Systematic review of the empirical investigation of resources to support decision-making regarding BRCA1 and BRCA2 genetic testing in women with breast cancer

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Systematic review of the empirical investigation of resources to support decision-making regarding BRCA1 and BRCA2 genetic testing in women with breast cancer

Short title: Review of resources to support decisions regarding BRCA1 and BRCA2 genetic testing

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3.

Highlights

- Few resources available to support genetic testing decision-making in breast cancer
- Resources to support decision-making for BRCA testing are endorsed by patients
- Existing tools increase knowledge/understanding of hereditary breast cancer
- New tools should include functionalities to support the decision-making process

Abstract

Objective: Identify existing resources developed and/or evaluated empirically in the published literature designed to support women with breast cancer making decisions regarding genetic testing for BRCA1/2 mutations.

Methods: Systematic review of seven electronic databases. Studies were included if they described or evaluated resources that were designed to support women with breast cancer in making a decision to have genetic counselling or testing for familial breast cancer. Outcome and process evaluations, using any type of study design, as well as articles reporting the development of decision aids, were eligible for inclusion.

Results: Total of 8 publications, describing 6 resources were identified. Resources were effective at increasing knowledge or understanding of hereditary breast cancer. Satisfaction with resources was high. There was no evidence that any resource increased distress, worry or decisional conflict. Few
resources included active functionalities for example, values-based exercises, to support decision-making.

Conclusion: Tailored resources supporting decision-making may be helpful and valued by patients and increase knowledge of hereditary breast cancer, without causing additional distress.

Practice implications: Clinicians should provide supportive written information to patients where it is available. However, there is a need for robustly developed decision tools to support decision-making around genetic testing in women with breast cancer.

Keywords:
BRCA1; BRCA2; breast cancer; decision aid; decision support; treatment-focused genetic testing

1. Introduction

Traditionally, genetic testing for women diagnosed with breast cancer has been offered within specialist services. The focus of provision has been on those with a family history and usually after completion of active treatment. Several factors are influencing the increasing number and nature of referrals for genetic testing. Technological advances mean testing is becoming cheaper and faster. It is also recognised that a substantial proportion of women with no family history of breast cancer, but who have other increased-risk features (including younger age at breast cancer diagnosis, certain ethnicities, tumour characteristics) may carry a BRCA1 or BRCA2 (hereafter BRCA1/2) mutation. This has resulted in changes to the threshold for referral to genetic services [1]. Additionally, while considerable international variation exists, testing for germline mutations at the time of cancer diagnosis to inform treatment decisions (treatment-focused genetic testing - TFGT) is becoming more common. Knowledge of BRCA mutation status is increasingly used or requested to support decision-making between breast conserving surgery versus mastectomy and/or...
contralateral mastectomy. The advantages and disadvantages of combining treatment of the primary cancer with that of future risk of the developing a second new primary can then be considered.

There is also evidence of increased public awareness of inherited predisposition to breast cancer and more referrals for genetic counselling following wide media coverage of preventative surgeries of actress Angelina Jolie (BRCA1 positive and with a family history of breast and ovarian cancer) [2, 3]. Finally, the advent of targeted drug therapies [4] means more breast cancer specialists are recommending genetic testing to their patients to inform the choice of chemotherapy regimens and inclusion in clinical trials.

The result is a trend towards ‘mainstreaming’ of genetic testing; with the ambition of offering testing for BRCA1/2 as part of routine patient care for young women diagnosed with breast cancer. It is therefore imperative that women are supported to make an informed choice about genetic testing given the likely short timeframes following diagnosis [5]. Women diagnosed at a younger age (≤50 years) represent a group for whom treatment decisions can be particularly complex; for example, they may consider risk-reducing surgery in the context of concerns about adverse impacts on fertility, sexual functioning, body image and self-esteem [6]. In a busy oncology clinic, the time and knowledge base to adequately inform women about the pros and cons of genetic testing is often limited.

Empirically evaluated decision support interventions (or decision aids) have been found to increase knowledge and result in patients feeling better informed and with clarity as to clearer about what matters most to them when making medical treatment and screening choices [7]. Decision aids aim to supplement clinical consultations and help patients make considered choices. They clearly state the decision to be made and the options available with associated benefits and harms. They also include components that allow patients to recognise their values associated with the decision being...
This is different to educational materials that describe the health condition and options but do not attempt to support patient contributions to the decision-making process [7]. Similar resources have been developed for women with breast cancer choosing between breast conserving surgery and mastectomy [9] and women at high-risk of developing breast and/or ovarian cancer making decisions about genetic testing [10]. Decision support tools could be particularly valuable in the context of decision-making for TFGT, where there is increased pressure to compress specialist genetic counselling into the timeframe required for the treatment of the primary cancer.

