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Oncology health professionals' attitudes towards treatment-focused genetic testing for women newly diagnosed with breast cancer

Stephanie Burcher\*<sup>1</sup>, Bettina Meiser\*<sup>2</sup>, Gillian Mitchell<sup>3,4</sup>, Christobel Saunders<sup>5</sup>, Belinda Rahman<sup>2</sup>, Kathy Tucker<sup>6</sup>, Kristine Barlow-Stewart<sup>1,7</sup>, Kaaren Watts<sup>2</sup>, Margaret Gleeson<sup>8</sup>, Judy Kirk<sup>9</sup>. \* Joint first authors

<sup>1</sup>Sydney Medical School, The University of Sydney, Sydney, NSW, Australia; <sup>2</sup>Psychosocial Research Group, Prince of Wales Clinical School, UNSW, Sydney, Australia; <sup>3</sup>Familial Cancer Centre, Peter MacCallum Cancer Centre, Melbourne, Victoria, Australia; <sup>4</sup>University of Melbourne, Melbourne, Victoria, Australia; Hereditary Cancer Clinic, Prince of Wales Hospital, Sydney, NSW, Australia; <sup>5</sup>School of Surgery and Pathology, University of Western Australia, WA, Australia; <sup>6</sup>Hereditary Cancer Clinic, Prince of Wales Hospital, Randwick, NSW, Australia; <sup>7</sup>The Centre for Genetics Education, NSW Health, Sydney, NSW, Australia; <sup>8</sup>Hunter Family Cancer Service, Newcastle, NSW, Australia; <sup>9</sup>Familial Cancer Service, Westmead Institute for Cancer Research, Westmead Millenium Institute, University of Sydney, NSW, Australia.

Corresponding author: Bettina Meiser, Psychosocial Research Group, Department of Medical Oncology, Prince of Wales Hospital, Randwick, NSW 2031, Tel 61-2-9382-2638, fax 61-2-9382-3372, e-mail: b.meiser@unsw.edu.au.

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**Aims:** This study explored the attitudes of oncology health professionals towards treatment-focused genetic testing (TFGT) for women newly diagnosed with breast cancer.

**Materials and methods:** Members of several relevant medical organizations in Australia and New Zealand were invited via email to participate in an online survey. **Results:** A total of 149 respondents, including 40 surgeons, 46 oncologists and 63 breast care nurses, completed the online questionnaire. The majority of respondents believed that TFGT was useful for patient care (87.3%) and valuable for the treatment and management of breast cancer (90.6%). In multivariable analyses, breast care nurses were significantly more likely to agree that TFGT was useful for patient care and the treatment and management of breast cancer, compared to oncologists and surgeons ( $\beta = 0.30$ , 95% CI 0.01, 0.60,  $p=0.045$ ). Participants also agreed that TFGT has an impact on treatment decision-making (96.0%), uptake of bilateral mastectomy (98.7%) and uptake of risk-reducing salpingo-oophorectomy (98.0%) in women newly diagnosed with breast cancer. A slight preference towards surgeons (49.7%) as the best health professional to make the initial offer of TFGT was observed, and the majority of respondents suggested the best time to offer TFGT was shortly after diagnosis, when the treatment plan is discussed. **Discussion:** The findings suggest health professionals have positive attitudes towards TFGT. Future training programs focusing on teamwork models and guidelines specifying health professionals' roles in regards to TFGT and follow-up management may be of benefit.

The identification of the *BRCA1* and *BRCA2* genes and their role in causing breast and ovarian cancer has greatly influenced clinical practice and cancer management. Women with a *BRCA1* or *BRCA2* mutation have been found to have a cumulative risk of ipsilateral breast cancer at 15 years of 23.5% following breast-conserving treatment compared to 5.5% following a mastectomy ( $p < 0.0001$ ) [1]; most breast cancers in this study appeared to be second primary breast cancers rather than a failure to control the primary breast tumor. It is also well established that the risk of contralateral breast cancer in women diagnosed with breast cancer with a *BRCA1* or *BRCA2* mutation is significantly increased. Specifically a recent systematic review reported that the 10-year risk of contralateral breast cancer ranges from 20% to 42% in women diagnosed with breast cancer with a mutation compared to 5% to 6% in women with sporadic breast cancer [2]. For example, Malone et al. (2010) found that women with *BRCA1* mutations had a 4.5-fold (95% CI, 2.8 to 7.1) increased risk of contralateral breast cancer and those with *BRCA2* mutations a 3.4-fold (95% CI, 2.0 to 5.8) increased risk, compared to non-carriers [3]. In addition, *BRCA1* and *BRCA2* mutations confer a 13% to 46% lifetime risk of ovarian cancer [4].

