Promoting Testicular Cancer Awareness and Screening: A Systematic Review of Interventions

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Abstract

Background

Testicular cancer (TC) is a relatively curable malignancy that predominantly affects young males. Key decision makers discourage TC screening due to lack of evidence about the benefits of this practice while others argue that men must be aware of normal versus abnormal testicular findings. Despite the debate on TC surveillance, a number of research efforts are still being made to increase men's awareness of TC and its screening.

Objective

To systematically review studies that were conducted to enhance men's knowledge and awareness regarding TC and its screening and increase their TC screening intentions and practices.

Methods

Studies published in English between 2004 and 2014 were reviewed using three e-databases and interventions that were in line with the review aims were selected.

Results

A total of 3076 records were screened for eligibility and 11 studies met the inclusion criteria. The majority of the reviewed interventions successfully enhanced men's awareness of TC and its screening and increased their intentions to perform testicular self-examination. Examples include videos about TC; shower gel sachets, stickers, and posters; a television show;

a university campaign; and high self-efficacy messages about TC screening. Men at risk for health disparities were underrepresented in the reviewed literature.

Conclusions

A number of interesting channels through which men can learn about TC were identified. Example include social media and mass media.

Implications for Practice

Given the controversy that surrounds TC screening, nurses can play a key role in increasing men's awareness of TC rather than advising periodical TC self-examination.

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INTRODUCTION

Cancer remains one of the leading causes of mortality and morbidity worldwide. It is expected that cancer cases will increase from 14 million in the year 2012 to 22 million in 20 years' time.[1] A number of malignancies can be prevented by means of screening; an example is testicular cancer (TC), a rare and relatively curable malignancy that predominantly affects men aged 20 to 34. TC constitutes 0.5% of new cancer cases and is expected to affect 8,430 men in the United States in the year 2015.[2]

Orchiectomy remains the primary treatment modality for TC and is often followed by chemotherapy and/or radiation therapy, depending on the staging of the disease.[3] Given the high curability of TC, survivors are expected to face a number of problems secondary to their illness, its treatment, or both.[4] Although TC survivors' quality of life is comparable to that of healthy males, there is evidence that men who receive aggressive treatment suffer from a number of physical and psychosocial complications.[5] For instance, chemotherapy and radiotherapy are known to cause chronic fatigue, peripheral neuropathy, ototoxicity, Raynaud-like phenomena, and reduction in gonadal function.[5,6] From a psychosocial standpoint, men who receive aggressive treatment for TC are at a high risk for body image disturbance, decreased sexual desire, and impaired sense of masculinity.[4,7] Both, the physical and psychosocial sequelae of TC and its treatment highlight the importance of awareness and early detection of this rather curable malignancy.

Controversy surrounds screening for cancer of the testes in healthy males.[8-10] Key decision makers such as the U.S. Preventive Services Task Force and the National Cancer Institute

discourage TC screening due to lack of evidence about the benefits of this practice and its effect on reducing mortality.[10-12] For instance, the National Cancer Institute believes that TC screening would result in unnecessary diagnostic tests and that screening for TC would not reduce mortality "in part because therapy at each stage is so effective." (n. pag.).[10] Furthermore, the U.S. Preventive Services Task Force issued a statement about the harms of false positive results on the man's wellbeing.[11] Others, however, argue that TC screening should be part of cancer-related medical check-ups and that men must be aware of normal versus pathologic testicular findings and must be encouraged to perform routine testicular self-examination (TSE).[13-16] In the literature on TC, men were found to be unaware of TC and its screening; however, they expressed their willingness to learn about TC and to practice TSE if instructed.[17-22]

Despite the debate on TC surveillance, a number of organizations still fund TC educational programs and TC awareness is still being addressed by clinicians, in colleges, and in the mass media.[23-28] Moreover, research efforts are still being made to explore men's TC awareness, enhance their knowledge of the various aspect of this malignancy, and increase their TC screening practices. Heretofore, to the authors' knowledge, no systematic reviews have been conducted to critically appraise findings from recent studies that aimed at increasing TC awareness and screening. Therefore, the aim of this paper is to systematically review studies that were conducted to enhance men's knowledge and awareness regarding TC and its screening and increase their TC screening intentions and practices. The specific research questions that guided the write-up of this review are as follows: What are the men's (i) knowledge, awareness, and attitude towards TC; (ii) knowledge, awareness, and attitude, towards TC screening; (iii) TC screening intentions; and (iv) TC screening practices?