This systematic review therefore aimed to identify existing resources developed and/or evaluated empirically in the published literature designed to support women’s decision-making regarding genetic testing for BRCA1/2 mutations. This was the first phase of a study, which set out to develop such a decision support tool for young women recently diagnosed with breast cancer. This is in line with the Medical Research Council guidelines for developing and evaluating complex interventions, which recommends identification of the relevant existing evidence base, ideally by way of a systematic review as a first stage of intervention development [11]. The objectives of the review are threefold: to characterise published resources, assess their acceptability and evaluate their impact. As well as informing intervention development, this evidence synthesis will serve to generate new research questions in line with clinical priorities and make practice recommendations on the basis of current evidence.

2. Methods

2.1 Literature searching: The following bibliographic databases were searched: MEDLINE, MEDLINE In-Process and other non-indexed citations, Embase, Web of Science (Conference Proceedings Citations Index) and Science Citation Index Expanded, Cochrane Library, PsychInfo, and Delphis University of Southampton Resource Search. Databases were searched from 1990 (to capture early studies to identify BRCA1/2 in women with a family history) to February 2015. The exception was Web of Science CPCI, which was used to identify recent conference abstracts which may not have resulted yet in manuscript publications. Searches in this database were conducted from 2013 to February 2015. No language restrictions were applied to the searches. Other potentially relevant references were also identified by examining the bibliographies of the studies included in the review. One additional reference (reporting in full a study detailed in a conference abstract found through the other searches) was identified by one of the co-authors (BM) and included in the review. See supplementary appendix 1 for Medline search strategy.

2.2 Study selection: The eligibility criteria for study inclusion were; studies including women who had a personal diagnosis of breast cancer or studies including women with and without a personal diagnosis of breast cancer provided results were given separately for participants diagnosed with breast cancer on at least one outcome of interest to the review. The inclusion criteria are detailed in Table 1. In brief, studies were included if they described or evaluated resources that were designed to support women in making a decision to have genetic counselling or testing for familial breast cancer. Outcome and process evaluations, using any type of study design, as well as articles reporting the development of decision aids, were eligible for inclusion.

Study selection followed a two-stage process. First, one of five reviewers (KP, JS, CG, A R-S, CF), assessed the title and abstracts of all the references identified in the searches for potential eligibility for inclusion in the review. Second, full texts were obtained of publications identified to be potentially relevant and these were screened by one of five reviewers (KP, JS, CG, A R-S, CF) against
the inclusion criteria. Publications where inclusion was uncertain were considered by a second reviewer and discussion took place until consensus was reached. Of the non-English language publications identified, full text references were retrieved for Dutch, Spanish and German studies as individuals within the research team were able to translate these. One Polish study was not retrieved as translation was not available.

2.3 Data extraction and quality assessment: Data extraction from each study was carried out using a piloted and standardised form (see supplementary appendix 2) by one of three reviewers (KP, CG, ES). A fourth reviewer performed a second, independent data extraction of all papers (A R-S). Data were extracted about the study aims, design and methodology, the country and setting, the participant inclusion criteria and participants' baseline characteristics. We also extracted detailed information about the intervention (including information about any theoretical models underpinning decision aid interventions), outcome measures, full results for all outcomes assessed, and study limitations.

Four reviewers critically appraised each study independently (KP, ES, CG, A R-S). To appraise publications describing outcome evaluations, we used a modified version of a tool by Reisch, Tyson & Mize (1989) [14] that was used in a previous related systematic review [6] and based on the work of Deeks et al. (2003) [15]. The tool includes 32 questions asking reviewers to assess aspects of the study’s methodology and reporting, such as if aims are clearly stated, if the randomisation method was appropriate (for randomised controlled trials), if the participants were likely to be representative of the population and reporting of dropouts. Based on the responses, an overall global rating of the quality of the study (strong, moderate or weak) was calculated. The calculation of the global rating was carried out independently by two reviewers (CG, A R-S) for each study as a quality assurance measure.
Process evaluations were critically appraised using quality assessment criteria for process evaluations [16]. Reviewers (KP, ES, CG, A R-S) judged the extent to which steps were taken in the study to reduce bias, how grounded the findings were in the data and breadth and depth of findings. Reviewers then provided a weighting of a) the reliability of the study findings (low, medium or high) and b) the usefulness of the study findings (low, medium or high). If a study included both outcome and process evaluations, both quality assessment tools were applied to the study.