Current Australasian practice guidelines recommend that women with breast and/or ovarian cancer and a moderate- to high-risk family history of cancer are referred to a family cancer service and offered genetic counseling with or without genetic testing for mutations in *BRCA1*, *BRCA2* and other breast/ovarian cancer predisposition genes [5], although the actual patterns of care around uptake of this recommendation in Australia and elsewhere where such services are available are unknown. Most women are referred to genetics services after completion of their adjuvant treatment and the genetic information they then receive only pertains to their personal future cancer risk as well as risk clarification for their family members.

However, the benefits of genetic testing offered around the time of a woman's breast cancer diagnosis to help the patient and her treating clinicians decide on an appropriate management plan for both the presenting cancer and future cancer prevention is becoming increasingly recognized. Hereafter, such testing will be referred to as treatment-focused genetic testing (TFGT). The confirmation of a *BRCA1* or *BRCA2* mutation can be information that is used to facilitate the decision between a breast-conserving approach (wide-local excision and radiotherapy) or a therapeutic unilateral mastectomy with or without a preventative mastectomy on the contralateral side [6]. For unaffected *BRCA1* and *BRCA2* gene mutation carriers, bilateral risk-reducing mastectomy is known to reduce the risk of breast cancer in by up to 95% [7]. For affected mutation carriers the risk of ipsilateral breast cancer is reduced by mastectomy compared to breast-conserving therapy [1], and a reduction of contralateral risk would be expected with bilateral mastectomy.

Importantly, women who undergo TFGT and are found not to carry a *BRCA1* or *BRCA2* mutation in the absence of a strong family history may be reassured that their future risk of ipsilateral/contralateral breast cancer is not increased above that of women with sporadic breast cancer [8]. The new breast cancer risk in the setting of a breast cancer family history will depend on the strength of the family history and age of onset of the first breast cancer.

In unaffected mutation carriers a risk-reducing salpingo-oophorectomy (RRSO) before the age of 50 reduces the risk of ovarian cancer by 85%-95% [9, 10]. In unaffected mutation carriers, RRSO also reduces the risk of breast cancer by half if performed in premenopausal women [11]. RRSO would similarly be expected to reduce the future risk of contralateral breast cancer in young mutation carriers with breast cancer. In the future TFGT may also be used to guide adjuvant chemotherapy such as the use of poly (ADP-

ribose) polymerase (PARP) inhibitors, once the efficacy of targeted systemic therapy for *BRCA1* and *BRCA2* mutation carriers is established through randomised controlled trials [6].

There is mounting evidence to support the utility of TFGT, and most previous studies have focused on the attitudes of patients towards genetic testing [12]. Research amongst newly diagnosed breast cancer patients suggests that they are both interested in, and willing to undergo, TFGT when it is offered, and that it can be readily integrated into clinical practice [13-15]. There is also widespread agreement about the prominent role health professionals will play when TFGT becomes more widely available in clinical practice and thus the opinions of health professionals are equally important [15].

Two small, qualitative studies of health professionals' attitudes to TFGT indicate that they feel concerned that TFGT may cause psychological distress and increase the burden of decision-making for women at an already vulnerable time [5, 15]. In one of these studies, 34 Australian medical and genetics specialists and genetic counselors working in cancer genetics were interviewed [5]. Participants acknowledged the advantages of genetic testing in regards to providing women with personalized treatment options, but they also expressed concerns that genetic information was likely to add to a woman's burden and psychological distress [5]. Their main reservations were related to the ethics of decision-making and consent at a time when women were often emotionally overwhelmed [5]. In one other qualitative study by Ardern-Jones, 17 health care professionals involved in breast cancer care in the UK (breast surgeons, oncologists, clinical geneticists, breast care nurses and cancer genetics nurses) were interviewed [15]; participants described concerns that

receiving genetic test results around the time of diagnosis were likely to lead to informational and emotional overload for the patient [5, 15].

While the acceptance of the potential utility of TFGT by both patients and health professionals is becoming increasingly acknowledged, several issues surrounding the procedural aspects of TFGT remain to be resolved. In particular, the timing of the offer of genetic testing appears to be a contentious issue among health professionals [15, 16]. TFGT may be offered before surgery [13]; while patients are having neo-adjuvant therapy, i.e. chemotherapy given prior to definitive local surgery [17]; or during systemic therapy and before radiation therapy [18]. It is helpful to know any results prior to administration of radiotherapy to complete a woman's breast-conserving therapy, because if she later chooses bilateral mastectomy in the event of receiving a positive mutation test result, reconstructive outcomes could be compromised, including better cosmetic results and less complications.

There is also debate regarding who might be the best professional to make the initial offer of TFGT. Studies of women offered genetic testing at breast cancer diagnosis varied in regards to which professional made the initial offer of TFGT. Stolier's study involved either a surgical oncologist or medical geneticist evaluating the patient's personal and family history information and making a decision about whether to make an initial offer of testing [18]. Cancer clinic staff were the primary professionals to offer genetic testing in another study [14], while a third study was unclear about who offered TFGT [13].

