in accordance with Krosshaber’s findings in which she describes humour as necessary for coping and acceptance [29].

Burn survivors had learned over time to manage conversations or minimize cues that led to questions by pre-empting questions and shutting down conversation with closed responses.

Avoidant strategies included hiding scars under garments or clothing, and using closed posture to avoid other people seeing their scars. Additionally, participants often avoided eye contact or other non-verbal communication that might result in questions about their scarring. It has been documented previously that avoidant coping strategies are associated with higher levels of PTSD and depression after burn [10,30] and Barille et al. [31] claim both active and avoidant coping strategies are predictive of PTSD after burn, and that posttraumatic stress has been shown to correlate with PTSD after burn. Although PTSD and PSTD are not the opposite of one another, they share some precursors, such as post-traumatic loss of control [32]. Willerbrand et al. [33] claim that individuals who use avoidant coping strategies had the lowest health status as measured by the Burn Specific Health Scale-Brief. These coping strategies are specific to the social challenges and do not describe the full range of techniques used by burn survivors to manage other aspects of their injury.

The strong theme of questions about the injury demonstrates the widespread need of people to understand what had occurred to the burn survivor. On the one hand people wish to assimilate what they see and connect it to an experience they understand, while on the other hand burn survivors value their privacy and to maintain their prerogative to explain their scars when, how and if they please. Internal conflict between wanting to forget the incident and having to address other people’s curiosity was a barrier to social interactions for burn survivors and could lead to social isolation. It is plausible that social isolation could potentially augment existing physiological and psychosocial problems due to the physical injury, be a barrier to PTSD and an additional risk to PSTD.

This was an adult population of Caucasian and English-speaking burn survivors and thus the generalisability of the findings may be limited, as with all qualitative investigation. Further research could involve quantitatively assessing the association of PTSD and coping styles using valid measurement tools such as the Posttraumatic Growth Inventory and the Coping with Burns Questionnaire. The impact of visible scarring on the development of PTSD is outside the scope of this study, and further research into the relationships between growth, distress and coping would add depth and understanding to this area. Further research into effective interventions to help patients is indicated. Cognitive-behavioral therapy (CBT) has been explored to promote PTSD after general trauma [34] and CBT in combination with social skills training has been explored to help people cope with having a visible difference [35] showing a reduction in depression, anxiety and concerns about appearance. This latter programme is online and computer based, thus bridging the two gaps of wide geographical spread of participants and narrow resource capacity. Self-expression or disclosure interventions have also been shown to promote PTSD after types of trauma [36]. Therefore, activities such as expressive writing, written journals, audio and video diaries and talking therapies could be explored for their effect on PTSD after burn, particularly for those with visible scarring. Thus, further research into CBT, social skills training and self-expression techniques are needed.

Social and peer support assists burn survivors come to terms with their injury and can help them normalise their experiences and create a feeling that they are not alone [29] and has been previously identified as an important factor which influences PTSD after burn [36]. If those who have visible scarring can understand possible reasons behind comments, questions and non-verbal negative communication such as staring, it can assist them to reframe the situation in a positive manner. Social skills training might assist them to manage social situations and in another active way to help them feel more in control of the unexpected.

5. Conclusion

There is a dichotomy between other people’s need to understand different aspects of a burn and the burn survivors’ need for privacy. Visible scarring means that the survivor is unable to forget as questions are asked without warning by complete strangers. Emotional and situational factors interact to create barriers to connection with others in order to protect the self. Positive reframing, humour, personal change and gratefulness were all active coping strategies which helped burn survivors cope with their visible scarring. Avoidant coping strategies included avoidance of eye contact, closed body language, using pressure garments and clothing to hide scars, and shutting down conversations. These avoidant strategies are also barriers to effective and open communication. Visible scars due to burn have a substantial effect on interpersonal relationships, increasing risk of social isolation and the associated sequelae and acting as a potential barrier to PTSD. Social skills training, peer support and good communication within their own close family and friends may develop
active coping strategies which are useful in managing social challenges.

Conflicts of interest

None.

Acknowledgments

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Appendix. Questions

How have your personal relationships changed?

In what ways do you approach your relationships differently?

In what ways has your reliance on other people changed?

Are there people you feel closer to? In what ways?

Do you express your emotions differently? In what ways?

Do you see people differently? How?

What have you learnt about others?

Do you think you need people more? How?

What are the important traits you see in your friends?

What have you learnt about friendship? Is there anything you would like to add?

References


Appendix III

POSTTRAUMATIC GROWTH AFTER BURN INJURY IN ADULTS: AN INTEGRATIVE LITERATURE REVIEW.

Martin L, Byrnes M, McGarry S, Rea S, Wood F.
Posttraumatic growth after burn in adults: An integrative literature review

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ABSTRACT

Posttraumatic growth after burn is a relatively new area of study with only a small number of studies that have examined this phenomenon. It is important to understand the presentation of posttraumatic growth and coping in burn survivors, how it changes over time and the components which influence growth so that we can understand how to promote posttraumatic growth in burn survivors. The aim of this review was to assess these three parameters. Studies were identified through multiple databases with specific search terms to identify posttraumatic growth after burn. From the 813 articles found, 57 were identified as potentially useful, and 8 as eligible for review; three qualitative, one mixed methods, two quantitative, one discussion paper and part of a review which assessed all psychosocial outcomes. Growth presented as realising personal strength, re-contextualising, spirituality, humanity, changed relationships, and compassion and altruism. Styles of coping included feelings of gratefulness and downward comparison, humour and planning. Suddenness of the event, and the severity and location of injury might affect the amount of growth experienced. Overall function, quality of life, social support and optimism, hope and new opportunities are influences on growth after burn, all of which have the potential for improvement through targeted intervention strategies. Further research is indicated in many areas related to growth, intervention and measurement.

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1. Introduction

Surviving a burn is associated with long-term physical and psychosocial impacts. Most psychosocial research for burns has focussed on psychopathology and quality of life [1] and thus the focus has been on problems and deficits brought about through burn. It is important to identify, measure and treat the impact of these appropriately to guide intervention. However, trauma has been known to promote psychological growth [2] and change our outlook [3] with little attention provided to this phenomenon after burn.

An important distinction needs to be made between the two constructs of posttraumatic growth and resilience. Posttraumatic growth (PTG) is positive change which occurs beyond the pre-trauma condition and was first described in 1995 [2,4]. Resilience is an attribute which allows a person to remain unchanged by the trauma, or to “bounce back” to the pre-trauma condition. However, definitions of resilience vary and there is a lack of consensus in the literature [5]. Historically growth was seen to be part of resilience, more recently growth has been identified as a separate construct. Resilience has been described as a “lower bar” in comparison to growth. However, it is a complex area and it also should be noted that those who report growth may also do worse over all [6].

The focus of this review is on how posttraumatic growth has been documented within the research literature specifically in relation to burn. The Posttraumatic Growth Inventory (PTGI) was designed by Tedeschi and Calhoun [7] to measure this construct, and has been used widely within general PTG research literature. There are other measures of positive outcomes in health such as the Benefit Finding Scale [8,9], the Changes in Outlook Questionnaire [10] and the Stress-related Growth Scale [11]; however these measures have not been reported in detail within the burn literature.

Although quality of life after burn survival has been widely explored within the research literature, the assessment tools used to measure quality of life after burn focuses on problem identification with the aim of restoring normal physical and psychological function [12-14]. Therefore the quality of life assessment tools identify and evaluate negative health states in order to return to pre-burn functioning, rather than assessing progress beyond the pre-burn level. Thus quality of life measures will not be the focus of this review.

It is important that we understand the presentation, process and progression of posttraumatic growth (PTG) across time after burn, and the factors that influence its evolution. The clinical implications of understanding this better will mean that we can advise and support our patients towards growth, and deliver and assess programs designed to promote growth. Potentially, this will ensure that we do not just aim to return our patients to a new normal, but that we can encourage them to progress beyond their previous level of psychosocial and physical functioning.

The overall aim of this integrative review is to explore the literature which explicitly describes posttraumatic after burn and discuss how this relates to other literature about psychosocial recovery. The specific aim is to identify and critique the current literature with respect to posttraumatic growth or positive change following burn in relation to its (1) presentation and coping (2) temporal changes and (3) associated factors in order to synthesise new insights, implications for practice and areas for investigation and research.

2. Method

An integrative review builds a comprehensive understanding of a phenomenon to inform clinical practice, future research and policy [15]. It is a useful method to use for this subject area because it can assess quantitative, qualitative and mixed method research together. Evidence based practice is essential to drive quality care, and literature reviews play an important part in compiling and assessing the current evidence to understand the current position, identify the gaps that need to be bridged, and reveal future directions [16].

The search strategy was guided by the process detailed in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [17] and is summarised in Fig. 1. The databases CINAHL Plus; Medline; Embase; PsycINFO; Proquest; Pubmed; Cochrane; Scopus were searched in March 2016 using specific search terms. In addition to this search strategy, citation searches were completed on key papers which specifically investigated PTG after burn to ensure completeness. Hand searches of linked citations of relevant papers were conducted, and a search of the grey literature via the Trove database conducted. The results are shown in Fig. 1.

2.1. Identification of relevant papers for inclusion

2.1.1. Search terms

1. Burn and
2. Posttraumatic growth; psychological growth; adversarial growth; positive change; adaptation; adjustment; thriving; benefit finding; resilience.

2.1.2. Population studied

Burn in adults only. The rationale: For children, psychological growth is hard to differentiate from normal maturational, and in fact, it could be argued that the burn becomes integrated into this growth process.

2.2. Screening criteria for papers

Those were screened for inclusion by an initial review of the title and abstract.

2.2.1. Included papers limited to

1. English language papers or papers translated to English.
2. Since 1990.
3. Full text only.
4. Peer reviewed journal articles.
5. All study designs—quantitative and qualitative.
Fig. 1 – Flowchart for literature search. This flowchart is based on the PRISMA guidelines and summarises the numbers of articles reviewed in the literature search.

2.3. Full text assessed for eligibility

2.3.1. Exclusion criteria

1. Not burn (burn-out commonly captured under above strategy).
2. Not PTSD—PTSD mentioned in the introduction or discussion, but the concept of growth itself not examined in the research.
3. Paediatric cohort or childhood burn.
4. No PTSD or elements of PTSD evident in paper. Thus papers which evaluated resilience, quality of life, or psychological adjustment that was not associated with growth were excluded.