METHODS

A systematic review is a thorough and rigorous scientific method that pools studies and aggregates their findings under specific aims and research questions. Systematic reviews are widely used to guide research and practice.[29] A number of standardized checklists that guide the write-up of a systematic review exist. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) checklist was used in this review.[30] Data from the reviewed studies was extracted using a standardized extraction matrix[17,31] and the quality of the reviewed papers was appraised using the Quality Assessment Tool (QAT).[32] The quality of evidence considering the review outcomes was assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) tool[33] and the review was rated as level C based on the American Association of Critical Care Nurses' hierarchy of evidence.[34]

Eligibility Criteria

The included studies were published in English between 2004 and November, 2014 and comprised findings from men only. Records published in other languages were excluded as their quality could not be assessed. As for the year of publication, although there is no golden rule with regard to selecting publications by date, the currency and recency of scientific papers that are more than 10 years old are often questionable.[35,36] All the included records were intervention studies that aimed at: increasing men's TC knowledge and awareness; enhancing their attitudes towards TC; and/or improving their TC screening intentions and practices. 'TC screening' was considered to include either TSE, TC examination by a clinician, or both.

Information Sources and Search Strategy

The search was limited to three e-databases namely MEDLINE, CINAHL, and Embase. The reference lists of the included records were checked for intervention studies that are potentially

appropriate for inclusion and that could not be identified during database search. The literature was systematically searched between September and November, 2014. Boolean operators 'AND' and 'OR', truncation, and Medical Subject Headings (MeSH) were used. The 'Explode' and 'Major Concept' features were selected to identify a wider range of articles that are potentially pertinent to the review questions; subsequently, the following search history was generated: (cancer* OR tumor* OR tumour* OR malignan* OR neoplas*) AND (testicul* OR testes OR testis OR testicle*) AND (self-exam* OR 'self exam*'OR screening OR 'early detection' OR awareness OR knowledge OR attitudes OR practice OR 'health promotion' OR symptoms). Only papers translated to or published in English from the year 2004 and on were reviewed. No other limits were used during the literature search.

Data Extraction

All records were exported to and pooled in a software for research and reference management (EndNode X7). Duplicates were deleted and the remaining records were screened on title and abstract and unrelated papers were segregated. Articles that were potentially appropriate for inclusion were read. Studies that were deemed eligible for inclusion were sorted chronologically.

Data from the included studies was extracted by the primary reviewer using a standardized form.[17,31] Data extracted included the source citation, the country and setting where the reviewed interventions took place, the sample characteristics, the study design and theoretical underpinning, the data collection process, and the results (Table 1). Findings were sorted according to the review questions as follows: What are the men's: knowledge, awareness, and attitude towards TC; knowledge, awareness, attitude, towards TC screening; TC screening intentions; and TC screening practices? The extraction form was independently cross-checked by

a second reviewer to ensure accuracy of findings and minimize mathematical and statistical errors.

Quality Appraisal

The valid and reliable QAT developed by the Effective Public Health Practice Project was used to evaluate the quality of the reviewed interventions (Table 1).[32] This tool is extensively used in systematic reviews and was recommended by the Cochrane Review Group as one of the best tools to appraise the quality of health promotion studies.[37] In this review, the quality of the studies varied between weak (n=6),[25,28,38-41] moderate (n=4),[27,42-44] and strong (n=1).[26] The majority of the studies that were considered weak did not use probability sampling and/or did not address blinding of the outcome assessor.

Level of Evidence Assessment

Since the majority of the studies scored low on the QAT, the GRADE tool was utilized to assess level of evidence considering the review outcomes (Table 2).[33] This step is essential in systematic reviews, as failure to do so often yields inaccurate recommendations. In this review, the quality of the evidence was assessed in terms of methodological limitations, heterogeneity and/or inconsistency of findings, indirectness of evidence, imprecision of results, and publication bias.[33] The quality of evidence was found to be very low with regard to TC awareness and low in terms of TSE awareness, intentions, and practices. This was attributed to major methodological limitations as well as imprecision in the results. For instance, none of the reviewed studies addressed blinding of the outcome assessor. In addition, the effectiveness of the reviewed interventions was assessed using researcher-designed questionnaires that were neither valid nor

reliable. As for imprecision, a number of studies had a small sample size whereby participants were purposely selected and exposed to very few research events.[45]

RESULTS

Data Selection

Database search yielded 3076 records (Figure). Following deletion of duplicates, 1731 records were independently screened by the primary reviewer and a second reviewer. Agreement between the two reviewers was found to be satisfactory (Kappa coefficient=0.77).[37] Eleven studies were deemed eligible for inclusion. No studies that met the review inclusion criteria were identified during reference list checks.