If TFGT is going to become an integral part of breast cancer management in the future, it is important to ascertain the opinions of healthcare professionals and resolve some of the

procedural issues associated with TFGT. The study aimed to ascertain the attitudes of three different types of oncology health professionals and tested the following hypotheses. First, that there will be differences between surgeons', oncologists' and breast care nurses' attitudes in relation to (i) perceived usefulness and value of TFGT, and (ii) the degree of impact they perceive genetic testing has on patient decision-making. Second, that the professional groups will differ in their views regarding which health professional would be best to make the initial offer of TFGT to patients and the timing of such offer.

### **Materials and methods**

The web-based survey items were purposively designed for this study based on a review of the relevant literature and using the advice of a panel of experts with expertise in genetic counseling, clinical genetics, psychology, oncology, breast surgery and genetics education. The survey items were pilot-tested with a convenience sample of five health professionals and changes were made accordingly. Scales were randomized to minimize possible ordering effects. The survey was open for 2.5 months, from June to mid-August 2012.

The survey (24 items) included 11 items about participant demographics and professional background, six items on the perceived usefulness and acceptability of TFGT, three items designed to assess the perceived impact of genetic knowledge about *BRCA1* and *BRCA2* mutation status on treatment decision-making, two items concerning attitudes towards the perceived future use of TFGT and two items developed to ascertain the preferred timing and type of health professional to make an initial offer of TFGT.

An invitation to participate was circulated via email to all members of the Medical Oncology Group of Australia (MOGA), Breast Surgeons of Australia and New Zealand



(BreastSurgANZ), Breast Cancer Interest Group (BCIG) and La Trobe Breast Care Nurses. The email contained a link to the online survey and to the Participant Information Sheet and Consent Form. An advertisement was also placed in the fortnightly electronic newsletter of the Royal Australian and New Zealand College of Radiologists (RANZCR). The inclusion criterion was working in a clinical setting. Eligible individuals who completed the survey had the option of receiving a \$30 Amazon voucher.

### **Data analysis**

Data was imported from the KeySurvey program and analyzed using the Statistical Package for the Social Sciences 20 (SPSS Inc., Chicago, IL). Univariate statistical methods were used to describe most of the results. Internal reliability for multi-item variables was assessed using Cronbach's Alpha test. Chi square tests were used to assess associations between categorical variables. The distributions of the outcome variables used for hypothesis testing were examined and a one-way analysis of variance and Kruskal Wallis tests were used for normal and non-normal distribution of continuous variables to compare attitudes between the three professional groups. Non-normally distributed continuous outcome variables were re-coded into binary variables, using a median split. Bivariate tests were followed by multivariable analyses for bivariate associations with  $p < 0.25$ , while entering age and sex as potential confounding variables. Multiple linear regression was used for normally distributed outcome variables and logistic regression for the re-coded binary outcome variables. Variables were progressively eliminated using a backwards elimination strategy until only those predictor variables with  $p < 0.05$  remained in the model.

## **Results**

### **Demographics and professional background characteristics**

Ethics approval was obtained from the appropriate institutional review board, and each participant provided informed consent. All 149 individuals who participated in the survey were included in the analyses. The professional groups were made up of 40 surgeons, 46 oncologists (two radiation oncologists, 40 medical oncologists and four medical oncology registrars) and 63 breast care nurses (including nurses involved in other areas of cancer care). Table 1 shows participants' sociodemographic and professional backgrounds characteristics.

Sixty-two (41.6%) participants saw over 60 new patients with breast cancer each year, 22 (14.8%) saw between 41 and 60, 39 (26.2%) saw between 21 and 40 and 26 (17.5%) saw less than 20. Twenty-six (19.5%) participants saw more than 30 patients who are younger women (diagnosed below age 50) with early breast cancer each year, 25 (16.8%) saw between 21 and 30, 42 (28.2%) saw between 11 and 20, 20 (21.5%) saw between 6 and 10, 20 (13.4%) saw less than five, and one participant (0.6%) saw none. Forty-two percent (41.6%) of participants reported not having received any cancer genetics training.

[Insert Table 1 about here]

### **Perceived usefulness and value of TFGT**

One hundred and thirty respondents (87.3%) believed that TFGT was moderately or very useful for patient care and 135 (90.6%) that it was moderately or very valuable for the treatment and management of cancer. A large proportion of respondents agreed or strongly agreed that an increased level of knowledge about *BRCA1* and *BRCA2* mutation status will

lead to improvements in the following areas: diagnostic clarification for patients ( $N=125$ , 83.9%), risk clarification ( $N=143$ , 96.0%), targeting of resources to at-risk patients ( $N=139$ , 93.3%), and discovery of new and improved treatment options (84.6%).