2.4. Critical appraisal, analysis and integration of papers

After a thorough search and assessment of the literature, a total of eight papers were identified as eligible for review; three qualitative [18-20], one mixed method [21], two quantitative [22,23], one discussion paper [24] and one review of psychosocial recovery after burn which included PTSD as a theme [1]. The mixed method paper [21] was research completed by the current authors of this review. All papers are summarised in Table 1. The literature search was completed by the first author (LM) under the guidance of SM and the final selection discussed and confirmed by PW and SR. Critical appraisal of each article was completed using the appropriate guidelines as defined by Greerghalp [16]. Methodology for the integration and synthesis of data was complete using strategies described by Whitlem and Kofal [15] who recommend techniques for data reduction, display and comparison and define the key elements of data analysis. The qualitative data was compared for patterns, themes and relationships. It should be noted that McCormack and McKeSla [20] qualitatively investigated PTSD in a burn survivor after the Bali Bombings of 2002, and the authors attributed more change to the bombing rather than the burn. However, they stated that the participant “was positioned in close proximity to the suicide bomber during the attack and thus maintained extensive physical injuries” receiving long hospital treatment, and therefore this qualitative account has been included. The quantitative data was assessed for verification and support of the qualitative themes, and provided an understanding of the amount of growth reported in each area, if measured. These studies were useful to help understand the strength and quality of relationships between PTSD after burn and related factors. Finally, a discussion of the findings summarises the evidence into a proposed model for growth and coping after burn.
### Table 1 - Summary of included papers

<table>
<thead>
<tr>
<th>Reference/country</th>
<th>Aim/Research questions</th>
<th>Study design/outcome measurements</th>
<th>Population</th>
<th>Contribution to the PTSD literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Askay and Magner-Koskelo [26] USA</td>
<td>To discuss PTSD concepts in general and after burn: Measurement issues and make recommendations for future research. How a therapist can create an atmosphere for growth. The role of religion and spirituality in burn recovery.</td>
<td>Discussion paper that assimilates two reviews about PTSD after trauma [132] and one article about PTSD after burn [21], and discusses the need to meet the spiritual needs of the patient.</td>
<td>Not applicable</td>
<td>Reviews Askay’s discussion paper and Rosenbach’s paper. Reinforces the necessity and priority of literature around the construct of PTSD, and recommends further research in the burn population.</td>
</tr>
<tr>
<td>Atlee and Pounsford-Corrin [1] England</td>
<td>To identify key findings of all aspects of psychosocial adjustment after burn. To identify future directions for research and practice.</td>
<td>Integrative literature review about all aspects of psychosocial recovery after burn. The PTSD component identified and assessed Askay and Magner-Koskelo [26] and Rosenbach and Rennberg [22].</td>
<td>Not applicable</td>
<td>Reviews Askay’s discussion paper and Rosenbach’s paper. Reinforces the necessity and priority of literature around the construct of PTSD, and recommends further research in the burn population.</td>
</tr>
<tr>
<td>Martin et al. [21] Australia</td>
<td>To assess how PTSD presents after burn and if these changes were adequately measured by the PTSD.</td>
<td>Mixed methods: Qualitative semi-structured interviews PTSD measurement: analysis and comparison. Teach’s method of data analysis.</td>
<td>n=17 male. Age 32-75 years (range 21-75 years). VRA 4.38 (range 15-83). Time after burn 0-63 months (range 2-73 months).</td>
<td>Assesses the presentation of PTSD after burn, potential barriers to growth, and the measurement of PTSD after burn with the PTSD.</td>
</tr>
<tr>
<td>McCormack and McKefair [20] England</td>
<td>To explore the impact of a terrorist attack on the psychological wellbeing of a person who sustained serious burn injury.</td>
<td>A qualitative longitudinal case study using interpretative phenomenological analysis.</td>
<td>Male, aged 59 years at injury, TRA not stated, interviewed at 2 and 7 years after burn.</td>
<td>Case study of patient who received burn in the 2003 Bali bombings. PTSD is attributed to terrorism more than burn by the author.</td>
</tr>
<tr>
<td>McLean et al. [19] Australia</td>
<td>To gain greater insight into the lived experience of facial burn injured patients with a focus on the possible changes to relationship with the body and early psychosocial adjustment.</td>
<td>Qualitative interviews Galatzer’s method of data analysis.</td>
<td>n=4 male. Age 38-47 years (range 30-47 years). TRA 6.94 (range 5-11). Time after burn -4 months.</td>
<td>PTSD components described in findings and linked to PTSD theory in discussion.</td>
</tr>
<tr>
<td>Rosenbach and Rennberg [22] USA</td>
<td>To investigate PTSD in burn patients and to identify correlates facilitating or preventing the acceptance of positive change.</td>
<td>Quantitative cross-sectional analysis of questionnaires PTSD, CGI, SCL-9-R, F-Burd, SIQL, clinical burn severity.</td>
<td>n=169 (54% response rate). 57% male. Age 34 (range 18-88 years). TRA 4.24 (range 1-9). Time after burn 0-9 years (range 3-29 years).</td>
<td>PTSD focus—quantitative study which assesses self-reported PTSD scores after burn and associated factors. The first study to explore PTSD after burn.</td>
</tr>
</tbody>
</table>
3. Findings

The presentation and temporal evolution of PTG is described here, followed by other associated factors.

3.1. Presentation of PTG

Posttraumatic growth after burn presents in three domains: a better understanding of the self, a better understanding of the world, and a better understanding of other people. Each of these domains has two sub-domains. In addition, the relationship of coping to PTG is inherent in the presentation of PTG, and is discussed here.

3.1.1. Understanding the self

The first domain, a better understanding of the self, has two subdomains: realizing personal strength and reorienting due to realizing true values.

1. Realizing or finding personal strength

The theme of personal strength was strongly evident throughout the research literature. Qualitative studies found that burn survivors felt that they were either stronger as a result of managing the challenges of burn [24], or that they had realized their existing strengths [24] and better understood their innate robustness and resilience [19] which led to feelings of personal pride [21,24]. Personal strength was the predominant dimension of PTG occurring in 50% of study participants in China and was thought to reflect new found self-efficacy [18]. Self-efficacy is the belief in one’s ability to manage tasks, control over their own events and reach personal goals [25], and this concept was supported by other researchers who identified that the determination to progress towards independence and recovery was important [21]. Several of the quantitative research studies also provided support for this theme and revealed that the PTGI factor of personal strength depicted a notable area of change [23-23] with median scores of 2.3 (21) and mean scores of 1.41 (23) and 3.41 (25) out of a range from 0 to 5. Thus, the theme of increased personal strength, or recognizing resilience with pride, is shown to be a key component of PTG and occurs as an individual develops a better understanding of their self.

2. Reorienting

The theme of understanding one’s true values and reorienting the important aspects of life was a major theme of posttraumatic growth after burn. Qualitative studies demonstrated that a new life philosophy or narrative was born from the gratefulness of survival [18,21] and the preciousness and fragility of life [19,20]. These feelings of fragility brought anxiety and the process of finding this new narrative took time [20]. New priorities which were developed included increased appreciation of one’s own health and well-being, and of other people and a return to family values [19] away from material possessions [21]. It was clear that the reminder of one’s own mortality drove appreciation of the present moment and the premise to no longer take things for granted [18,21]. The various quantitative studies assessed factor 5 of the PTGI (Appreciation of Life) as having been positively impacted with a higher injury severity with median scores of 3-4 (range 0-5) [21] and a mean score of 3.4 (25) out of a range of 0-5 in patients with mean TRSA of 30% or more, and moderately impacted in smaller TRSA means with a mean score of 1.4 (23). Thus, the theme of reorienting values is a further component of PTG and may occur as an individual develops a better understanding of their own values.

3.1.2. Understanding the world

The second domain of a better understanding of the world has two subdomains of spirituality and humanity.

1. Spirituality

The theme of spirituality was identified as a factor in the PTGI and is discussed in full by Askay and Magruder-Rusell who postulates that individuals who use religious or spiritual

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Table 1 (continued)

<table>
<thead>
<tr>
<th>Reference/country</th>
<th>Aim/research questions</th>
<th>Study design/outcome measurements</th>
<th>Population</th>
<th>Contribution to the PTG literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhai et al. [14]</td>
<td>To discover the experience of PTG in Chinese burn patients and find out if there are dimensions of PTG that are not tapped by the PTGI and to describe common and unique factors that facilitate PTG.</td>
<td>Phenomenological methodology: individual semi-structured interviews</td>
<td>N=10 70% male, Age 3.5 years (24-68 years), TRSA 9 (0.2%) (range 11-95%), Time after burn 5.12 years (range 5 months-6 years).</td>
<td>PTG focus–Two overarching themes – “process of PTG” and “presentation of PTG”. Results indicate commonality to Tedeschi and Calhoun’s model of PTG [9]. Differences in domains of relationships with others are reported as cultural differences. No spiritual growth reported.</td>
</tr>
</tbody>
</table>

PTGI, Posttraumatic Growth Inventory; CGI, Coping with Burns Questionnaire; MSFI, Multidimensional Scale of Perceived Social Support; ISS, Injury Severity Score; ESS-8, Brief Eastern Scale Revised; BHS-R, Burns Specific Health Scale-Brief; LQI-8, Life Orientation Test Revised; SCL-90-R, Symptom Checklist-90-R; SSQ-14, Social Support Questionnaire; SRS-33, Health-related quality of life.
coping methods appear to have more growth potential [24]. These qualitative studies appear to describe variable findings with faith being negatively or positively impacted by a burn trauma and the existence of faith can be used to support burn survivors or can be eroded by their traumatic experience [21]. In some instances, changes may not be recognized by the burn survivor as relating to spirituality, and some burn survivors reflected changes in their thinking styles which were fatalistic [20] or deterministic [21]. In some instances, spirituality assisted in meaning making and recovery for some burn survivors but was not noted for others [19] and 80% of the Chinese patients reflected not expressing changes in their religiosity [18]. The quantitative studies report the PTGI factor ‘Spiritual Change’ and was measured by 2 items on the inventory. The quantitative studies reported median scores of 0-1 [21] and mean scores of 0.47 [23] and 2.09 [22] out of a range of 0-5. These scores are clearly lower than the other domains of the PTGI with changes in spirituality appearing to be both individual and cultural.

2 Humanity

A deeper understanding of the nature of humanity was a further theme that emerged from the review of the research literature. The qualitative studies reflected that the realisation of human vulnerability was a shock [21] and that the question ‘why me?’ could be a recurring question [20]. This led people to seek meaning to assess why the burn happened, and the meaning of life [18-21] and was identified as a priority in the discussion by Askley and Magner-Russe [24]. In fact, the level of community support and generosity amazed the burn survivors and led them to realise that people want to assist and will do what they can [19,21]. It was important to note that the process of creating a better understanding that people make mistakes appeared to foster forgiveness [21] and humanitarianism [26].

As this aspect was not measured specifically by the PTGI, it was not reflected in the quantitative studies, but was closely linked to the theme of spirituality.

3.1.3. Understanding others

The third domain of a better understanding of others has two subdomains of changed relationships and compassion and altruism.

1 Changed relationships

An overriding theme was with respect to the changes that occurred to personal relationships. The qualitative studies described a process of greater connectedness and closeness with trusted family members [18,19,21] and the feelings of strength and resilience that this encouraged [19]. It was reflected that long term support was important to aid recovery and growth, and assist with the transition from a position of dependence to independence [21]. It was also noted that there was a greater awareness that people cared [18] and that friends and family want to assist in times of need [21] resulting in improved feelings of self-worth [19]. This was overshadowed by the loss of some friends and an increased clarity of the true nature of previous friendships. The quantitative studies reported relationships with others via factor 1 of the PTGI. This was the largest factor accounting for seven of the 21 items of the PTGI. The quantitative studies reported median scores of 2.5 [25] and mean scores of 1.46 [23] and 3.41 [22] out of a range of 0-5. The themes of reprioritising values, combined with a better understanding of others and an improved clarity of existing relationships, drove the changes within this theme of changed relationships.