2.4 Data synthesis: The findings were narratively synthesised and tabulated, describing the study design, resource developed/evaluated, target population and outcomes (where appropriate). It was not possible to conduct meta-analysis for any outcomes due to the heterogeneity of the included studies.

In line with the aims of this review, three broad areas of information from the studies were of interest and structured the synthesis:

1. Description of the format and components of the resources.

2. Assessment of the impact of using the resources on the decision-making process. Elwyn et al. (2012) [17] developed a model for shared decision-making in clinical practice which is divided into 3 steps; a. Introducing choice (patients are made aware of the options that are available); b. Describing options (knowledge is checked and additional educational materials may be used) c. Decision talk (with an emphasis of personal preferences and values). Therefore outcomes relevant to these categories were captured, as well as outcomes measured after a decided action was taken, i.e. psychological morbidity and decisional conflict.

3. Evaluation of acceptability of the resources.

3. Results
Figure 1 shows the flow of studies in this review. A total of 3,598 publications were identified (after removal of duplications). On inspection of titles and abstracts, 3,434 publications were excluded, and 2 full texts were unobtainable. Full texts were examined for 162 articles and 9 met the criteria for final inclusion [18-25]. Rahman et al. (2012) [21] was a conference abstract detailing a study reported in full in Quinn et al. (2017) [26]. The 9 references identified described 6 different resources. Two publications describe development and testing of a resource, five describe the evaluation of a resource and two describe the development of a resource and process evaluation (see Table 2). The majority of studies were conducted in the United States, followed by Australia and the Netherlands.

3.1 Quality of studies: Of the studies that included a process evaluation, Meiser et al. (2012) [18], Permuth-Wey et al. (2010) [20] and Vadaparampil et al. (2014) [24] were rated as ‘medium’ and Quinn et al. (2017) [26] as strong for reliability and usefulness of findings. The main limitations of these studies were lack of transparency of participant selection processes [18], recruitment of an atypical population for part of the study, i.e. delegates at a conference [24], and limited breadth and depth of qualitative data [20]. Thompson et al. (2004) [23] was rated as ‘low’ for usefulness of findings and reliability of findings due to an unrepresentative sample, the use of rapid focus groups and no audio recording of transcriptions of the focus groups.

Four of the studies reporting an outcome evaluation were rated as ‘moderate’. Key weaknesses include descriptions of samples and response rates [18, 19, 21, 25] and a lack of validated outcome measures [18, 19]. Furthermore there was no evidence of checks of intervention fidelity in Venne & Hamann’s (2007) [25] study. Sie et al. (2014) [22] was rated as strong in terms of quality.

3.2 Target population:

3.3 Characteristics of resources

Purpose:
The purpose of the resources differed (see Table 2). Meiser et al.’s (2012) [18] pamphlet aimed to prepare women for decision-making around TFGT and was subsequently tested in a randomised controlled trial where its efficacy as an alternative to standard pre-test genetic counselling was evaluated (see Watts et al., (2012) [28] for trial protocol and Quinn et al. (2017) [26] for evaluation). Permuth-Wey’s culturally tailored visual aid, the impact of which was evaluated by Pal et al. (2010) [27], sought to provide a printed educational resource to supplement phone-based genetic counselling. It was designed specifically for the African-American community with the aim of increasing hereditary breast cancer knowledge; however, the materials themselves were not evaluated. Venne & Hamann’s (2007) [25] peer-delivered educational model’s primary focus was to impact on cancer genetics knowledge and interest in genetic testing. Thompson et al. (2004) [23] sought to increase the readability of an existing paper-based resource describing genetic risk for breast cancer and designed to be used alongside genetic counselling. In contrast, Vadaparampil et al. (2014) [24] set out to develop and evaluate the acceptability of a written booklet designed to
increase uptake of *BRCA1/2* genetic counselling in high-risk breast cancer survivors, which will be tested in a pilot randomised controlled trial.