Characteristics of the Included Studies

The reviewed interventions were conducted in the United States (n=5),[27,28,38,39,42] the UK (n=4),[26,40,43,44] France (n=1),[25] and Pakistan (n=1).[41] Most of the data were collected from university students (n=5).[26-28,40,44] The sample size ranged from 74[44] to 874[43] and participants' ages ranged between 15[43] and 86[38]. Pre-test post-test research design was used in the majority of the reviewed studies (n=6),[25,27,38,39,41,43] followed by post-test only research design (n=2),[28,42] randomized controlled design (n=2),[26,40] and randomized factorial design (n=1).[44] Of the reviewed studies, six were underpinned by theories, namely the extended parallel process model,[26] the standard model of health communication,[27] the theory of reasoned action,[28] implementation intentions,[40] the health belief model,[42] and Rogers protection motivation theory.[44] Researchers used a number of interventions to increase TC awareness, TC screening knowledge, intentions, and/or practice. These interventions included: self-reflection questionnaires and briefing sessions;[25] information about TC and TSE;[26] a university campaign

using social media, print messages, TC events, videos, and mass media;[27] 'mass-mediated' information delivery;[28] a video about TC using the American Sign Language;[38,39] implementation of intentions;[40] educational and awareness sessions, symposia, lectures, and hands-on practice;[41] printed educational material about TSE, a shower card, and a peer-taught video;[42] shower gel sachets with TSE instructions, waterproof stickers and posters;[43]and persuasive messages about TC and TSE.[44] Given the use of different interventional approaches and outcome measurements, it was not possible to conduct a meta-analysis, therefore a narrative synthesis is presented.

Awareness of Testicular Cancer

Of the reviewed studies, ten addressed awareness of the different aspects of TC.[25-28,38-40,42-44]At baseline, knowledge of TC risk factors ranged from 7.75% (n=31)[25]; 47.5% (n=48)[38] to 50.6% (n=80)[40]. The majority of the interventions that were tailored to increase TC awareness were successful in doing so. For instance, following exposure to a video about TC, TC knowledge increased from 47.5% (n=48) pre-test, to 93.1% (n=94) immediately after the video and remained significantly higher (84.2%, n=80, $p<0.05$) two months later.[38] Likewise, men who were provided with shower gel sachets, stickers, and posters about TC scored significantly higher on questions that assessed TC knowledge in comparison to men in the control group ($p=0.014$).[43] Similarly, TC knowledge scores were significantly higher among men who received information about TC and TSE as compared to those who received information about TC only and those who did not receive any information ($p=0.007$).[26] Following exposure to a university campaign about TC and TSE, students scored higher post-test as compared to pre-test ($p<0.001$) and had significantly higher TC knowledge scores than the control group ($p<0.001$).[27] It is worth noting that racial, ethnic, socioeconomic, geographical, and sexual disparities were not addressed in the reviewed literature.

Testicular Cancer Screening Awareness

Knowledge about TC screening was addressed in seven interventions.[25,26,28,40-42,44] Knowledge of TSE ranged between 4% (n=3)[41] and 16.3% (n=65)[25] and did not exceed 53.2%.[40] This was mainly due to lack of education about this practice. University students who watched a television show about TSE reported significantly higher TSE knowledge scores ($p<0.001$) and had a more positive attitude towards TSE ($p<0.01$) in comparison to those who did not watch the show.[28] A series of interventions including lectures, discussions, role-plays, and presentations were successful in increasing men's knowledge of TSE from 4% (n=3) pre-test to 72% (n=41) four months following the interventions ($p<0.001$).[41] In another study, high self-efficacy messages enabled men to feel more capable of performing TSE and improved their attitude towards this practice as compared to men who got exposed to low self-efficacy messages ($p<0.0001$).[44] Similarity, on a scale of 0 to 10, men who were exposed to messages about TC and TSE had higher TSE self-efficacy (Mean=5.24, CI=6.06-6.42, $p=0.004$) and learned the most about TSE ($p=0.004$) in comparison to those who were exposed to information about TC only and those who were not exposed to any messages.[26] It is worth mentioning that only one study was conducted in a developing country.[41]