2 Compassion and altruism

Another theme that emerged involved a new understanding of other people which led to greater compassion and the drive towards altruism [18,21]. The qualitative studies revealed that some burn survivors felt a greater compassion towards others, particularly those who also had a burn. It appears that compassion, in conjunction with feelings of citizenship and connection with the community, motivated the desire to want to help by paying forward in altruistic ways [18,19,21]. Zhai et al. [18] suggested that this need to be altruistic was also borne of suffering, and that helping others increased self-worth, self-efficacy and positive connection and could potentially make the world feel more benevolent. Martin et al. [23] suggested that compassion for others could be a reflection of the degree of compassion for self. The quantitative studies, because they are measured by the PTGI, only assess the construct of compassion via a single item: (45) ‘I have more compassion for others’ with the factor scores not quantifying compassion in itself. The question scores were reported by Martin et al. [23], and for the 17 participants, the median reported score for this factor was 2 out of 5 (Q53). This score reflected that some burn survivors felt more compassionate while others did not experience this growth change in compassion. Indeed, the supporting qualitative information demonstrated that the degree of compassion felt was influenced by the perception of other people’s circumstances.

3.1.4. Coping

The theme of coping was often interweaved with the themes described above, and therefore individual coping styles which were linked to PTG were revealed by the examination of PTG in the review of these research studies. The qualitative studies emphasize the importance of specific coping strategies that are associated with PTG including use of humour [19,23,24], positive reframing [21] and downward comparison [18]. Downward comparison is a process which can result in gratefulness which is a coping strategy itself [21]. The process of making sense of the injury event or making meaning from the consequences of the event were also an important outcome from rumination about the trauma [18-21]. Those with an existing and active religious faith might continue to use this coping strategy for support both early after injury [19,23,24] and in the long term [21]. Planning for future recovery and the determination to return to normal life is a further strategy used to cope [19,23]. The quantitative studies did not measure coping and coping styles as a separate construct, however feelings with respect to the effectiveness of coping skills and acceptance are reflected in the personal strength factor. The overall PTG scale was positively correlated with...
active coping style as measured by the Coping with Burns Questionnaire (CBQ) r = 0.53 (p < 0.01) and not with avoidance coping style in a German study [22]. Different relationships were documented by Baillie et al. [23] with moderate associations between PTG and avoidance coping (r = 0.34, p < 0.01) and PTG and adjustment coping (r = 0.40, p < 0.01), and a low correlation between PTG and instrumental/action coping (r = 0.32, p = 0.01). Therefore, the theme of coping occurs widely throughout the qualitative literature regarding PTG and was reflected in overall PTG scores, however is not specifically targeted by the PTGI itself.

3.2. Temporal changes in PTG

The attempt to assess how PTG changes and evolves over time is problematic with respect to the current research literature. With only one qualitative study collecting longitudinal data, the case study by McCormack and McKellar [20]. This temporal information was clearly not able to be extrapolated to a larger population, particularly as the authors attribute the participant’s growth to the terrorist event more than the burn itself. Askay and Megary-Russel [24] reminds us that the earlier literature [3] proposes that growth arises from distress after trauma via positive reframing, positive affect and good social support, and that this process requires time to evolve. Therefore it is important to surmise that the process of PTG should not be explored too soon after the burn as it may not be present due to the necessity of time for PTG to evolve.

The qualitative study by McLean et al. [23] includes a study population who have been interviewed within 4 months of facial burn, thus giving a description of PTG in the early stage after burn. Two cluster themes emerged within the larger emergent themes of relationship to self/other, coping and meaning-making. These themes are congruent with the construct of PTG and hence this study reveals that PTG actually can commence at early stages after injury. The qualitative study by Baillie et al. [23] reports a positive correlation between time since burn and PTG (r = 0.34, p < 0.01) further reinforcing the concept of PTG evolving over time. The various studies detailed above suggests that PTG commences early and continues to evolve over time.

3.3. Factors influencing PTG

3.3.1. Pre-burn factors

Both age and gender have the potential to affect posttraumatic growth but unfortunately neither age nor gender were reported within the qualitative studies in relation to PTG. In the quantitative by Rosenbach and Renenberg [22] females reported higher total PTG scores in comparison to men (t = 2.35, df = 147, p < 0.05) and specifically for two PTG factors: Appreciation of Life (t = 2.38, df = 147, p < 0.05) and New Possibilities (t = 2.29, df = 147, p < 0.05). This result was in spite of there being no documented gender differences with regard to coping support and distress (all p > 0.2), although women did score lower on the Mental health domain of the SF-12 quality of life assessment (t = 2.01, df = 147, p < 0.05). Baillie et al. [23] found neither age nor gender had a significant effect on PTGI scores.

3.3.2. Burn factors

3.3.2.1. Injury severity. Burn severity is a potential factor that could influence PTG. However, the qualitative literature did not assess aspects of PTG in relation to injury severity. Within the quantitative literature Injury severity was reported as a TRBAS measurement. Rosenbach and Renenberg [22] used an independent t-test to compare total PTGI scores of those with burn greater than 30% TRBAS with those of 30% or below, finding no significant difference. This population had a mean TRBAS of 32.2%. It is possible that the 30% TRBAS separation point chosen was too high, and not sensitive enough to demonstrate a difference. In contrast, Baillie et al. [23] found a positive association between TRBAS scores and overall PTGI scores (r = 0.47, p < 0.01) using a regression model for predictors (regression coefficient β = 0.132, p = 0.002). The mean TRBAS for this latter population was 9.41%.

3.3.2.2. Body location of burn. The location of the burn on the body and its effect on psychosocial recovery has drawn mixed findings within the burn research literature [1]. The qualitative studies do not report findings on body location of the injury, except that it was important to note that McLean et al.’s study was focused on those with facial injury [19]. In the quantitative literature, Baillie et al. [23] report that participants with visible scarring to both face and hands reported higher overall mean PTGI scores (mean = 9.86, 95%CI 2.13, 3.79) than those with face not hands (mean = 1.15, 95%CI 0.45, 2.80) and those with neither face nor hands (mean = 1.01, 95%CI 0.70, 1.39) with significant differences between scores (p = 0.001). Body image plays a large part in our interactions with others, and is highly likely to affect PTG scores, particularly those in factor 1 (relating to others) and factor 3 (personal strength).

3.3.2.3. Sudden event. The circumstances of the injury event were explored qualitatively by McCormack and McKellar [20] in which the case study participant was involved in the 2005 Bali bombing. The theme of “violent interruption” suggests that the sudden unexpected shock stopped his life trajectory in its tracks and caused him to take stock and reconsider his life meaning. This was supported by Martin et al. [23] who reported that the impact of a sudden injury event drove greater appreciation of life. The qualitative literature compared

The personality trait of dispositional optimism is thought to influence PTG in other areas of trauma. Most of the reviewed literature did not assess personality factors. However, dispositional optimism was explored by Baillie et al. [23] via the Life Orientation Test Revised (LOT-R) and found not to be associated with PTG (r = 0.03, ns). No other study assessed optimism as a personality trait per se, although optimism was described as an outcome or associated factor for PTG.

McLean et al. [19] found that all interview participants reported previous significant trauma. This is a logical finding because burn is likely to be more common in those who have other social issues or indulge in risk-taking behaviour. However, she does not report potential risk factors regarding the participant group, which could include social factors such as substance use, interpersonal violence, younger age, male gender, single relationship status, and lower education levels.

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accidental injury, workplace injury and intentional injury and found no significant difference in PTGI scores, although numbers in the latter group were small (4% of 74 participants) and therefore these results need to be interpreted with caution.

3.3.3. Factors after burn

3.3.3.1. Overall function and quality of life. Overall function and quality of life was measured within the quantitative studies via questionnaires. The analysis of the PTGI scores in relation to Burns Specific Health Scale Brief (BSHS-B) revealed that individuals whose quality of life was most impacted by their burn were more likely to report higher PTGI scores in the domain of overall function ($r = -0.40$, $p = 0.00$), body image ($r = -0.26$, $p = 0.03$), work ($r = -0.33$, $p = 0.00$), hand function ($r = -0.34$, $p = 0.00$), and heat sensitivity ($r = -0.39$, $p = 0.00$). However, these low to moderate correlations need to be interpreted with caution([23]) as Rosenbach and Renneberg([22]) reported no significant association between SF/2 quality of life and PTGI scores.

3.3.3.2. Social support. A dynamic factor which often influences PTG is the support of family, friends and significant others. In the qualitative literature the influence of social support on PTG are difficult to extract from the theme of changed relationships or the presentation of PTG itself. Seeking emotional social support was found to be an important theme of PTG in Chinese participants and was claimed to be important in cognitive construction and thus influenced the process of PTG. In addition, they believe that it is an important aspect of Chinese culture to support significant others and provide additional motivation to Chinese burn survivors([18]). Long-term support based on trust and loyalty were important to effective coping([24]). In the quantitative literature, the Social Support Questionnaire (SSQ-14), a German scale which measures instrumental support, emotional support and social integration, was used to assess social support in relation to PTGI scores. In this analysis, PTG was found to be highly correlated with perceived social support ($r = -0.55$, $p < 0.00$)([29]). An analysis of the association of PTGI scores with the Multidimensional Scale of Perceived Social Support (MSPPS), a scale which assesses support by family, friends and significant others, demonstrated a low but significant positive correlation ($r = 0.22$, $p < 0.001$)([32]).

3.3.3.3. Optimism, hope and new opportunities. Despite the proposal that dispositional optimism was not found to be associated with PTG by Baillie et al.([23]), the qualitative work by McGee et al.([19]) revealed that all of her participants described feelings of optimism and hopefulness about recovery. The quantitative studies assessed optimistic and problem solving coping as part of the active coping domain of the CRQ however did not specifically assess this sub-domain as a separate entity. With respect to new possibilities, the action of

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**Fig. 2 - Model of posttraumatic growth after burn.**

This diagram illustrates a proposed model of burn-specific posttraumatic growth and coping as synthesised from the integrative literature review.
returning to work is another important milestone towards establishing a new normal lifestyle but is dependent on discovering a new work-life balance dependent upon new life priorities [21]. The division of time between work, leisure and choice of activity is a portion of the New Possibilities domain of the PTG [21] with burn survivors reporting in the quantitative literature a median scores of 0.3 [21] and mean scores of 0.17 [21] and 2.77 [21] out of a range from 0 to 5 indicating that this factor accounts for a low level area PTG after burn.