3.3.1 *Conceptual/theoretical framework:*

Use of a conceptual or theoretical framework to develop resources to support decision-making can help inform the components of that resource and identify how the resource impacts on outcomes, such as knowledge and decision-making capacity [29]. Previous reviews of decision support resources report a lack of reference to the use of theoretical frameworks [30, 31]. This observation is confirmed in the current review, with only one paper explicitly identifying a theory or conceptual framework guiding resource development [24], in this case the Health Belief Model [32].

3.3.2 *Format and content of the resources:*

Of the resources identified, three were paper-based only [18, 23, 24]. One publication described an educational resource delivered face-to-face by peers [25]. Sie et al. (2014) [22] developed a novel, multimodal intervention for delivering genetic counselling through telephone consultation, written and web-based information (hereafter referred to as home-based genetic testing). This was compared with standard face-to-face counselling (hereafter referred to as face-to-face genetic counselling). The content of both delivery modes are based on standard genetic counselling, but the home-based genetic counselling group received telephone call(s) and visited a website which hosted an educational movie. The clinician who delivered the telephone counselling was also available for questions via telephone or email. In another study using telephone-delivered genetic counselling, Pal and colleagues (2015) [19] evaluated telephone-based counselling supplemented with a culturally tailored visual aid. Only one study provided access to the resource in question to enable review of specific content (Quinn et al. (2017) [26]). However, all studies describe the provision of educational content around genetic testing and/or counselling and hereditary breast cancer,
including for example, how genetic testing is performed, explanations of genetic inheritance and cancer risk based on mutation status.

In relation to the 3-step model of deliberation in shared decision-making by Elwyn and colleagues outlined earlier, all identified resources included information relevant to the stages of a) introducing choice and b) describing the options, i.e. knowledge based exercises. However, there was little evidence of ‘decision talk’ where the emphasis is on personal preferences and values, that is, deciding what matters most to the individual [17].

3.4 Impact of resources

The impact of resources is summarised in Table 2. Data is provided on outcomes relevant to the deliberation process of decision-making (i.e. knowledge) and the psychosocial impact of using the resource. A narrative synthesis is presented below.

3.4.1 Knowledge/understanding:

The primary outcome(s) of interest among the five studies describing an evaluation of a resource varied, but all reported positive impact on knowledge/understanding of hereditary cancer, though methods of measuring this construct varied. Perceived understanding of TFGT and importance of genetic testing was assessed following pilot testing of Meiser et al.’s (2012) [18] short educational pamphlet for young women close to the point of diagnosis. Fifteen of 17 participants reported improved understanding and recount TFGT as important for their situation. Similarly, Venne & Hamann (2007) [25] described knowledge and interest in genetic testing after receipt of the Reach for Recovery peer-delivered educational module in a randomised controlled trial. This compared those receiving the intervention to a control group receiving other Reach for Recovery modules, including one on exercise and nutrition after breast cancer. Knowledge change scores were statistically significantly higher among the intervention group compared with controls one month
after study end. However, gains were seen in both groups, and there were no differences in interest in genetic testing between the two groups at follow-up. Participants in Sie et al.’s (2014) [22] study self-evaluated their knowledge after the intervention as ‘good’, though results are not presented separately by group (i.e. home-based vs face-to-face genetic counselling). In the pre-post evaluation of Pal and colleagues’ (2015) [19] culturally tailored visual 73% of the 37 participants reported an increase in knowledge of genetic testing and its implications for treatment and future management of breast cancer risk.

3.4.2 Distress/worry:

Four studies measured the constructs of distress and worry. In Venne et al.’s (2007) [25] study three items were adapted from the intrusion subscale of the Impact of Events Scale to measure cancer specific intrusive thoughts following the peer-delivered educational module [25]. The authors reported similar levels of worrying/concerning thoughts between those who did and did not receive the intervention at baseline, but did not provide follow-up scores. In the non-randomised preference trial of home-based genetic versus face-to-face genetic counselling, change in cancer worry, hereditary cancer-specific and general distress were reported [22]. Global distress as measured by the GHQ (General Health Questionnaire) and heredity-specific distress did not change over time in either group. The majority (13 of 17) reported being ‘not at all’ worried/concerned. Test-related distress was also measured in the noninferiority randomised controlled trial comparing the brief information pamphlet with standard pre-test genetic counselling. The authors report no difference in levels of distress between groups 2 weeks or 12 months after receiving genetic testing results [26].