Testicular Cancer Screening Intentions

Intention to perform TSE was addressed in six studies.[25-28,40,44] With the exception of one study[40], the reviewed interventions were successful in increasing men's intentions to perform TSE. For instance, TC screening intentions increased among men who were exposed to TC facts and TSE advice ($p=0.002$),[26] took part of a TC campaign ($p<0.001$),[27] watched a show about TSE

($p<0.001$),[28] as well as those who were provided with a number of messages about TSE ($p<0.0001$).[44]

Testicular Cancer Screening Practices

Implementation of interventions (n=7) led to a statistically significant increase in TC screening practices among participants.[25,27,40-43] For example, men who were provided with information about TSE using shower gel sachets, posters, and stickers scored higher on TSE practice in comparison to men who were not exposed to TSE information ($p=0.006$).[43] Similarly, an increase in TSE practices from 2% (n=1) pre-test to 26% (n=15) post-test was seen among men who were exposed to a number of TSE interventions (i.e. lectures, discussions, role-plays, and so on).[41] Although small, this change was found to be significant ($p<0.001$). Moreover, men who were exposed to high self-efficacy messages were found to have the highest odds of performing TSE (OR=3.09).[44] Likewise, participants who took part of a series of TC and TSE activities had a significant increase in their TSE practices ($p<0.001$) and were more likely to perform TSE in comparison to those who were not involved in the activities ($p<0.001$).[27] Only one study addressed TC screening by a clinician.[25] Following a physician-led briefing session, 31.37% (n=16) of those who declined TC examination earlier (n=51), agreed to have their testes examined.

With the exception of one study[41], TC screening practices were not addressed in developing countries. Moreover, there was no mention of health disparities in the reviewed studies.

DISCUSSION

A deficit in TC knowledge was seen at baseline in a number of studies. However, the majority of interventions that aimed at increasing TC knowledge were successful in doing so.[27,40,43] Men's

knowledge of TC risk factors was addressed the most.[28,40,42] The remaining studies focused on general TC knowledge rather than knowledge of particular aspects of this malignancy namely its signs and symptoms, prognosis, and treatment. Interventions that succeeded in increasing TC knowledge included information about TC and TSE,[26] a university campaign that aimed at raising awareness about TC and its screening,[27] a video about TC,[38] and shower gel sachets, stickers, and posters about TC and TSE.[43] Overall, limited details were provided regarding the intervention content and the use of underpinning theory. There is evidence, however, that interventions that are underpinned by a theory have a greater efficacy than interventions that lack a theoretical basis.[46]

Lack of education was perceived as the main reason why men did not know about TC screening.[40] Fortunately, interventions that aimed at educating men about TSE were successful in enhancing their knowledge about this practice. Interventions were also successful in increasing their intentions to perform TSE. Examples include: exposure to information about TC and TSE,[26] a television show that featured a celebrity who survived TC,[28] lectures, discussions, role-plays, and presentations about TSE,[41] and exposure to high self-efficacy messages about TC and TSE.[44] TC screening practices also increased following various interventions including physician-led briefing sessions,[25] a series of TC and TSE activities,[27] questions about the time and place where participants plan on performing TSE,[40] exposure to lectures, discussions, and role-plays featuring TSE,[41] information about TSE using shower gel sachets, posters, and stickers,[43] and high self-efficacy information.[44]

It is worth noting that only one intervention was designed and tested in a developing country.[41] Findings from this intervention reflect the overall situation with regard to cancer screening in the developing world. In Iran, for instance, breast cancer is diagnosed at an advanced stage; this was

attributed to the absence of formal screening programs.[47] Similarly, despite clear evidence that breast cancer screening would help reduce mortality among Indian women, no initiatives have been taken to develop a national screening program.[48] This was thought to be caused by conflicting healthcare priorities and economic circumstances. Another example is a population-based survey that was administered in 57 different developing countries to explore screening practices for cervical cancer. It was found that coverage of screening for this malignancy was on average 19% and was as low as 1% in Bangladesh as compared to 63% in developed countries.[49] Alarmingly, women who were at the highest risk for developing cervical cancer were least likely to undergo screening. Once again, these findings were attributed to the absence of adequate healthcare infrastructure and the limited access to health services in the developing world. Culture is also known to affect cancer screening and is at times perceived as the prime cause of health inequities.[50] For instance, in a survey that explored Chinese-American women's colon cancer screening practices, it was found that older women with a strong Eastern cultural background were least likely to get screened.[51] Straughan et al. and Yu et al. explained this finding in terms of the traditional Eastern culture whereby individuals put a great emphasis on traditional Chinese medicine and often believe that cancer is inevitable and incurable.[52,53]