3.3.3.4. Posttraumatic stress. Posttraumatic stress and PTG occur concurrently with a curvilinear relationship demonstrated within the general trauma literature, with most PTG reported at moderate levels of distress [26,27]. The quantitative studies assessed PTG and distress; Baillie et al. [29] assessed PTG against the Impact of Event Scale—Revised (IES-R), a measurement (ix) that captures intrusive thoughts, avoidance and arousal demonstrating a small but significant positive correlation (r=0.32, p<0.01). However, there was no evidence of a curvilinear relationship within this population. Rosenberg and Renneberg [22] assessed emotional distress via the SCL-K-9-Symptom Checklist and the mental health domain of the SF12 with findings of no association between PTG and either scale. Thus the relationship between posttraumatic growth and distress after burn is not clear or resolved in the current literature.

4. Incidence and clinical recommendations

Posttraumatic growth was not found to be a universal concept, and the facets of growth experienced by participants varied. In China, the theme of personal strength was predominant (in 90% of participants), however, in contrast, the theme of religious growth was minimal (10% of participants). The general trauma literature has recommended a minimum total PTG score of 42 to indicate meaningful PTG, on the 25 item PTG this suggests an average score of 2 out of 5 for each item. The total mean PTG1 score for Rosenberg and Renneberg [22] study was 47.12, as Baillie et al. [22] was 32.62 and calculated data from Martin et al. [21] was 9.3. Martin et al. [21] suggest a mean score of 2.5 (equivalent to a total PTG of 52.5) could be used as a benchmark to identify those who experience less growth and may benefit from additional psychosocial intervention strategies to improve their PTG after burn.

4.1. Recommendations for future research in the literature

Altoe and Poursoltani [1] highlight that PTG is a new consideration within the burn literature, and this is evident from the articles reviewed within this integrative review. There is a clinically important gap in the literature which reflects the necessity to develop and test intervention strategies which are designed to improve psychosocial outcomes after burn [1,21]. Longitudinal research is needed to explore the natural progression of PTG over time, determine which factors are most relevant at different time points, and the success of targeted interventions [21,23,24]. It is also important to note that proxy reports of PTG from significant others could build this body of knowledge [29]. Further exploration of personality factors, particularly extraversion and optimism, could be a focus of future research to assess whether the burn population is similar to other areas of PTG research [22]. Ashtari and Mogant-Rosell [24] suggest that future research could involve measures that enable the exploration of negative responses, and the determination of how PTG is affected by cognitive processing style, gender, ethnicity, and culture. They also request the creation of definitions around the separate constructs of positive emotion, resilience and PTG as well as the integration of PTG into biopsychosocial models of burn recovery.

5. Discussion

Posttraumatic growth (PTG) is positive change which occurs beyond the pre-trauma condition. This review specifically explores how posttraumatic growth has been reported in the literature in relation to burn. The earliest definitive PTG literature in the burn population was published in 2008 [22]. More recently the literature has burgeoned, however, only eight papers were in fact eligible for inclusion in this review with two of the papers secondary reviews [1,24]. In other clinical research literature concerned with psychosocial adaptation and recovery after burn, aspects of growth are intermingled with distress, psychopathology, quality of life and resilience [25,29]. Indeed, there are important differences between the concepts of PTG and resilience [30] although the two constructs overlap. An early paper which discusses resilience after severe burn, published in 1997 [31], incorporates descriptions of growth without extracting and describing the growth as a separate construct. Posttraumatic growth has been defined as “the subjective experience of positive psychological change reported by an individual as a result of the struggle with trauma” [32] and is commonly measured by the PTGI [7].

This integration of research into posttraumatic growth after burn reveals three domains; understanding the self, understanding the world, and understanding others, with each of these domains having two subdomains. In the domain of understanding the self the first sub-domain is that of personal strength. Personal strength is a newly recognised process by the burn survivor, and concurs with other psychosocial research after burn [22]. It likely occurs because the burn survivor has no choice but to 'sink or swim' while they endure the challenges they face. It is also likely that they never could have imagined what these challenges would be like or that they would be theirs to manage, which concurs with the PTG literature which proposes growth as being triggered by a shattering of the worldview. Zhu et al. [16] suggests that the realisation of strength is linked to new found self-efficacy, and the importance of self-efficacy as part of the coping response after a burn has been recently identified in other literature [34].

The second sub-domain within understanding the self is that of reprimiting and arises as a consequence of a better understanding of personal values and the realisation that everything can change in an instant.

The second domain of understanding the world has two sub-domains; spirituality and humanity. Spirituality is related to the internal process of making meaning from the burn event.
and its consequences and how this impacts ultimate on core beliefs [35]. This assists to drive the process of reappraising, and is a result of cognitive rumination. It is unclear whether formal religious doctrines may or may not be part of this process, and are likely to be utilized as a form of coping only if this is already an integral part of life pre-burn. Indeed, social support from religious communities is likely to be helpful because it would be drawn from like-minded people. The concept of making meaning has been explored in other related burn literature [33,36] with the understanding of humanity related to a better understanding of the outer world, and a clarity about the roller coaster nature of life, including the flaws and frailties of people which leads to a more forgiving and humane outlook [37,38].

The sub-domains of the third domain, understanding others, are those of personal relationships and compassion/altruism. Changes in interpersonal relationships are the biggest area of change with its magnitude of importance represented by seven of the 21 items of the PTGI. Interpersonal relationship changes can be negative as well as positive [21] and this is congruent with the seminal literature [2]. Compassion and altruism are reported in later research regarding PTG after other forms of trauma and are measured in a tool developed in 2013 [29] with a component regarding compassion added to the PTGI tool.

Therefore, the process of growth is an increased clarity and understanding of the self, the world and others. The various outcomes of growth include an improved quality of life with more effective coping strategies. In fact Janoff-Bulman [90] proposed that PTG should be referred to as posttraumatic coping, and that this might be a more accurate representation of the construct. Humour has been shown to be important in other burn psychosocial research [31,41] and is part of the reframing process. Reframing was identified as a process through which posttraumatic growth occurred, with gains such as gratitude, insight, self-esteem and identity [42] and positive reframing has been shown to have a small but still negative relationship with depressive symptoms after burn [43]. It has also been noted that the areas of increased clarity and understanding are influenced by other factors with these factors influencing the quality of functional coping. Pre-burn factors of age, gender, personality and previous trauma, and the circumstances of the injury event cannot ultimately be influenced after burn. However, if we learn how these factors might contribute to the risk of poor PTG and response to intervention type, then they may become important markers to identify relevant intervention strategies.

The physical characteristics of the injury can also guide recovery programs after burn to maximize overall function and return to a (new) normal life. Early psychosocial interventions for posttraumatic stress symptoms can promote functional coping. Support is paramount from family, close friends, health care practitioners, peers and the community, and its importance is demonstrated widely throughout the literature [31,36,44-47]. Support strategies can be used to encourage hope and optimism for the future by working with the patient to set realistic goals, planning, and feedback of progress and has previously been identified as an important need [48,49]. Dispositional optimism may not be required for PTG although it has been reported elsewhere for both PTG generally and effective coping after burn [46,50] and therefore begs the question ‘can we encourage optimistic thinking in non-optimist individuals to bring hope?’ Indeed, it might be that we can; an intervention of cognitive behavioral training was shown to increase optimism in burn survivors [51].

The relationship between growth and distress needs to be examined more closely as those with more distress after burn appear to report more growth. Studies in other types of trauma have demonstrated a curvilinear relationship, with those who have moderate levels of distress showing the greatest growth [1,52]. This relationship has not been determined or demonstrated within this review. The evolving question is whether growth buffers distress, and if so, is a tool which measures the negative aspects as well as the positive required.

Other literature has touched on the subject of positive outcomes after burn. Reeve et al. [38] measured positive change after burn with the Benefit Finding Scale. However, the authors do not discuss the details of the findings except to report that 44% reported moderate benefits and a further 26% reported greater benefits. A report regarding changes in life 5 years after burn revealed 19-20% of 153 burn survivors reported positive change, but no specific details regarding the change are published [54].

This comprehensive synthesis of the published literature reveals an emerging model for posttraumatic growth and coping after burn [Fig. 2]. Further research to further develop or consolidate this model after burn is needed, together with the evaluation of other measurement tools with the inclusion of a compassion dimension [39] or with negative and positive parameters [10]. Interventions to enable burn survivors to better understand their progress should be tested. These could be either patient led, for example journaling, or could be clinician led, such as feedback on quality of life progression together with practical planning, realistic goal setting and education of the patient for potential treatments and outcomes. Realistic outcome expectations are important because acceptance is only useful if change is not possible, and determination is only useful if change is possible, and knowing what is possible will influence motivation. Information about how PTG evolves over time is lacking, although other research claims stability at 6 months after trauma [24]. This may be different for burn survivors, who may continue to be engaging in treatment to restore function or face outcome even at this time point. Longitudinal research which measures PTG after burn is needed to assess normal temporal changes and enable the various intervention programs to be assessed for effectiveness.

6. Limitations

There has been limited work in the area of posttraumatic growth after burn, and therefore a paucity of published work to synthesize. From a methodological quality viewpoint, the purely qualitative research papers [18,19] did not mention that saturation had been reached which may have had an impact on the depth, quality and translation of the research conducted in addition to another research article being presented as a case study [20]. Burn is unique in terms of its physical and psychological challenges and therefore it is
important to understand the "what" and the "how" of PTG through qualitative research without simply quantifying the various domains identified in different, diverse populations. In addition, it can be difficult to identify the cause of the PTG; whether the burn, other related circumstances of the event, other trauma or natural maturation. As more research is published in the area, a more complete picture will emerge, allowing for meta-analysis to be conducted.

7. Conclusion

The integration and synthesis of the research literature which explores posttraumatic growth after burn reveals posttraumatic growth themes and factors that influence the coping strategies of each individual. It is clear that helpful support from family, friends, the community, peers and health care professionals is paramount, and various strategies which guide the supportive network and encourage posttraumatic growth will influence the coping strategies used by burn survivors. Health care professionals have the potential to positively influence growth by ensuring maximal overall function and quality of life and the facilitation of a return to a new normal. This must be done in conjunction with recognition of progress, and clear goal planning towards realistic outcomes to enable the determination to succeed or the acceptance of limitations as appropriate for the individual burn survivor. Thus, recommendations for practice are to apply a multidisciplinary approach to care, facilitate a support network, maximizing function and return to normal, until research into effective interventions has identified specific strategies that can improve PTG.

8. Conflicts of interest

None.

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psychological outcomes following burn injury: reduced incomes and hidden emotions are predictors of greater
Appendix IV

QUALITY OF LIFE AND POSTTRAUMATIC GROWTH AFTER ADULT BURN: A PROSPECTIVE LONGITUDINAL STUDY.

Martin L, Byrnes M, McGarry S, Rea S, Wood F.
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Quality of life and posttraumatic growth after adult burn: A prospective, longitudinal study

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Abstract

Posttraumatic growth is a positive psychological change that occurs beyond pre-trauma levels. Understanding the relationship between growth, stress and quality of life after burn improves understanding about the nature of postburn psychological growth and associated quality of life factors. This study aimed to determine the nature of these relationships, and whether posttraumatic growth changed over time in individuals. Two hundred and seventeen surveys were collected from 73 adult burn patients. The Posttraumatic Growth Inventory, Depression, Anxiety and Stress Score, SF-36 quality of life and Burns Specific Health Score – Brief surveys, together with demographic and clinical information was collected over a six-month period. Acute and non-acute burns were equally represented. Growth and stress were positively correlated (p = 0.004), but depression and growth had a curved relationship (p = 0.059). Growth scores reduced as stress (p = 0.008) and mental health improved (p = 0.001), and were highest at mid-levels of physical recovery (p = 0.001). This supports the concept that PTG is linked to coping as higher growth is reported with more stress, and that depression is a barrier to growth. As patients recover both physically and mentally from burn, less growth is reported. Early identification and management of depression is important to optimise growth outcomes.