3.4.3 Interest in/uptake of genetic counselling:

Interest in and/or uptake of genetic counselling and testing was assessed in 2 studies. Sie et al. (2014) [22] report that fewer of those in the group who received standard face-to-face counselling
went on to be tested for BRCA1/2 mutations than those in the home-based group. However, the authors report differences were due to fewer participants meeting the selection criteria for genetic testing. Venne & Hamann (2007) [25] measured participants’ interest in having genetic testing on a one-item scale. At follow-up (one month after study end) there were no significant group differences in interest in receiving genetic testing.

3.4.3 Decisional conflict:
Decisional conflict about TFGT was the primary outcome in Quinn et al.’s (2017) [26] noninferiority randomised controlled trial. The authors conclude that when controlling for baseline levels there was no statistically significant difference between the groups, suggesting equipoise between the two methods of information delivery.

3.5 Evaluation of acceptability of resources
Meiser et al. (2012) [18] interviewed women and investigated their satisfaction with the pamphlet. The overall evaluation was positive with most women reporting high satisfaction and stating it would have been helpful at the time of diagnosis; however, women reported they would have liked more detail regarding the implications of TFGT, surgical options and information about the timing of TFGT. Some confusion also arose regarding the explanation of possible results of genetic testing. Women also approved of the question-answer format of the pamphlet.

Sie et al. (2014) [22] also reviewed participants’ satisfaction with the home-based genetic counselling and evaluated reasons for choosing this over face-to-face genetic counselling. Most women cited a practical rationale for choosing home-based counselling, e.g. no need for an appointment, travel, and some felt they already had sufficient information. Those who chose face-to-face counselling, valued the personal interaction and the opportunity to ask questions.
Phase 3 of Vadaparampil et al.'s (2014) [24] paper describes the learner verification evaluation of their written resource, assessing attraction, comprehension, cultural acceptability and persuasion. It was found to be easy to read, but some sections were felt to be too long. Use of an illustration of family pedigree was thought to be helpful. Participants also requested more information around the coverage of health insurance for genetic counselling/testing.

Permuth-Wey et al.'s (2010) [20] culturally tailored genetic counselling booklet for young African American women was also well received. Its clarity, colour scheme and layout were appreciated. Reference to particular terminologies were made, for example, “runs in the family” was preferred to “inherited” or “hereditary”. Participants also made suggestions on the use of photographs, e.g. including a mother and daughter and adapting images to reflect the diversity of Black women. Similarly to Vadaparampil et al. (2014) [24], inclusion of a family tree diagram was positively appraised and women valued the inclusion of vignettes.

Finally, Thompson et al.'s (2004) [23] written resource was adapted to increase its readability and successfully reduced the reading age of the brochure. Despite this, adults with low literacy still struggled with the comprehension of some of the contents and found some images describing genetic dominance and dominant inheritance confusing.

4. **Discussion**

4.1 **Discussion**

This systematic review set out to identify resources in the published literature designed to support decision-making around genetic testing for *BRCA1/2* mutations. The format, content and purpose varied across studies, though all studies included some paper-based information. All publications that provided an evaluation of the resource describe gains in knowledge or understanding of hereditary breast cancer.
No publications described negative impact on distress, anxiety or decisional conflict as a result of their use. However, it should be noted that all studies were relatively small (ranging from <10 participants to 161) and often used unvalidated outcome measures therefore the results of the studies as a whole are subject to some uncertainty. With relatively few women testing positive for BRCA1/2, larger studies are required to determine the impact of resources on this group.

Satisfaction with the resources was generally high, suggesting that the resources were considered acceptable by the women who used them. All studies included written materials, and this format was well received. Women valued the avoidance of jargonistic language and use of acronyms, question/answer format and bullet points were evaluated positively. Inclusion of vignettes and pictures/photographs to which the women could relate were also popular, as well as bright colours and a professional appearance to the resource. Resources that are tailored to the specific needs of the population (e.g. culturally specific) were also well appreciated.