In bivariate analysis, there was a statistically significant difference ( $z= 15.66$ ,  $p<0.001$ ) between the professional groups' attitudes towards the usefulness of TFGT. Breast care nurses were more likely to agree that TFGT was useful for patient care and the treatment and management of cancer – mean (SD)=27.1 (2.86), compared to oncologists – mean (SD)=25.4 (2.67) and surgeons – mean (SD)=25.1 (3.10). These differences between professional groups persisted in multivariable analyses using linear regression ( $\beta = 0.30$ , 95% CI 0.01, 0.60,  $p=0.045$ ), after controlling for age ( $t=-0.61$ ,  $p=0.54$ ) and gender ( $t=1.01$ ,  $p=0.31$ ).

### **Perceived impact of genetic knowledge on treatment decision-making**

The majority of participants strongly agreed or agreed that TFGT would have had an impact on treatment decision-making ( $N=143$ , 96.0%), uptake of bilateral mastectomy ( $N=147$ , 98.7%) and uptake of risk-reducing salpingo-oophorectomy ( $N=146$ , 98.0%) in women newly diagnosed with breast cancer. No significant differences were observed between professional groups in terms of mean scores of “Perceived impact of TFGT on treatment decision-making” ( $z=2.22$ ,  $p=0.33$ : oncologists – mean (SD)=10.7 (1.05), surgeons – mean (SD)=11.0 (1.08), and breast care nurses – mean (SD)=10.9 (1.18).

### **Future uses of TFGT**

A significant proportion ( $N=128$ , 85.9%) of participants agreed or strongly agreed that TFGT will become an integral part of health care in the future. Ninety-eight (65.8%)

respondents strongly agreed or agreed that TFGT will improve the treatment recommendations and cure rates for breast and/or ovarian cancer patients within the next decade.

### **Best professional to make initial TFGT offer**

Table 2 shows surgeons' oncologists' and breast care nurses' views on the best health professional to make an initial offer of TFGT to the patient. About half ( $N=57$ , 49.7%) the respondents felt that surgeons would be the best health professional to make the initial offer if TFGT is to be integrated into standard care, followed by genetic counselors or genetics specialists ( $N=39$ , 32.2%), oncologists ( $N=21$ , 17.4%) and lastly breast care nurses ( $N=4$ , 33%).

[Insert Table 2 about here]

The 28 participants who selected more than one health professional as the best professional to make an initial offer of TFGT were excluded from the analyses; these analyses showed significant differences between professional groups in terms of who they considered to be the best health professional to make an initial offer of TFGT to patients ( $\chi^2= 18.3$ ,  $p=0.005$ ). As shown in Table 2, oncologists were relatively divided, with 31.2% suggesting surgeons, 34.4% oncologists, 34.4% genetic counselors or genetics specialists and none suggesting breast care nurses. The majority (66.7%) of surgeons felt they would be the best professional to make the initial offer of TFGT, followed by genetic counselors or genetics specialists (25.0%) and oncologists (8.0%). Breast care nurses believed surgeons would be the best professional group (43.4%) followed by genetics specialists or genetic counselors (35.8%), oncologists (13.2%) and lastly breast care nurses (7.5%).

### **Timing of initial TFGT offer**

Eight-seven oncology health professionals (58.4%) believed the best time for the initial offer of TFGT to be made to the patient was shortly after diagnosis when the treatment plan is discussed. Thirty-seven (24.8%) felt that the initial offer of TFGT should be made at diagnosis or when diagnosis is confirmed; seventeen (11.4%) after breast surgery and before commencement of adjuvant therapy; six (4.0%) thought it should be offered after treatment has been completed (standard genetic testing), and two (1.3%) specified a different time point.

## **Discussion**

### **Perceived usefulness and value of TFGT**

Almost all the oncology health professionals surveyed in this study believed TFGT to be highly valuable and useful for the treatment and management of breast cancer. These positive attitudes are consistent with the study conducted by Van Riel et al., which examined the attitudes of 92 surgeons, medical and radiation oncologists as well as radiologists towards genetic counseling and testing for *BRCA1* and *BRCA2* mutations, although it should be noted that their study did not specifically focus on attitudes to genetic counseling and testing shortly after a new diagnosis of breast cancer [16]. Almost 90% of specialists in the latter study reported that genetic counseling and testing added to optimal treatment for breast cancer patients [16]. Unlike our study, the medical specialists' attitudes did not differ significantly between professional groups [16].