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1. Introduction

Posttraumatic growth (PTG) is the patient’s report of positive psychological change that occurs beyond pre-trauma functioning, beliefs and values. The changes relate to benefit finding in the domains of interpersonal relationships, philosophy of life and perception of self and this phenomenon has been extensively researched in areas of trauma other than burn [1-4]. It has been previously demonstrated that self-reported growth after burn presents in two discrete ways. Firstly by gaining a changed understanding of the self, others and the world and secondly, by the use of specific coping mechanisms and ways of thinking. These ways of thinking include the use of humour, positive reframing, downward comparison, grotesqueness and meaning making [1] and other studies regarding burn recovery have supported these findings [5,6]. The relationship between PTG and burn has been moderately explored in the literature [7-9], however the relationship of PTG with stress and quality of life has not, despite having been identified as an important area of research in this field [10]. It has been proposed that PTG is thought to arise from a ‘shattering’ of worldview [11] and may be triggered by deliberate rumination about the trauma [12]. It is not the opposite of posttraumatic stress, and respondents have concurrently reported positive and negative effects in corresponding survey items simultaneously [13] suggesting a ‘double track’ of posttraumatic recovery [14]. Stress may trigger growth through the process of reflection and rumination resulting in changes in thinking in order to make meaning from the injury event [11,15].

The relationship between posttraumatic growth and stress has been widely explored in the non-burn literature with inconsistent findings [15]. Some studies have demonstrated a curvilinear relationship between posttraumatic growth and posttraumatic stress with the majority of growth occurring at moderate levels of trauma exposure [16] and distress [17,18], although that curvilinear pattern has not yet been identified and demonstrated after burn [19,20]. Recovery from burn can be long, and physically and psychologically arduous on both the patient and their families [5]. Qualitative research into posttraumatic growth after burn has demonstrated that the consequences of this burden is a barrier to interpersonal communication within families, which is a possible barrier to PTG [9] in addition to within wider social circles [21].

Depression after general trauma has been reported in up to 43% of survivors, and can persist for many years [22]. The prevalence of depression after burn is variable, and has been reported up to 53% within the first month of burn, and between 13% and 35% at 12 months post burn [23] although these rates might be accounted for by pre-burn prevalence [24]. Depression has been previously reported as a barrier to PTG in people affected by an earthquake [25]. Anxiety has been found to be equally common after injury and can persist in the longer term [26] and when depression, anxiety and stress were assessed via the DASS-21 outcome measure within general trauma increased scores at 3 months post injury were predictive of longer term psychopathology [22]. In contrast, worse mental health outcomes do not appear to be related to burn severity [27].

There are general (global) and burn-specific health-related quality of life (HRQoL) measures that are used to assess recovery after burn. Routine use of these measures occur in burns units locally and internationally, and relationships between these measures and the presence or absence of posttraumatic growth could enable clinicians to identify response patterns which are early indicators of good or poor positive psychological recovery, thus enabling early intervention, intervention and referral. As patient reported HRQoL outcome measures are a burden on patients’ time, and depression, anxiety and stress are not independent of these, it is beneficial to get a more comprehensive understanding from a small number of routinely collected measures. A meta-analysis reported no association between global health-related quality of life (HRQoL) and PTG after various non-burn trauma [27]. Other studies found that cancer patients reported better quality of life and less anxiety and depression with higher reports of growth [28], and that more growth was associated with better mental component scores from the SF-36 [29]. However, after burn, no significant association was found between PTG and quality of life using the SF-36 measure [30]. Burn specific quality of life can be assessed with the Burn Specific Health Scale Brief (BSHS-B) [30-35] and is routinely used within our clinical environment. As this HRQoL measure is specific to burn, and because the investigation of PTG after burn is a relatively new area of research with a minimal number of published studies, the evidence that assesses the two measures together is reduced to one published study [29]. This study reported significantly higher posttraumatic growth scores for the BSHS-B subdomains of hand function (r = 0.34, p < 0.001), body image (r = 0.26, p = 0.03), heat sensitivity (r = 0.39, p < 0.001), work (r = 0.31, p = 0.001) and overall function (r = 0.40, p < 0.001) [19]. However, this study did not report a relationship between posttraumatic growth scores and the BSHS-B subdomain of Interpersonal relationships, despite this being a key part of PTG theory [4]. This might be because the two measures assess different aspects of this theme, with no other study having assessed the relationship of these two specific outcome measures together.

Temporal changes in PTG are difficult to assess due to the lack of published longitudinal studies. A 12 month longitudinal study of Taiwanese cancer survivors found four different trajectories of PTG, each having different relationships with HRQoL measures, namely, stable high, high decreasing, low increasing and low decreasing [34]. These are no longitudinal studies exploring PTG after burn, however a cross-sectional study suggested that a positive relationship exists between PTG and time since burn, but did not specify a time when PTG is optimal, and does not assess repeated measurements in individuals [19]. It is important to identify the interrelationship between PTG and HRQoL so that we can better understand the nature of growth, what might drive and impede it and ultimately reveal potential interventions for better growth.

Thus, it is important to understand the relationships between HRQoL after burn and PTG. Understanding these relationships will help to clarify the nature of PTG after burn and may identify specific quality of life factors associated with the presence or lack of growth after burn. This means that it will be easier to identify those at risk of poor psychological
growth after burn by the assessment of widely used assessment tools, often routinely collected in the burn outpatient clinic, and this will allow the opportunity for early intervention and referral to appropriate clinical services. The first aim of this study was to determine the nature of any significant relationships between PFG and HRQoL outcome measures after adult burn. The second aim was to assess whether posttraumatic growth changed significantly over time in individuals with burn.

2. Method

This research was approved by the ethics committees of Royal Perth, Fiona Stanley Hospitals and University of Western Australia. This was conducted in accordance with the guidelines and principles of Australian Code for the Responsible Conduct of Research. All patients gave written informed consent before their participation following full discussion of the study (HREC# RGC-15-178).

This was a prospective, longitudinal, two-group cohort study. All participants were identified from hospital databases and were patients of the Burn Service of Western Australia. A total of 217 assessments were collected from 73 patients from two groups of participants. Group 1 were a cohort of participants with non-acute injury, more than 6 months post burn (n=34), and group 2 were a cohort of participants with acute injury, less than 6 months post burn (n=39). The median time since burn for the non-acute cohort was 36 months (IQR 75 months). The participants in the non-acute group had more severe burns (TBSA p < 0.0001) than those in the acute group because they required a longer period of clinical follow up. A battery of quality of life questionnaires were collected at 0, 1, 3, 6 and 12 months from the non-acute cohort, and immediately after discharge, 3 and 6 months from the acute injury cohort.

Participants were included if they had been admitted to the burns unit for a burn which required acute wound surgery. The need for skin graft surgery to heal a burn wound is an indicator of greater burn depth, and surgery to heal burn wounds occurs if a burn is deemed not to heal within 10-14 days in our unit. The two features of a burn that are indicative of greater severity are burn depth and burn area. Thus, in this study, burn depth was used to select patients who had more significant injuries. In addition, burns deep enough to require surgery were routinely followed up in clinic for scar management. Those willing to participate were recruited following full verbal discussion and informed consent of the study. Patients were not eligible for inclusion if they were less than 18 years old at the time of injury, or if they were unable to read or understand the patient information and consent form.

Patients with acute burns were asked to participate while inpatients, and those with non-acute burns were invited by letter sent prior to their outpatient’s appointment. This allowed time for the patient to consider whether they would be willing to participate and any questions regarding the study. Paper versions of the measures were collected from patients in the outpatient clinic; and were always collected together in a single session. An online version was available as a second option for patients who were not able to attend clinic.

2.1. Demographic and clinical data

Demographic information including gender, age at injury, marital status, and country of birth (COB) was collected. Clinical information including total body surface area burnt (TBSA) and burn type was also collected. These patient characteristics are displayed in Table 1. Congruent with our overall burn admission figures, 69% of the study population were male, with flame burns being the most common cause of injury.

2.2. Measures

Quality of life (HRQoL) measures need to be valid, reliable, sensitive to change, appropriate for purpose, and practical [32]. They are important measures to assess the outcomes of health care interventions, and are used in routine clinical practice to screen and assess individual patients for psychosocial and physical problems post burn. The following measures were chosen to assess general health-related quality of life, burn-specific quality of life, and positive and negative psychological change. All measures were collected concurrently for each patient visit.

The SF-36 is a generic 36-item health-related HRQoL measure widely used in many disciplines of health care, and which has also been proved useful to assess outcome after burn. This measure is particularly sensitive to change and assesses the two broad domains of mental health and physical health, which are comprised of eight subscales [36].

The Burn Specific Health Scale-Brief (BSHS-B) is a 40-item tool which assesses recovery from burn [30], it is a valid and reliable measure which is appropriate for use in both smaller and larger total body surface area (TBSA) burns [32,33]. It assesses physical functioning, psychosocial functioning, body image and burn-related issues.

The posttraumatic growth has been extensively researched by Tedeschi and Calhoun since 1995 [32,4,37,58] and can be measured with their associated outcome measure, the Posttraumatic Growth Inventory (PTGI) devised to measure patient reported positive psychological change after trauma [2,3]. This is a 21-item measure, reported to be reliable and valid in 1996, that has been assessed in many areas of trauma, including burn [9]. It assesses change in the areas of interpersonal relationships, new possibilities, personal strength, spiritual change and philosophy of life.

The depression, anxiety and stress scale (DASS) is a 21-item tool that assess the three subscales of depression, anxiety and stress, and correlates well with other measures of affect [56]. It is easy to administer and has been validated for use in a hospital setting [22].

2.3. Calculation

This longitudinal data was analysed using Stata 12.1 [40]. The primary outcome variable was total PFGI score. Mixed regression models allows us to analyse longitudinal data with time component for individuals with a series of time points to allow repeated measures analysis. Classifying data into panels (i.e. links the data entry points for each individual) allows a unidirectional analysis which accounts for differences in
time settings and visit numbers between individuals [41, 42]. The advantages of this approach include getting more information and more degrees of freedom from the sample size and it better controls for the heterogeneity of the covariates. This method is a fair and effective way of utilizing all collected data for each patient. First, longitudinal regression analysis was used to assess the effects of the demographic and injury event variables on total PTGI scores. Second, Chi-square and Wilcoxon Rank Sum (Mann-Whitney) tests were done as appropriate (as the nonparametric data) to test for differences in demographic and patient characteristics between the acute and non-acute groups. Third, PTGI scores were compared for differences between the groups. If a variable showed some evidence of an effect on PTGI at the 0.05 significance level, and this variable was difference between the two groups, this variable was accounted for in the regression analysis which assessed the relationship of each HRQoL measure to total PTGI scores.