There is a lack of theoretical or conceptual underpinning of the resources identified making it difficult to ascertain why/how an intervention had an impact on outcomes. This finding is consistent with other reviews of decision support interventions [30]. Elwyn and colleagues sought to address this ‘theory-practice’ gap by considering a number of decision-making theories and examining how they might inform the design and evaluation of decision support interventions [33]. They conclude that none of the existing theories are able to address all the necessary components of a decision support intervention, and most notably they focus on the cognitive aspects of how a person comes to a decision, rather than how to support the decision-making process. While work is required to address this, theories that focus on cognitive aspects of decision-making, for example Expected Utility Theory [34] and Fuzzy Trace Theory [35], still have utility within the design of decision support interventions.
The majority of resources identified were designed [26] to be adjunct information to accompany or precede genetic counselling, primarily focused on enhancing knowledge of hereditary breast cancer and BRCA1/2 testing. Exceptions include the study by Sie and colleagues, who evaluated an alternative model to standard, face-to-face genetic counselling, as did Quinn et al. (2017) [26] who suggest their brief written pamphlet could be used as a cost-effective alternative to traditional pre-test face-to-face genetic counselling.

The primarily educational resources described in this review are valuable in providing information about genetic testing and the options available to women. Two resources also explicitly state the inclusion of a list of pros and cons to genetic testing [23, 27]. However, these only go part way to supporting decision-making as to whether or not to have a genetic test. Decision support interventions (such as decision aids) provide information to patients, but they also help to clarify patients' values by evaluating the treatment outcomes and/or health decisions that matter most to them [36] and incorporate ‘deliberation’ components allowing users to thoughtfully consider their choices [37]. By communicating risk, providing exercises that support ‘value classification’, and guidance on how to come to a decision, decision aids may improve understanding, reduce uncertainty, and lead to greater satisfaction with treatment decisions [38]. Such facets were lacking in the resources included in this systematic review, evidenced by the lack of outcomes relating to the ‘decision talk’ element of Elwyn et al.’s (2012) [17] model of shared decision-making.

Limitations: Interpretation of the findings of this review must take into account the methodological weaknesses in the included studies. Most of the studies lacked a control or comparison groups, and often used unvalidated outcome measures, thus few studies robustly evaluated the efficacy of the resource. Furthermore, the sample sizes of the included studies were mostly small. Therefore only a small proportion of women will be identified as having a high-risk genotype, where adverse
outcomes are most likely to be observed. Only empirical papers published in academic literature were included in this review. Other resources are available on the internet. However, reviews of internet resources are difficult to reproduce and are rapidly outdated. Furthermore, such resources are unregulated, often unevaluated and synthesis of empirical studies provides more robust conclusions.

4.2 Practice implications and research recommendations:
This systematic review reveals that tailored resources to support associated decision-making may be helpful and valued by patients and increase knowledge of hereditary breast cancer, without causing additional distress or anxiety. We therefore suggest clinicians provide supportive written information to patients where it is available. However, provision of such evidence-based resources is limited and is not keeping pace with clinical advances and increase in demand for genetic counselling and testing services. Further international research is clearly warranted particularly given the importance of developing tailored resources, focusing on groups with particular needs including various cultural groups, those with low literacy and younger women. Existing resources also focus primarily on information provision with few supporting decision-making through deliberation or value-based exercises. Development of such decision support interventions, following established guidelines, for example the International Patient Decision Aids Standards [8] and considering an underlining theoretical framework, would provide additional support for the growing number of women making complex decisions at a difficult time. Results from this review will therefore be incorporated into the development of a decision support tool for young, newly diagnosed breast cancer patients in the UK.

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Conflict of interest

The authors declare that there is no conflict of interest.

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Contributions

Claire Foster and Diana Eccles are joint chief investigators of this Breast Cancer Now Funded project, they made substantial contributions to the conception of the systematic review design, critically revising the article and approved the final version for submission, CF also contributed to title screening.

Chloe Grimmett contributed to the conception of the systematic review, study selection, data extraction and synthesis, interpretation of the data, drafted the article and approved the final version.

Karen Pickett contributed to study selection, data extraction synthesis, interpretation of the data, critically revised the article and approved the final version.

Jonathan Shepard contributed to review design, study selection, data extraction synthesis, interpretation of the data, critically revised the article and approved the final version.

Alexandra Recio-Saucedo study selection, data extraction and synthesis, interpretation of the data, critically revised the article and approved the final version.

Karen Welch contributed to study design, developing the search strategy, critically revised the article and approved the final version.
Elke Streit contributed to data extraction and quality assessment, critically revised the article and approved the final version.

Helen Seers contributed to the conception of the systematic review critically revised the article and approved the final version.

Anne Armstrong contributed to the conception of the systematic review critically, revised the article and approved the final version.

Ramsey Cutress contributed to the conception of the systematic review critically, revised the article and approved the final version.