Our study demonstrated that breast care nurses were more likely to agree that TFGT was useful for patient care and the treatment and management of cancer compared to oncologists and surgeons. It is possible that the greater perceived utility of TFGT is

because breast care nurses have an ongoing involvement with patients and are more likely to experience the utility of TFGT on a day-to-day basis. Although the oncologists and surgeons surveyed were also highly supportive of the utility of TFGT, their somewhat lower levels of perceived utility may reflect greater concerns about the psychosocial implications of TFGT. Other studies that have surveyed oncologists and surgeons also reported that these health professionals were concerned about the psychological distress testing may cause patients and their families [15, 16].

### **Perceived impact of genetic knowledge on treatment decision-making**

Almost 100% of participants agreed that TFGT would have an impact on treatment decision-making, and uptake of bilateral mastectomy and/or of risk-reducing salpingo-oophorectomy in women newly diagnosed with breast cancer. This finding also concurs with results from Van Riel's study, which states the most frequently mentioned positive outcome of genetic testing (28%) by the specialists surveyed was the opportunity for *BRCA1* or *BRCA2* mutation carriers with breast cancer and unaffected family members who carry the mutation to elect to have risk-reducing surgery [16].

### **Future uses of TFGT**

Almost 90% of participants agreed that TFGT will become an integral part of health care in the future. The overwhelming positive response from participants towards the future integration of TFGT into standard healthcare is concordant with previous research indicating both patients and health professionals support the imminent integration of TFGT into healthcare [5, 19]. Participants, however, expressed lower levels of agreement (65%) that TFGT will improve treatment recommendations and cure rates within the next decade. This may be for several reasons: health professionals are confident with the current

treatment recommendations and believe they are not likely to change within the next decade; treatment recommendations and cure rates are dependent on other factors apart from *BRCA1* and *BRCA2* mutation status such as pathology and stage of cancer at diagnosis; other tests such as tumor profiling may be more likely to improve treatment recommendations and outcomes in the future than germline *BRCA1* and *BRCA2* testing; and improving treatment recommendations and cure rates is a long-term goal, therefore research examining response rates to treatments of *BRCA1* and *BRCA2* related tumors is unlikely to have a big impact in the next decade.

### **Best professional to make initial offer of TFGT**

Our findings suggest a slight preference for the surgeon to make the initial offer of TFGT to the patient, with 50% of participants reporting they believe the surgeon would be the best health professional to make the initial offer of TFGT, followed by genetics specialists or genetic counselors (32%), oncologists (17%) and lastly breast care nurses (3%). The study by Ardern-Jones also showed a general agreement that surgeons and oncologists should be the health professionals to initially raise the issue of genetic testing [15]. However the latter study highlighted a discrepancy in views between professionals in regards to who should provide genetic information to the patient, with some health professionals feeling more comfortable with the genetics team handling genetic aspects of counseling, while others, in particular surgeons and oncologists, strongly believed it was their responsibility to communicate genetic information to the patients [15].

Our findings illustrate several differences between surgeons', oncologists' and breast care nurses' perceptions towards the best health professional to make the initial offer of TFGT. Almost 70% of surgeons felt they would be the best professional to make the initial offer,

and 25% of surgeons thought a genetics specialist or genetic counselor would be the best professional. Oncologists' and breast care nurses' opinions were more divided, with no clear preference being apparent for the preferred professional group (i.e. surgeons, oncologists, genetics specialists) to offer TFGT. These differences may also relate to the workplace of the respondent. Some multi-disciplinary breast cancer care teams have a fully integrated cancer genetics specialist, whereas other teams may have to consult with external genetic specialists, who may or may not have cancer genetics as their primary role.

Surgeons are one of the first health professionals to establish a relationship with the patient and have the knowledge and capability to offer TFGT to patients. As decision-making about TFGT is a complex and often emotional process, it could be argued that patients require detailed pre-test counseling to make informed decisions regarding TFGT and that surgeons may lack the time and training to provide such counseling, when making an initial offer of TFGT. However, preliminary data from an ongoing randomized controlled trial involving 128 younger women (<50 years), who were offered TFGT at diagnosis before definitive breast surgery, suggests that brief educational materials provided by her surgeon are not inferior to face-to-face genetic counseling by a genetic counselor or a genetics specialist in preparing women for decision-making about TFGT [20, 21]. These results suggest that detailed pre-test counseling may not be needed to achieve informed decisions regarding whether or not to undergo TFGT, and that brief educational materials may be a safe and effective way of informing women newly diagnosed with breast cancer about TFGT. However, in this trial all women who opted for TFGT received their results at a genetics service through trained genetics professionals [20, 21]; when designing the trial it was considered essential that result disclosure took place in the context of a genetic



risk assessment that takes into account the strength of any existing family history to ensure correct interpretation of the results.