Next, the panel data was analyzed using multiple linear regression analysis appropriate for repeated measures analysis to explore the relationship between SF-36, BHIS-B, and DASS scores and their factors with total PTGI scores, including quadratic relationships. If overall testing of a HRQoL measure demonstrated a significant relationship, the individual factors were tested to assess their contribution to that relationship. If overall testing did not display a significant relationship, the individual measures were not tested. A backwards elimination process was used to eliminate nonsignificant variables. This statistical approach allowed testing for, and control of, the observed differences between the two groups. $R^2$ is not reported in the output for the appropriate regression analysis for this data. The intraclass correlation is reported (p) which can be interpreted as a reliability coefficient. Finally, an assessment of total PTGI across time was analyzed using paired t-tests and longitudinal regression analysis, and was repeated for acute and non-acute groups while adjusting for TBSA and time since burn.

### Results

#### 3.1. PTGI scores by demographic and injury event variables

Longitudinal multiple linear regression analysis was conducted to assess if PTGI scores could be predicted from demographic or injury event details. PTGI did not differ between men and women ($p=5.93$, $r=0.73$, and

<table>
<thead>
<tr>
<th>Table 1 - Demographic and clinical data.</th>
<th>Acute</th>
<th>Non-acute</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender - male</td>
<td>219(94%)</td>
<td>217(74%)</td>
<td>50(89%)</td>
</tr>
<tr>
<td>Age at assessment - Years</td>
<td>44.3(13.5)</td>
<td>41.8(14.5)</td>
<td>43.0(14.0)</td>
</tr>
<tr>
<td>Age at injury - Years</td>
<td>43.7(13.3)</td>
<td>36.8(14.2)</td>
<td>40.5(14.4)</td>
</tr>
<tr>
<td>Marital status - Never married</td>
<td>8(30.5)</td>
<td>11(32.4)</td>
<td>19(30.0)</td>
</tr>
<tr>
<td>Married/divorced</td>
<td>24(66.7)</td>
<td>20(58.8)</td>
<td>46(66.0)</td>
</tr>
<tr>
<td>Divorced/separated</td>
<td>5(12.8)</td>
<td>2(5.9)</td>
<td>7(10.4)</td>
</tr>
<tr>
<td>Widowed</td>
<td>0(0)</td>
<td>1(2.9)</td>
<td>1(1.4)</td>
</tr>
<tr>
<td>Country of birth - Australia</td>
<td>22(94%)</td>
<td>26(76%)</td>
<td>48(70%)</td>
</tr>
<tr>
<td>Elsewhere</td>
<td>17(44%)</td>
<td>8(24%)</td>
<td>25(38%)</td>
</tr>
<tr>
<td>TBSA %</td>
<td>61(3.9)</td>
<td>32.7(31.2)</td>
<td>18.5(20.1)</td>
</tr>
<tr>
<td>Burn type - Chemical</td>
<td>3(7.7)</td>
<td>2(5.9)</td>
<td>5(6.9)</td>
</tr>
<tr>
<td>Contact</td>
<td>6(13.4)</td>
<td>1(2.9)</td>
<td>7(6.5)</td>
</tr>
<tr>
<td>Explosion</td>
<td>1(2.6)</td>
<td>25(8.5)</td>
<td>26(5.1)</td>
</tr>
<tr>
<td>Flame</td>
<td>19(48.7)</td>
<td>28(82.4)</td>
<td>47(64.0)</td>
</tr>
<tr>
<td>Friction</td>
<td>2(5.1)</td>
<td>0(0)</td>
<td>2(2.7)</td>
</tr>
<tr>
<td>Scald</td>
<td>8(20.5)</td>
<td>3(7.9)</td>
<td>9(12.7)</td>
</tr>
</tbody>
</table>

Data reported with Mean and Standard Deviation or 'Number and Percentage as indicated.
Table 2 – Longitudinal regression analysis results for the association of PTGI and DASS domains adjusted for TBSA.

<table>
<thead>
<tr>
<th></th>
<th>Linear</th>
<th>Quadratic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>p value</td>
</tr>
<tr>
<td>Depression</td>
<td>0.745</td>
<td>0.068</td>
</tr>
<tr>
<td>Anxiety</td>
<td>1.165</td>
<td>0.003τ</td>
</tr>
<tr>
<td>Total DASS score</td>
<td>0.2255</td>
<td>0.068</td>
</tr>
</tbody>
</table>

* p value <0.05; ** p value <0.01.

was not affected by age at injury (β = −0.15, p = 0.3, rho = 0.74), or time since injury (β = 0.04, p = 0.3, rho = 0.75). PTGI also did not differ with marital status (β = 0.1, p = 0.09, rho = 0.73), or between those born in Australia and those born elsewhere (β = 3.78, p = 0.5, rho = 0.75). TBSA demonstrated evidence of a small effect on PTGI scores (β = 0.3, p = 0.05, rho = 0.74) however this effect was reduced after adjustment for burn type (β = 0.044, p = 0.07, rho = 0.74).

3.2. Patient characteristics and clinical injury variables by group

The non-scute group consisted of patients with a significantly higher proportion of flame burns compared to scald burns (Chi-sq test, p = 0.04), bigger TBSA (Wilcoxon rank sum test, p = 0.0001), and a slightly younger age at injury (Wilcoxon rank sum test, p = 0.0350). There were no differences between proportions in the acute and non-scute groups for gender (Chi-sq test, p = 0.4), marital status (Chi-sq test, p = 0.6) or being Australian born (Chi-sq test, p = 0.07).

3.3. PTGI scores by group

After adjustment for TBSA, burn type and injury age, PTGI scores were lower in the acute group (β = −2.6) this was not statistically significant (p = 0.7). The groups were considered homogeneous and hence the full dataset was used in the analysis of total PTGI scores and other quality of life measures. The variables TBSA and group are highly correlated and thus should not both be included in the same statistical model because of colinearity. TBSA is continuous and has greater statistical power than dichotomising by group.

3.4. PTGI and DASS score analysis

TBSA demonstrated a positive effect on total PTGI scores that was close to significance (p = 0.055). As this was the only demographic or clinical variable to show possible evidence of an effect on PTGI scores, it was controlled for in the regression analysis. After adjusting for TBSA, the effect of total DASS scores on PTGI scores showed a small positive effect which was non-significant (β = 0.26, p = 0.068, rho = 0.74), but when assessed for a quadratic relationship the effect was highly significant (β = 1.3, p = 0.0001, rho = 0.76) and demonstrated a curved relationship, indicating that more growth was reported at moderate levels of total DASS score. Longitudinal analysis of the subdomains of depression, anxiety and stress are displayed in Table 2. Backwards elimination regression analysis further assessed these, and identified a significant inverse type curved relationship between development and

<table>
<thead>
<tr>
<th>Table 3 – Backwards Elimination Analysis for PTGI scores and DASS domain scores.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>1 Initial model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2 Depression score</td>
</tr>
<tr>
<td>Anxiety score</td>
</tr>
<tr>
<td>Stress score</td>
</tr>
<tr>
<td>TBSA</td>
</tr>
<tr>
<td>3 Depression score</td>
</tr>
<tr>
<td>Anxiety score</td>
</tr>
<tr>
<td>Stress score</td>
</tr>
<tr>
<td>TBSA</td>
</tr>
<tr>
<td>4 Final model</td>
</tr>
<tr>
<td>Anxiety score</td>
</tr>
<tr>
<td>Stress score</td>
</tr>
<tr>
<td>TBSA</td>
</tr>
</tbody>
</table>
growth, with a tipping point score of 3.99, with growth scores reducing at higher levels of depression, and a positive straight line association between stress and growth. The results are displayed in Table 3 and illustrated in Fig. 1.

3.5. **PTGI and BSHS-B analysis**

After adjusting for TRSA, the effect of total BSHS-B scores on PTGI scores was negligible (β = -0.09) and non-significant (p = 0.156) until assessed for curvature which showed a significant inverted u-shaped relationship (β = -1.06, β₂ = -0.005, p = 0.058, R² = 0.75). PTGI scores were greatest at mid-levels of overall burn-specific health-related quality of life. Table 4 shows the association of PTGI scores and BSHS-B scores. Each subdomain was assessed with adjustment for TRSA, and those found to have a significant effect were used in the backwards elimination regression. Table 5 shows the backward elimination analysis results and Fig. 2 illustrates these relationships.

3.6. **PTGI and SF-36 analysis**

After adjusting for TRSA, the effect of the Mental Component Scores of the SF-36 on total PTGI scores was highly significant for straight line regression (β = -0.992, p < 0.0001, R² = 0.75) but was not significant for quadratic regression (p = 0.4). The effect of the Physical Component score of the SF-36 on total PTGI scores was highly significant for straight line regression.
Table 4 - Longitudinal regression analysis results for the association of PTGI and BSBS-I domains.

<table>
<thead>
<tr>
<th>BSBS-I sub domain</th>
<th>Linear</th>
<th>Quadratic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>p value</td>
</tr>
<tr>
<td>Affect</td>
<td>0.35</td>
<td>0.310</td>
</tr>
<tr>
<td>Body image</td>
<td>0.05</td>
<td>0.900</td>
</tr>
<tr>
<td>Hand function</td>
<td>-0.09</td>
<td>0.995</td>
</tr>
<tr>
<td>Heat sensitivity</td>
<td>-0.46</td>
<td>0.092</td>
</tr>
<tr>
<td>Interpersonal relationships</td>
<td>-0.08</td>
<td>0.922</td>
</tr>
<tr>
<td>Sexuality</td>
<td>0.68</td>
<td>0.442</td>
</tr>
<tr>
<td>Simple abilities</td>
<td>1.32</td>
<td>0.014</td>
</tr>
<tr>
<td>Treatment regime</td>
<td>-0.08</td>
<td>0.820</td>
</tr>
<tr>
<td>Work</td>
<td>-0.84</td>
<td>0.030</td>
</tr>
</tbody>
</table>

(β = −0.298, p = 0.003, r² = 0.132) and also significant for quadratic regression (β = 1.818, 0.024, p = 0.000, r² = 0.717). Backwards elimination results are displayed in Table 6 and illustrated in Fig. 1 with a model of straight line regression for both mental and physical component scores to assess the suitability for practical clinical use.

3.7. PTGI changes over time

Comparing acute and non-acute burn patients, no impact on PTGI scores overall. However, the cohorts displayed different patterns of change in PTGI scores across visits and is displayed in Fig. 4. The difference between the two groups is not significant, however, paired sample t-test analysis revealed a significant drop in total scores between baseline and 6 months for the acute group (t = 1.95, p = 0.05) but not the non-acute group (t = 1.67, p = 0.13). Similar analysis of total PTGI between 3 months and 6 months showed no change for either group (non-acute group: p = 0.3, acute group: p = 0.6). Supporting this, longitudinal regression analysis showed the impact of time since injury (in days) on PTGI scores was not significant (p = 0.7) and that both TBSA (p = 0.3) and number of days since injury (p = 0.7) had no effect.