Gareth Evans contributed to the conception of the systematic review critically, revised the article and approved the final version.

Ellen Copson contributed to the conception of the systematic review critically, revised the article and approved the final version.

Bettina Meiser contributed to the conception of the systematic review critically, revised the article and approved the final version.

REFERENCES


randomized controlled trial of two models of delivering education about treatment-focused genetic testing to younger women newly diagnosed with breast cancer, BMC Cancer, 12 (2012) 320.


[34] J. von Neumann, Morgenstern, O., Theory of Games and Economic Behaviour, University Press, Place Published, 1944.


Figure 1: Flowchart showing the flow of studies through the systematic review. *Specified outcomes were knowledge of the test and its implications, attitudes towards testing, testing uptake, decision conflict, satisfaction/comfort with decision made, psychological outcomes and treatment plan changes.
References identified from reference lists of included studies  
\( n = 2 \)

Titles and abstracts inspected  
\( n = 3597 \)

Excluded  
\( n = 3434 \)

Full text unobtainable  
\( n = 2 \)

Full text references retrieved and screened  
\( n = 162 \)

Full papers excluded,  
\( n = 153 \),  
for the following main reasons:
- Not a study of women diagnosed with breast cancer, or was a study including both diagnosed and unaffected women without a subgroup analysis of women diagnosed with breast cancer (\( n = 98 \))
- Did not evaluate a decision making resource, or study evaluated genetic counselling alone (\( n = 26 \))
- Not an outcome or process evaluation, or did not describe the development of a resource (\( n = 16 \))
- Did not measure any of the specified outcomes\(^4\) (\( n = 6 \))
- Unclear if met criteria due to insufficient information (\( n = 5 \))
- Paper retracted (\( n = 1 \))
- Non-English item in a language for which we did not have translation resources (\( n = 1 \))

Publications included in our review  
\( n = 9 \)

(5 reported an evaluation of a resource, 2 described the development of a resource, and 2 references each described the development and evaluation of the same resource, respectively)
Table 1: Study inclusion criteria

| Population | Women diagnosed with breast cancer, with no restrictions on treatment status or family history of breast cancer. Studies including both women with and without a prior diagnosis of breast cancer were also eligible, as long as results were provided separately for participants with a diagnosis of breast cancer on at least one outcome of interest to the review and supporting data were provided |
| Intervention | Resources (including decision aids/decisional support interventions) to support women in making a decision to receive genetic testing for familial risk of breast cancer, including: digital media, video, leaflets/booklets |
| Comparator | (if available) with/without information support. If not available, studies reporting use of resources or other method of information provision |
| Study design | Any outcome evaluation type, process evaluations and references describing the development and/or testing of a resource |
| Outcomes | Knowledge of the test and its implications for treatment and future management; attitudes towards testing; uptake of testing; decision conflict; satisfaction/comfort with decision made; psychological outcomes; and, treatment plan changes |
Table 2: Characteristics and findings of studies included in the review

<table>
<thead>
<tr>
<th>Authors, (year), country</th>
<th>Description of resource</th>
<th>Comparator</th>
<th>Study type</th>
<th>Population</th>
<th>Outcomes/Processes</th>
<th>Main findings</th>
<th>Theoretical underpinning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meiser et al. (2012), Australia</td>
<td>Short educational pamphlet for TFGT</td>
<td>N/A</td>
<td>Development and pilot testing</td>
<td>Development phase: N=26 who had genetic testing (N=14) or diagnosed in last 6-12 months (N=14)</td>
<td>Qualitative analysis of information preferences i. Understanding of TFGT ii. Perception of importance of TFGT iii. Emotional impact of reading resource iv. Satisfaction with resource v. Suggestions for improvement</td>
<td>Purpose of TFGT, chance of carrying gene mutation, factors that increase risk of breast cancer, implications of results, practicalities of blood test, wait time for result, emphasis that family members make independent choice for testing themselves. N=16/17 satisfied/very satisfied with resource. N=15/17 improved their understanding of TFGT. N= 7/17 the pamphlet would be sufficient to inform a decision about TFGT. N= 13/17 report being ‘not at all worried/concerned’ by reading the pamphlet. 4/17 little/somewhat concerned. More detail was required re implications of TFGT, surgical options, and timing of testing, some clarification of language was suggested.</td>
<td>None described</td>
</tr>
<tr>
<td>Venne and Hamann (2007), USA</td>
<td>Development and testing of peer-lead genetics module as part of the</td>
<td>Peer support without genetics module</td>
<td>RCT</td>
<td>N = 113 55.3yrs (13.6) 1-175 months since diagnosis (mean 19 months)</td>
<td>Cancer genetics knowledge Attitudes towards testing Interest in testing</td>
<td>Higher knowledge scores for intervention group. No difference between groups at follow-up for interest in genetic testing.</td>
<td>None described</td>
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<tr>
<td>Reach to Recovery volunteer-led programme</td>
<td>Intrusion subscale of IES</td>
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### Publications describing resource outcome evaluation