Furthermore, experiences in study implementation of the trial show that there are several limitations to having a sole “gate keeper”, including the possibility of eligible patients being missed by the surgeon if he/she does not recognize the patient as being eligible for testing, or if he/she forgets to offer testing or refer for testing; thus a multidisciplinary approach may be required to ensure all patients who are eligible for testing are informed about the opportunity to have TFGT [20, 21].

Surgeons may make the initial offer of TFGT but the genetics team is likely to manage the long-term care of the patient and their family. Genetic counseling services and family cancer clinics have the time and expertise to provide genetic information to patients and facilitate decision-making [15]. If TFGT is to become integrated into standard practice, an important part of the roles of genetic specialists and genetic counselors will be to discuss the long-term implications of TFGT, treatment options and address psychosocial and familial issues after test results are disclosed. Another important role of these health professionals is to raise the issue of a genetic predisposition at multi-disciplinary meetings so the referral can be a shared responsibility.

### **Timing of offer**

Almost 60% of professionals felt TFGT should be offered shortly after diagnosis when the treatment plan is discussed. Our findings are in contrast with studies that have examined health professionals’ attitudes to genetic testing after a new diagnosis of breast cancer. In the UK interview study by Ardern-Jones, health professionals’ views as to the timing of

the offer of genetic testing also varied considerably [5, 15]). In Van Riel's UK survey study assessed knowledge about hereditary breast cancer, attitudes about *BRCA1* and *BRCA2* testing and referral pattern to a family cancer clinic and the best timing of an offer of genetic testing [16]. In the latter study physicians thought the best time for genetic testing was after adjuvant therapy or during follow up, and only 10% of participants stated the optimal time for genetic testing was immediately after diagnosis [16].

While our findings contrast with previous studies of health professionals, the findings presented here are recent (corresponding to introduction of targeted therapy in clinical trials) and do concur with studies exploring patients' attitudes towards genetic testing. Studies on patient attitudes indicate that women want to undergo genetic testing soon after diagnosis and feel that it is highly relevant to their surgical decision-making [14, 19, 22]. For example, in a qualitative study undertaken in Australia, 17 out of 26 women under the age of 50 who had been diagnosed with breast cancer requested genetic testing to be offered at or soon after their breast cancer diagnosis [19].

### **Strengths and limitations**

This study is the first study to examine the experiences and attitudes of a larger sample of oncology health professionals in relation to providing TFGT to women newly diagnosed with breast cancer. One of the strengths of the study is that it included three different groups of oncology health professionals and compared their views. The limitations of the present study include the relatively small sample size and the opt-in design of the survey, which may have generated response bias. In particular, it is possible that health professionals with more favorable attitudes to TFGT may have been more likely to have opted into the study. This cannot be confirmed or discounted due to the anonymous nature

of the survey. The present study was limited to a relatively small group of oncology health professionals in Australia and New Zealand, and no genetics professionals were surveyed as part of this study. Therefore future studies with a larger sample size that includes genetics professionals should be conducted in other countries.

### **Implications**

Before the widespread implementation of TFGT, several issues need to be addressed. Although our findings suggest a slight preference for the surgeon to make the initial offer of TFGT to the patient, the treatment and management of breast cancer patients requires a multidisciplinary approach. In future, it will be important for surgeons, oncologists, genetics specialists, genetic counselors and breast care nurses to work closely together to ensure the patient receives quality care. Future training programs focusing on teamwork models and guidelines specifying health professionals' roles in regards to TFGT and follow-up management may be of benefit. The type of health professional making the initial offer of TFGT may not matter as long as the information regarding TFGT is presented to the patient at an appropriate time, sufficient information on the purpose and implications of TFGT is provided [12], and that follow up with a genetics team is available in the event a mutation is identified or, in the absence of a mutation, there is a strong family history.

### **Conclusion**

The oncology health professionals who participated in the present study held positive attitudes towards the usefulness and value of TFGT and the impact of knowledge of *BRCA1* and *BRCA2* mutation status on patient decision-making. Breast care nurses were more likely to agree that TFGT was useful for patient care and the treatment and

management of cancer compared to oncologists and surgeons. There was a slight preference towards surgeons as the best health professional to make the initial offer of TFGT to the patient, and almost 60% of professionals felt TFGT should be offered shortly after diagnosis when the treatment plan is discussed. While this study focused specifically on *BRCA1* and *BRCA2* genetic testing, it is the package of genetic assessment with or without genetic testing that will need to be available if the potential for a genetic predisposition is to be integrated into acute breast cancer management; only a small fraction of the breast cancer predisposition genes have been discovered to date and additional factors, such as family history, can indicate the possibility of another genetic etiology. This will not need to be a full classical genetic assessment for every woman with a new diagnosis of breast cancer, but will require a professional experienced in genetics assessment (a genetics or oncology professional) to be part of the multidisciplinary team. Before treatment-focused genetic assessment with or without genetic testing is implemented into routine breast cancer care, it will be important to develop strategies regarding the timing and the role of oncology health professionals in offering such assessment to patients and the long-term management of patients and their families found to be at risk.