4. Discussion

In this population of acute and non-acute burn participants, there were higher self-reported levels of growth with higher levels of stress, and there were lower levels of growth as mental health and affect improved. The curved relationship with respect to depression is clinically significant and suggests that very low levels of depressive symptoms have a minimal effect on growth, but as depressive symptoms increase with scores above 4, self-reported posttraumatic growth scores drop further. This curvilinear relationship concurs with other non-burn studies [17,18] that assess PTGI and depression and is the first study to demonstrate this relationship after burn. In addition, more severe burns have an increased effect on growth in its relationship with depression and stress. The results suggest that the presence of depression is an important barrier to growth, that even low levels of depression can prevent growth, and that high levels of depression also have a great impact on growth. This is a key finding that impacts on clinical practice, especially due to the high

Table 5 - Backwards Elimination Analysis for significant BSBS-I domain scores and PTGI scores.

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Co-efficient</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 initial model</td>
<td>Affect</td>
<td>4.035</td>
<td>2.295</td>
<td>-0.46</td>
<td>8.53</td>
</tr>
<tr>
<td></td>
<td>Affect²</td>
<td>-0.722</td>
<td>0.554</td>
<td>-0.18</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships</td>
<td>11.65</td>
<td>6.363</td>
<td>-0.32</td>
<td>24.12</td>
</tr>
<tr>
<td></td>
<td>Interpersonal relationships²</td>
<td>-0.533</td>
<td>0.256</td>
<td>-2.45</td>
<td>0.390</td>
</tr>
<tr>
<td></td>
<td>Simple abilities</td>
<td>-0.407</td>
<td>0.508</td>
<td>1.570</td>
<td>0.766</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>-0.589</td>
<td>0.312</td>
<td>1.20</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
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<td>0.225</td>
<td>0.139</td>
<td>-0.48</td>
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<tr>
<td>2</td>
<td>Affect</td>
<td>4.114</td>
<td>2.297</td>
<td>-0.38</td>
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<td></td>
<td>Affect²</td>
<td>-0.721</td>
<td>0.554</td>
<td>-0.17</td>
<td>0.36</td>
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<td>6.360</td>
<td>-0.86</td>
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<tr>
<td></td>
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<td>-0.535</td>
<td>0.254</td>
<td>-1.05</td>
<td>0.032</td>
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<tr>
<td></td>
<td>Simple abilities</td>
<td>-0.407</td>
<td>0.508</td>
<td>1.570</td>
<td>0.766</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>-0.699</td>
<td>0.276</td>
<td>1.33</td>
<td>-1.17</td>
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<td>TBSA</td>
<td>0.239</td>
<td>0.139</td>
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<td>3</td>
<td>Affect</td>
<td>4.040</td>
<td>0.400</td>
<td>0.944</td>
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<td>15.95</td>
<td>5.739</td>
<td>4.704</td>
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<td></td>
<td>Interpersonal relationships²</td>
<td>-0.697</td>
<td>0.294</td>
<td>-1.156</td>
<td>-0.237</td>
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<tr>
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<td>Simple abilities</td>
<td>-0.407</td>
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<tr>
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<td>0.298</td>
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<td>TBSA</td>
<td>0.236</td>
<td>0.138</td>
<td>-0.55</td>
<td>0.496</td>
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<tr>
<td>4 Final model</td>
<td>Affect</td>
<td>3.864</td>
<td>0.400</td>
<td>0.777</td>
<td>1.846</td>
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<td>15.45</td>
<td>5.747</td>
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<td>-0.681</td>
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<tr>
<td></td>
<td>Work</td>
<td>-0.775</td>
<td>0.268</td>
<td>1.239</td>
<td>-0.520</td>
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</table>
prevalence of depression after burn [3,24] and demonstrates the importance of early recognition of depression with appropriate referral to psychological services and support for timely treatment.

These results support the concept that changes in worldview and changes in thinking styles are integral to the elements of posttraumatic growth after burn and might be used to cope with stress, whilst depression may inhibit the ability to employ these thinking styles, reduce motivation and disrupt the capacity to cope. As mental health improves, the need to use PTG related coping styles are no longer necessary, and thus evidence of PTG in the form of PTG scores decrease.

Similarly, poor physical health after burn, which is typified with pain, itch, restricted movement and poor function, might overwhelm the ability to employ useful thinking patterns associated with growth. In this study, more severe burns, as measured by TBSA, impacted on the relationship of growth and depression and stress. However, this study did not demonstrate a relationship between growth and the BSBS-B subdomains of heat sensitivity, hand function and body image, and therefore does not support the findings in the study by Baillie et al. [19]. As physical recovery occurs and total burn-specific health scores improve generally, growth scores are highest at moderate levels of recovery, then reduce again while recovery continues as burn survivors return to work and resume everyday life. The finding that returning to work is significant in psychological recovery after burn supports other studies which have emphasised the importance of this

Table 6 - Backwards Elimination Analysis for SF-36 PCS and MCS scores and PTG1 scores.

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Co-efficient</th>
<th>SE</th>
<th>95% CI</th>
<th>P</th>
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<tr>
<td>1 Initial model</td>
<td>MCS</td>
<td>-0.944</td>
<td>0.213</td>
<td>-1.36, -0.527</td>
<td>&lt;0.0005</td>
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<tr>
<td></td>
<td>PCS</td>
<td>1.547</td>
<td>0.632</td>
<td>0.307, 2.786</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>PTG1</td>
<td>-0.023</td>
<td>0.077</td>
<td>-0.199, 0.006</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>TBSA</td>
<td>0.259</td>
<td>0.175</td>
<td>0.009, 0.513</td>
<td>0.005</td>
</tr>
<tr>
<td>2 Final model</td>
<td>PCS</td>
<td>1.636</td>
<td>0.632</td>
<td>0.306, 2.787</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>PTG1</td>
<td>-0.229</td>
<td>0.077</td>
<td>-0.370, 0.009</td>
<td>0.001</td>
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<tr>
<td>Alternative model</td>
<td>MCS</td>
<td>-0.367</td>
<td>0.218</td>
<td>-1.392, -0.538</td>
<td>&lt;0.0005</td>
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<tr>
<td></td>
<td>PCS</td>
<td>-0.349</td>
<td>0.097</td>
<td>-0.539, -0.159</td>
<td>&lt;0.0005</td>
</tr>
</tbody>
</table>
milestone [35,44], and concurs with the study by Baillie et al. [19]. Final PTGI scores were higher than initial scores, indicating an ongoing benefit to the patient. It may be that good physical health renders a high level of coping as unnecessary, and as this study population only assesses patients with burn which require surgery, a population of patients with burns which heal without the need for surgery may report less posttraumatic growth overall.

The curved association of interpersonal relationships as measured by the BSHS-B with total PTGI scores is interesting. Lower interpersonal relationship scores recorded on the BSHS-B represent greater disconnection and loneliness, and higher scores represent a lack of difficulties with relationships. The interpersonal relationship items in the PTGI assess greater effort, better connection, and increased understanding of others, which reinforce more harmonious, supportive relationships. Thus, the BSHS-B assesses unfavourable aspects of relationships and the PTGI assesses favourable aspects of relationships as they measure different continuums of relationships. We may not expect a linear relationship between the interpersonal relationship domain of the BSHS-B and the overall PTGI scores despite the interpersonal relationship domain of the PTGI accounting for one-third of the overall score. Just as posttraumatic growth and posttraumatic stress may occur concurrently [3], so might helpful and unhelpful relationship characteristics. The results demonstrated within this study indicate that patients who reported higher overall growth reflected moderate levels of social disconnection, whilst those who reported a good deal of loneliness and disconnection or no relationship problems, reported less growth. The presence of depressive symptoms may impact on interpersonal connection and relationships, and thus these factors are interrelated. Social support is important for recovery from burn and for posttraumatic growth, however as burn survivors strive to regain some form of normality and independence, the support from others may be welcomed even though the dependence on others may be frustrating. It is likely that as health returns and independence is regained, that relationships may improve [22].

Overall, burn survivors reported no change in posttraumatic growth over time. Those in the non-acute group may have reached a status quo in their physical and mental health. In contrast those in the acute group reported significantly lower growth at three months post burn compared to self-

Fig. 3 – Association between significant SF-36 scores and PTGI scores from linear regression analysis.

Fig. 4 – Total PTGI scores over time for acute and non-acute burn.
reported growth immediately post discharge, with growth scores remaining significantly lower at 6 months compared to discharge. This remained significant after adjustment for days since burn and burn severity. If PTG scores are lower when levels of stress are lower, and when physical and mental health is better, this supports the above proposed findings that this burn cohort appears to be returning to a new normalized life. The finding suggest that by three years post burn growth levels have stabilized for those with severe burns, and by physical recovery for those whose burns are less severe.

Individually, studies have demonstrated inconsistent findings regarding the relationship between growth and stress [14]. Collectively, a meta-analysis suggests that there is a positive relationship between PTG and PTSD symptoms, which might be linear overall, and curvilinear for PTG factors, with the various associations and patterns varying for different types of stressful events [7]. This study adds to the literature, and is the first study to closely examine the relationship between HRQL and PTG after burn. This study supports the concept that PTG and PTSD are not extremes on a spectrum but are related concepts which may occur concurrently and can be understood as a "double track" of separate experiences [14]. Consistent with PTG theory [14], the results indicate that most growth is reported when high levels of coping are required, which is when stress levels are high and physical and mental function are low. It is also consistent with Lazarus’ theory about stress and coping which describes a stressful set of environmental conditions as those which exceed personal coping resources [4]. Thus, growth occurs when a highly stressful situation instigates a person to "dig deep" into their personal resources to find previously unrecognized or unused coping methods; hence realizing they were stronger than they thought" [2,9]. As depression worsens, growth drops, which could be explained by a lack of motivation and the feeling that personal coping resources may become overwhelmed. Also as recovery occurs, high levels of coping are no longer required, and self-reported growth is lower.

If depression is a barrier to growth and coping, then routine, early screening of patients to identify and treat depression is important. This will not only lessen depressive symptoms, but will improve growth and coping to aid recovery. In addition, education to inform patients about normal trajectories of depression, stress, growth and coping will reassure them about their progress. In addition, future research could include screening, early identification and treatment of depression to assess with PTG outcomes are improved.

5. Conclusion

The relationship between posttraumatic growth, stress and quality of life after burn reveals information about the nature of growth itself. It is not the opposite of stress, and it occurs when stress levels are high, and when high levels of effective coping are required and utilized. Depressive symptoms are a barrier to growth, with the greater the depression, the greater the impact on growth making early diagnosis and treatment of depressive essential. As affect and mental health improves, growth scores reduce with growth levels higher at mid-levels of physical recovery, and reduce as physical recovery occurs, with return to work recognized as a significant milestone. This is important information for health care practitioners as it might help to explain that recovery motivation may be initially low, improve mid recovery then decline again.

6. Limitations

This study is limited by a modest sample size, low recruitment rate and short follow up period. The two group design may be a further limitation, although burn severity did not appear to significantly influence PTG scores in this population, the trajectories were different in the acute group until initial recovery had occurred. Future research could use a larger population of burn patients from multiple sites who see followed up for 12 months or more to explore this further.