| Pal et al. (2010), USA linked with Permuth-Wey et al. (2010) | Culturally tailored visual aid to accompany telephone-based genetic counselling | N/A | Cohort (one group pre + post) | N = 37 Age at diagnosis ≤50yrs, 2-5 yrs post diagnosis | i. Knowledge of hereditary cancer (based on 12 elements of informed choice for genetic testing, from the American Society of Clinical Oncology) ii. Methods perceived as useful in enhancing knowledge | 73% increased knowledge of test and its implications for treatment and future disease management. |

| Order of usefulness of intervention elements; 1) telephone counselling, 2) visual aid, 3) personalised letter. |

| Sie et al. (2014), Netherlands | Home-based genetic counselling (written and digital information) | Face-to-face genetic counselling | Non randomised, preference trial | N = 161 Home-based group: 47 (23-71) yrs at diagnosis, months since diagnosis 6 (0-247) Standard genetic counselling group: 49 (28-74) yrs at diagnosis 6 (0-195) months since diagnosis | Self-evaluated knowledge of hereditary breast cancer Uptake of testing Decisional conflict of undergoing genetic testing Satisfaction with choice QoL GHQ-12 and hereditary specific distress Cancer worry Risk perception of genetic disposition for breast cancer and breast cancer recurrence | Self-evaluated knowledge of hereditary breast cancer was considered to be good in both groups. No difference in QoL, breast cancer worry, or perception of cancer between groups or over time. Baseline distress (general and hereditary-specific) higher in standard genetic counselling group than home-based group, no change over time. 98% of those in standard genetic counselling group report strong/moderate satisfaction with choice, 92% for home-based group. | None described |
| Rahman et al. (2012, Australia) | Short educational pamphlet for TF GT | Standard face-to-face genetic counselling | RCT | Women <50 years at diagnosis for breast cancer and before definitive surgery, N =62 | Decisional conflict around TF GT | Both groups decisional conflict reduced post intervention (i.e. after information provision and before results disclosure), there were no differences between groups | NA |
| Thompson et al. (2004), USA | Enhancing readability of materials describing genetic risk | NA | Revision and evaluation of an existing information resource | Phase 1 N = 7, 44-54 yrs. Time since diagnosis not stated | Phase 1: ‘Rapid’ focus group to provide feedback on images in leaflet (BC survivors) | Despite alterations to reduce the reading level of the resource, adults with low literacy had difficulty with comprehension and found some diagrams confusing. | None described |
| Permuth-Wey et al. (2010), USA | Development of printed educational materials for African American women to supplement telephone-based genetic counselling | NA | Intervention development and process evaluation | N = 11 members of a community advisory group | Qualitative data for feedback on: readability, comprehension, appearance, acceptability, self efficacy | Booklet was well received with good comprehension and visual appeal, vignettes were well received. Suggested revision: pictures to include women of varying ages and body shapes and amendments to family pedigree illustration. | None described |
| Vadaparambil et al. (2014), USA | Psycho-educational intervention - print-based booklet designed to increase uptake of testing | Comparing 2 psychoeducational printed booklets | Intervention development (phase) and review of acceptability (phase 2) and learner verification (phase 3). | Phase 1 N = 58 Personal or family history of BC. Phase 2 N = 10 BC diagnosis, 9 <50 yrs, 61% within 12 months diagnosis | Acceptability, appeal, visual content and format/layout of resources. Appropriateness of communication for the target population (using learner verification). | No significant difference in overall booklet preference. Chosen booklet was well received but perceived as too long by some, some modifications were made after user verification; e.g. deleting information of screening and surveillance measures for BRCA1/2 positive women, included more information on insurance. | Health belief model |

TFGT: Treatment focused genetic testing; HCP: Health care professionals; GHQ-12: General Health Questionnaire