Findings from the aforementioned studies can be transferred to the TC context. For instance, men in developing countries have a number of misconceptions about TC which hinders screening for this malignancy.[17] Lebanese men, for example, perceived TC as a life-threatening illness.[4] Moreover, compared to men living in the West, Eastern and African men were found to be least knowledgeable about TC and TSE which was attributed to the lack of national cancer screening initiatives and lack of public awareness with regard to TC screening.[54-60]

Overall, the reviewed interventions were effective in enhancing men's knowledge of TC and its screening, improving their intentions to perform and/or undergo screening, and increasing their screening practices. These findings, however, are presented from men living in developed countries with the majority being university students.[26-28,40,44] Only one study was conducted in the developing world in a community setting.[41] Despite addressing TC knowledge among deaf men,[38,39] none of the reviewed interventions included racial, ethnic, socio-economic, geographical, religious, and sexual and gender minorities.[61] This is believed to impede the generalizability of the findings and the applicability of the interventions to minority groups who are at a high risk for health disparities.[62]

Limitations of the Reviewed Studies

Methodologically, the reviewed interventions have a number of limitations that are worthy of discussion. For instance, researchers used different questionnaires to collect data and provided little information about the reliability and validity of their tools. Additionally, a number of interventional approaches were used to measure different outcomes which made it impossible to conduct a meta-analysis. Very few researchers reported on how their interventions were tailored and whether they were piloted or not. Furthermore, very few studies addressed the informational needs of men prior to designing and implementing the interventions and a number of studies had a high attrition rate. For instance, Brown et al. had to change their study design from pre and post-test to post-test only due to the large number of drop-outs.[42] Moreover, some of the pre and post-test design studies had a significantly smaller number of participants during post-test and only two studies reported on the long-term effects of their interventions.[26,38] Despite improving men's awareness of TC and TSE and increasing their TSE intentions and practices, the quality of

the majority of the interventions as well as the quality of evidence per review outcome were found to be low which negatively affects the recommendations made in the reviewed studies.

Limitations of the Systematic Review

Rigour was sought during the review process through the use of the PRISMA-P checklist.[30] Moreover, to the authors' knowledge, no previous systematic reviews were conducted to pool, analyse, and critically appraise findings from recent interventions designed to improve knowledge about TC and its screening and to increase TC screening intentions and practices. Critical appraisal of this review, however, yielded a number of limitations that are worth discussing. First, the evidence presented within this review cannot be rated as high using the American Association of Critical Care Nurses' hierarchy of evidence (level C evidence).[34] Second, selection bias could have taken place due to a number of methodological limitations. For instance, only three databases were used during the search process, studies from the Grey literature were not sought, and the search was limited to studies published in English between the year 2004 and 2014. Moreover, the search strategy was developed to be as comprehensive as possible which limited its sensitivity and specificity and yielded a large number of hits that were reviewed separately by two authors. Third, reporting bias could have taken place since only findings that serve the aim of the review and answer the review questions were extracted and discussed. This could have led to missing valuable data. For instance, the effect of the intervention by Shallwani et al. on female participants was not extracted because findings were originally sought from males only.[41] Fourth, one of the reviewers had to calculate some descriptive statistics that were not explicit in the reviewed studies. This could have led to mathematical errors and consequently faulty data. A second reviewer, however, cross-checked the statistics separately in order to minimize these errors. Finally, the quality of evidence was

assessed based on the review outcomes, therefore the quality scores could have been different if other outcomes have been considered. In addition, given the heterogeneity of the research tools, times of measurement, and research designs, it was not possible to conduct comparative analysis and to pool data from the reviewed interventions using a summary of findings table.

Implications for Future Research

Worryingly, minority groups were underrepresented in the reviewed literature which hinders the generalizability of findings and limits their applicability to individuals who are at risk for health disparities.[62] For this reason, researchers should be urged to create interventions that are tailored to fit the needs of minority groups bearing in mind the individual variations within each group. Examples are the studies conducted by Folkins et al.[38] and Sacks et al.,[39] whereby videos recorded using the American Sign Language succeeded in increasing the deaf men's TC knowledge. Moreover, the majority of the reviewed interventions were conducted in universities and included relatively educated men, which informs the need to include men with low educational and/or socioeconomic background in future research.