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**Table 1. Sociodemographic professional characteristics of participating surgeons, oncologists and breast care nurses**

	<b>Surgeons (N=40)</b>		<b>Oncologists (N=46)</b>		<b>Breast care nurses (N=63)</b>	
	N	%	N	%	N	%
<b>Sex</b>						
Male	23	57.5	26	56.5	0	0.0
Female	17	42.5	20	43.5	63	100.0
<b>Age</b>						
18-29	0	0.0	2	4.3	0	0.0
30-39	9	22.5	22	47.8	10	15.9
40-49	15	37.5	11	23.9	23	36.5
50-59	10	25.0	8	17.4	29	46.0
60+	6	15.0	3	6.5	1	1.6
<b>What is your primary area of practice?</b>						
Breast cancer	32	80.0	10	21.7	47	74.6
Ovarian cancer	0	0.0	2	4.3	0	0.0
All cancers	5	12.5	30	65.2	9	14.3
Other	3	7.5	4	8.7	7	11.1
<b>Where do you spend the majority of your professional time?</b>						
Public hospital	26	65.0	33	71.7	37	58.7
Community clinic	0	0.0	0	0.0	7	11.1
Academic Setting	0	0.0	1	2.2	0	0.0
Private Practice	13	32.5	9	19.6	6	9.5
Other	1	2.5	3	6.5	13	20.6
<b>How long have you been practicing in your current field?</b>						
0-5 years	11	27.5	20	43.5	20	31.7
6-10 years	6	15.0	6	13.0	21	33.3
11-20 years	14	35.0	12	26.1	14	22.2
20+ years	9	22.5	8	17.4	8	12.7
<b>How long ago was your most recent training in cancer genetics if any?</b>						
Within the last 2 years	11	27.5	12	26.1	16	25.4
3-5 years ago	3	7.5	6	13.0	11	17.5
6-10 years ago	3	7.5	4	8.7	2	3.2
11-20years ago	5	12.5	3	6.5	5	7.9
More than 20 years ago	3	7.5	2	4.3	1	1.6
No cancer genetics training	15	37.5	19	41.3	28	44.4

**Table 2. Surgeons', oncologists' and breast care nurses' views on the best health professional to offer TFGT to the patient**

	<b>Best health professional to offer TFGT</b>				
<b>Professional group responding*</b>	Surgeon N (%)	Oncologist N (%)	Breast care nurse N (%)	Genetic counselor /Genetics specialist N (%)	Total
Oncologists	10 (31.2)	11 (34.4)	0	11 (34.4)	32 (100.0)
Surgeons	24 (66.7)	3 (8.3)	0	9 (25.0)	36 (100.0)
Breast care Nurses	23 (43.4)	7 (13.2)	4 (7.5)	19 (35.8)	53 (100.0)
Total	57 (47.1)	21 (17.4)	4 (3.3)	39 (32.2)	121 (100.0)

\* Twenty-eight participant responses are not shown in this table as they selected more than one health professional.

## Appendix (for inclusion in online supplementary material)

### A: Demographic of respondents

1. Do you work in a clinical setting?
  - Yes
  - No
  
2. What is your gender?
  - Male
  - Female
  
3. What is your age
  - 18-29
  - 30-39
  - 40-49
  - 50-59
  - 60 +
  
4. What is your professional background?
  - Medical Oncologist
  - Radiation Oncologist
  - Surgeon
  - Breast care nurse
  - Genetic counsellor
  - Clinical geneticist
  - Other (please specify \_\_\_\_\_)
  
5. What is your primary area of practice?
  - Breast cancer
  - Ovarian cancer
  - All cancers
  - Other (please specify \_\_\_\_\_)
  
6. How do you predominantly spend your professional time?
  - In a public hospital
  - Community clinic
  - Academic
  - Private practice
  - Other (please specify \_\_\_\_\_)



Please tick the response which best describes the location of your primary area of practice:

<sub>1</sub> Urban

<sub>2</sub> Rural

<sub>3</sub> Both

7. Did you receive your training in Australia?

Yes

No (please name the country in which you received training)

8. How long have you been practicing in your current field?

0-5 years

6-10 years

11-20 years

more than 20 years

9. How long ago was your most recent training in cancer genetics if any?

Within the last 2 years

3-5 years ago

6-10 years ago

11-20 years ago

more than 20 years ago

no cancer genetics training

10. How many new patients with breast cancer do you see each year?

0-20

21-40

41-60

more than 60

11. How many new patients who are younger women (below age 50) with early breast cancer do you see each year?

None

Less than 5

Between 6 and 10

Between 11 and 20

Between 21 and 30

More than 30

General attitudes, perceived usefulness and acceptability of TFGT:

12. In your opinion, an increased level of genetic knowledge about BRCA1 and BRCA2 mutation status will lead to improvements in the following areas:

a) Psychological and behavioural impact on patient

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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b) Diagnostic clarification for patients

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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c) Risk clarification

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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d) Targeting of resources to at risk patients

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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e) Discovery of new and improved treatment options

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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13. The following statements ask you to rate whether you agree that the TFGT has an impact on treatment decision-making in women newly diagnosed with breast cancer. Please rate each item according to whether you strongly agree, agree, disagree, or strongly disagree or whether it is not applicable. (Please answer all items).

Would you say that the provision of treatment-focused genetic testing:

	Strongly agree	Agree somewhat	Disagree somewhat	Strongly disagree	Not applicable
Impacts on treatment decision-making	<input type="checkbox"/> <sup>5</sup>	<input type="checkbox"/> <sup>4</sup>	<input type="checkbox"/> <sup>3</sup>	<input type="checkbox"/> <sup>2</sup>	<input type="checkbox"/> <sup>1</sup>
Impacts on uptake of bilateral mastectomy	<input type="checkbox"/> <sup>5</sup>	<input type="checkbox"/> <sup>4</sup>	<input type="checkbox"/> <sup>3</sup>	<input type="checkbox"/> <sup>2</sup>	<input type="checkbox"/> <sup>1</sup>

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Impacts on uptake of risk-reducing salpingo-oophorectomy

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<sup>5</sup>

<sup>4</sup>

<sup>3</sup>

<sup>2</sup>

<sup>1</sup>

14. How valuable do you believe TFGT is for the treatment and management of cancer?

<sup>1</sup> Not at all

<sup>2</sup> A little

<sup>3</sup> Somewhat

<sup>4</sup> Moderately

<sup>5</sup> Very

15. Overall, how clinically useful do you believe TFGT is for patient care?

<sup>1</sup> Not at all useful

<sup>2</sup> A little useful

<sup>3</sup> Somewhat useful

<sup>4</sup> Moderately useful

<sup>5</sup> Very useful

16. Please indicate our agreement with the following statement. TFGT will become an integral part of health care in the future.

<sup>1</sup> Strongly disagree

<sup>2</sup> Disagree

<sup>3</sup> Neutral

<sup>4</sup> Agree

<sup>5</sup> Strongly agree

17. Please indicate our agreement with the following statement. TFGT will improve the treatment recommendations and cure rates for breast and/or ovarian cancer patients within the next decade?

<sup>1</sup> Strongly disagree

<sup>2</sup> Disagree

<sup>3</sup> Neutral

<sup>4</sup> Agree

<sup>5</sup> Strongly agree

18. If TFGT is integrated into standard care, who do you think is the best health professional to offer TFGT to the patient (i.e. to make the initial offer)?

- <sup>1</sup> Surgeon
- <sup>2</sup> Medical oncologist
- <sup>3</sup> Radiation oncologist
- <sup>4</sup> Breast care nurse
- <sup>5</sup> Genetic counsellor or genetics specialist
- <sup>6</sup> Other (please specify) \_\_\_\_\_

19. When is the best time for the initial offer of TFGT to be made to the patient (tick one option only)?

- <sup>1</sup> At diagnosis, when diagnosis is confirmed
- <sup>2</sup> Shortly after diagnosis when treatment plan is discussed
- <sup>3</sup> After treatment finishes
- <sup>4</sup> Other \_\_\_\_\_

## **Future perspective**

- In the future, given the rapidly decreasing costs of genetic testing, it is likely that genetic testing after a new diagnosis of breast cancer (treatment-focused genetic testing, TFGT) may be offered routinely to women at increased risk of carrying mutations in breast cancer predisposition genes.
- Given this anticipated increase in availability of TFGT, the need to provide counselling and testing to many patients with breast cancer will undoubtedly increase the burden on familial cancer services.
- It is highly likely that in the future non-genetics trained health professionals, including surgeons, will be increasingly become involved in offering genetic testing to women with breast cancer.

## **Executive summary**

- Currently most women who have breast cancer and a strong family history of breast cancer are referred to genetics services after completion of their adjuvant treatment.
- However, genetic testing offered to women shortly after a new diagnosis of breast cancer can assist the patient and her treating clinician to decide on an appropriate management plan for both the presenting cancer and future cancer prevention.
- This survey assessed the attitudes of 149 oncology health professionals (oncology nurses, oncologists and surgeons) towards TFGT for women newly diagnosed with breast cancer.

- The vast majority of the oncology health professionals surveyed believed that TFGT was useful for patient care and valuable for the treatment and management of breast cancer.

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