Conflicts of interest

None.

Acknowledgments

We especially would like thank the Julian Burton Burns Trust, South Australia for financial support. We would also like to thank the nursing staff and all members of the multi-disciplinary team for their help. In particular, we would like to thank all patients who honoured us with their time and involvement in this study. This study was part of doctoral research and conducted with the financial support of an Australian Postgraduate Award and University of Western Australia Top-Up Award Scholarship.

References

Appendix V

POSTTRAUMATIC GROWTH AND RESILIENCE: SIMILARITIES AND DIFFERENCES.


Poster presented at the Australia and New Zealand Burn Association Annual Conference Auckland 2016.
## Posttraumatic growth and resilience: Similarities and differences

**Lisa Martin, Michelle Byrne, Sarah McGarry, Suzanne Rea, Fiona Wood**

### Definition of PTG
Positive psychological change reported by an individual as a result of the struggle with trauma.

### Definition of Resilience
The ability to maintain relatively stable, healthy levels of psychological and physical functioning.

### Process of PTG
A number of proposed theories share similar attributes: posttraumatic stress leads to rumination and an increased understanding of self, others, and the world. Making meaning is important. Specific coping styles help: humour, positive reframing and gratitude.

### Process of Resilience
Resilience is a trait, and traits allow prediction of the present from the past. Brief intermittent stress exposures build resilience. Theories of hardness and self-efficacy lead to a sense of coherence model which proposes that resilience required events to be comprehensible, meaningful and manageable.

### Differences between PTG and resilience

<table>
<thead>
<tr>
<th></th>
<th>PTG</th>
<th>Resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dynamic</strong></td>
<td>Static, Homeostasis</td>
<td>Lower posttraumatic stress levels</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td>Change to worldview and a rebuilding of assumptions</td>
<td>Little change to worldview, and is able to assimilate trauma into existing experience.</td>
</tr>
<tr>
<td><strong>Rumination</strong></td>
<td>Little rumination</td>
<td>Focus is on present and future.</td>
</tr>
<tr>
<td><strong>Focus on event</strong></td>
<td>Repressive coping detrimental</td>
<td>Repressive coping used.</td>
</tr>
<tr>
<td><strong>Develop a better understanding of own personal strengths and so increases self-esteem.</strong></td>
<td>High self-esteem. Good problem solving ability. Good self-regulation.</td>
<td></td>
</tr>
<tr>
<td><strong>Internal struggle to make meaning of the trauma and understand the event</strong></td>
<td>Event is easily or already meaningful and comprehensible.</td>
<td></td>
</tr>
</tbody>
</table>

### The relationship between growth and resilience after trauma
Trauma causes stress and rumination. Rumination results in further stress, which might be enough to become a disorder (PTSD) and in growth (PTG). PTG presents as making meaning of the trauma, a changed understanding of the world, and specific coping mechanisms. Thus PTG can make the event comprehensible, manageable and meaningful, which are traits of resilience. PTG helps improve long-term resilience. High levels of PTG can buffer stress and lower levels can lead to resilience. Resilient people can still experience growth after a traumatic event but there are less negative effects because learnt coping strategies are more effective. Building resilience via growth requires benefit-finding, future orientation and making meaning.

### Similarities between PTG and resilience
- Good social support networks - family, friends, peers and professional
- Coping strategies for, but not exclusive to, PTG: 1) use of humour 2) gratitude and downward comparison, and 3) positive reframing

### References

**Affiliations**: (1) Injury Research Unit, University of Western Australia; (2) Centre for Health Research and Education, Western Australia; (3) Brain Injury Research Institute, University of Western Australia; (4) Fiona Stanley Hospital, Perth, WA, 6150, Western Australia.
Appendix VI

POSTTRAUMATIC GROWTH AND POSTTRAUMATIC:

STRESS A DISCUSSION OF THE LITERATURE.

Posttraumatic growth and stress: A discussion of the literature
Lisa Martin1, Michelle Byrne2, Sarah McGarry3, Suzanne Rees3, Fiona Wood3

Introduction
Burn injury can be devastating, and psychosocial recovery is complex. The first year after hospitalisation has been identified as unique and challenging. Both long-term psychological complications have been reported at 10-55%. Posttraumatic growth (PTG) has been identified as a positive psychological change reported by an individual as a result of the struggle with trauma1. This review discusses the relationship between growth and stress; the theory, the evidence, and the possible clinical implications for burn patients.

Method
AMED, CINAHL, Embase, Medline, PsychInfo, Pubmed, Medline and Scopus were searched for posttraumatic stress and posttraumatic growth with English language, 10 year filters to yield 435 articles. The addition of AND burn injury reduced the search results to 7 articles, 4 of which were excluded for not meeting either PTG or PTS or their relationship. 1 was excluded as it was a review article which reported the remaining 2 eligible articles2-5.

The theory in the general trauma literature
Trauma causes stress and rumination. Rumination results in further stress, which might be enough to become a disorder (PTSD) and in growth (PTG). It has been postulated that growth arises from stress, and that stress is a necessary precursor to trigger growth. High levels of PTG can 'buffer' stress and lower levels can lead to resilience. Some studies have shown a curvilinear relationship between the two with most growth occurring at moderate levels of stress6,7.

The evidence in the burn literature
Two quantitative studies assessed PTG and PTS in the burn literature.8,9 There was no association between the two when PTG was assessed as a measure of emotional distress for patients with larger burn injuries or when it was assessed against the impact of event scale revised in patients with smaller burn injuries. However, psychosocial support, coping and meaning making have been shown to have significant positive impact on both PTG and PTS in the burn and general trauma literature.

For further details about PTG and resilience see poster entitled Posttraumatic growth and resilience: Similarities and differences

Discussion
The relationship between posttraumatic stress (PTS) and PTG has been widely explored in the non-burn literature, but not in the burn literature. The general literature shows us that trauma increases both PTS and PTG, that they occur concurrently, and that PTG precedes PTG, and that most growth occurs at moderate levels of stress. The relationship is not resolved in the current literature.

Coping strategies associated with growth may also help stress, such as the use of humour, gratefulness and positive reframing10. Social support promotes growth and is protective against stress for trauma and burn patients alike11,12. Interventions that promote these will benefit our patients by maximizing the growth that will assist in building resilience and buffering stress.

References
1. 877-878
2. 877-878
3. 877-878
4. 877-878
5. 877-878
6. 877-878
7. 877-878
8. 877-878
9. 877-878
10. 877-878
11. 877-878
12. 877-878
Appendix VII

SIX ASPECTS OF BETTER COPING AFTER BURN – THE RATIONALE BEHIND THE RESOURCE.


Six aspects of better coping after burn – the rationale behind the resource
Lisa Martin, Michelle Byrnes, Sarah McNally, Suzanne Rees, Fiona Wood

Introduction
The model of postburn growth and coping illustrates that some people change their understanding of themselves, other people and the world after a burn. These changes in thinking can help them to make meaning, change their perspective and find new ways to cope.

Method
A narrative review of the academic literature discusses the conceptual and cross theoretical mapping of the sense of coherence theory of resilience (1), the self-determination theory of motivation (2) and the theory of posttraumatic growth (3, 4) after adult burn (5) and reveal six themes that underpin helpful coping styles.

Results
Helpful coping styles have been identified and can be grouped into six basic coping qualities. These six themes, and their associated core messages, provide a solid, theory-based rationale for the patient education information.

Conclusion
Changes in perspective drive better coping, but the patient can only change their perspective through their own deliberate rumination. Their intrinsic motivation, together with feelings of competence, a sense of autonomy and better relatedness, can help them towards their own value-driven goals for optimal recovery.

References

Six principles behind the patient resource
1. This information comes from other burn survivors – their words, their experiences.
2. Deliberate rumination is needed to boost resilience in those who do not have existing resources to understand, manage and cope with their burn, define their values and bring hope.
3. Patient goals need to be value driven.
4. Every burn has different impacts depending on the individual, their environment and their injury, and therefore recovery trajectories differ.
5. Clinicians cannot create, only facilitate.
6. Clinicians must choose their words carefully for fear of causing offence.

Six qualities of growth-related coping

<table>
<thead>
<tr>
<th>Quality of growth-related coping</th>
<th>Core message</th>
<th>Self-determination theory aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Acceptance</td>
<td>You can't change your past but you can change your future.</td>
<td>Competence, autonomy</td>
</tr>
<tr>
<td>B. Seeing through the lens</td>
<td>You are stronger than you thought.</td>
<td>Competence, autonomy</td>
</tr>
<tr>
<td>C. Compromise</td>
<td>We need to pace ourselves and set realistic goals.</td>
<td>Autonomy</td>
</tr>
<tr>
<td>D. Resilience</td>
<td>You can get through this.</td>
<td>Competence, autonomy</td>
</tr>
<tr>
<td>E. Mindfulness management</td>
<td>Understand what you feel, say what you feel.</td>
<td>Resilience</td>
</tr>
<tr>
<td>F. Family, friends and social support</td>
<td>You are not alone.</td>
<td>Resilience</td>
</tr>
</tbody>
</table>

Index
Appendix VIII

PROMOTING POSITIVITY AFTER BURN: IS IT POSSIBLE?
FUTURE INTERVENTION STRATEGIES FOR RESEARCH.

Poster. Presented at the Australia and New Zealand Burn Association Conference, Adelaide, Australia. October 2017
Promoting positivity after burn: Is it possible? Future intervention strategies for research

Lisa Martin, Michelle Byrnés, Sarah McGarry, Suzanne Reay, Fiona Wood

Introduction: Some patients have the capacity to identify positive psychological changes after a burn. These changes might be affected by burn severity, burn location, and recovery trajectories [1]. In addition, there are specific changes in thinking that affect postburn coping, and there are a number of potential ways these could be influenced [2].

Method: The Model of Postburn Growth and Coping [3] was used to propose future research opportunities for growth. This model identifies the presentation of growth as changes in thinking which result from deliberate rumination [4]. It recognizes the importance of psychosocial support and identifies particular influencing factors in promoting positive psychological change after burn, thus these three areas were explored for potential intervention types.

Results: The possible interventions that have the potential to encourage helpful rumination styles, improve social support networks and further explore the influencing factors have been identified. These interventions and research possibilities to promote growth, improve coping and facilitate better recovery can be either patient-led, clinician-led, or psychology-led.

Conclusion: Potential interventions are illustrated here, and it is recognised that some concepts have been researched in the areas of resilience [5] and coping [6] after burn. The research possibilities proposed here are designed to approach growth from three distinct ways. First, those theoretical to aid deliberate rumination processes are colour-coded yellow, those that explore psychosocial support interventions are colour-coded red, and those that explore the influencing factors are colour-coded orange. The Venn diagram depicts whether these interventions can be led by the patient, burn team clinicians or psychosocial clinicians.

References:

Affiliations: Burn Injury Research Unit, University of Western Australia; Clinical Psychology Research Unit, Perth Institute for haematology and Translational Science, University of Western Australia; Kirby Institute, University of New South Wales.

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