It is worth considering the informational needs and the preferred intervention format suited for men prior to designing and implementing interventions. Given the age group at risk for TC, social media and mass media may serve as potentially interesting channels through which men can learn about TC and its screening. From a methodological perspective, random sampling should be encouraged to yield a representative sample and decrease the risk of selection bias. In addition, researchers should be encouraged to use valid and reliable tools to assess TC knowledge and screening practices and to utilize theoretical frameworks and models to underpin their interventions.[46] For instance, Wanzer et al. made good use of the elements of the Standard

Model of Health Communication to tailor a number of TC events in colleges, designed to appeal to students.[27] Moreover, behavioural change theories and intervention-based models can assist researchers in promoting awareness of TC and TSE; examples include: the Health Belief Model,[63] the Theory of Reasoned Action,[64] the Theory of Planned Behaviour,[65] the Social Cognitive Theory,[66] the Self-Determination Theory,[67] the Stages of Change Model,[68] the Precaution Adoption Process Model,[69] and the Tannahill Model.[70]

The findings from this review will enable researchers to plan, design, and test an intervention to raise awareness of TC and its screening. A mixed methods research approach may be used for this purpose. Firstly, researchers could interview clinicians about their clinical experiences, and practices with regard to testicular examination, and TC screening. Secondly, the general public and specific minority groups could be interviewed about their knowledge, attitudes, and TSE practices. To address the aforementioned gaps in the literature on TC, the educational needs and the preferred learning strategies of the general public and minority groups should be explored throughout the interview process. Finally, adopting the mixed methods approach, permits researchers to plan, design, pilot-test, and implement a comprehensive intervention to raise awareness of TC among the public including individuals who are at risk for health inequities. Adopting this methodological approach necessitates the integration of one or more of the aforementioned behavioural change theories and intervention-based models.

Implications for Practice

From a practical standpoint, lack of consensus regarding screening for cancer of the testes exists due to the absence of clear guidelines about this practice. For instance, In the United Kingdom, awareness of normal testicular findings is still recommended.[14] Moreover, in its cancer screening

guidelines, the American Cancer Society still recommends TC examination by a clinician as part of the cancer-related check-ups.[13] The U.S. Preventive Services Task Force, however, believes that TC screening might cause unnecessary anxiety and therefore discourages this practice.[11]

Given the controversy that surrounds TC screening, nurses involved in health promotion could learn from successful interventions to increase men's awareness of TC without necessarily promoting regular TSE. For instance, nurses could make good use of high self-efficacy messages to increase TC awareness and decrease the fear and anxiety associated with a cancer diagnosis while bearing in mind the specific needs of minority groups. Nurses could also educate young men about signs and symptoms of testicular disorders and encourage them to seek medical help in the event of testicular abnormalities.

CONCLUSION

In this systematic review, data was extracted from studies conducted to enhance men's knowledge and awareness regarding TC and its screening and increase their TSE intentions and practices. The quality of the majority of the reviewed interventions as well as the quality of evidence per research outcome were found to be low.

Overall, participants were uninformed about TC screening. Lack of education about this practice has led to decreased TC screening intentions and practices. Fortunately, the majority of the reviewed interventions succeeded in increasing men's awareness of TC and TSE and in enhancing their intentions to undergo screening and perform TSE. Example of interventions that succeeded in enhancing men's TC and TSE awareness include: TC facts and TSE advice,[26] a university campaign,[27] information about TSE using shower gel sachets and waterproof stickers and posters,[43] and high self-efficacy messages.[44]

It is worth mentioning that men living in developing countries as well as individuals who are at risk for health disparities were underrepresented in the reviewed literature which raises a number of questions with regard to the generalizability of findings and their applicability to different sociocultural contexts.

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LEGENDS

Figure: Study Identification, Screening, and Selection Process

Table 1: Characteristics and Quality Appraisal of the Reviewed Interventions

Table 2: Level of Evidence Assessment

Table 1. Characteristics and Quality Appraisal of the Reviewed Interventions

Author (s) & Year	Country & Setting	Study Population [a]	Design & Theoretical Underpinning	Data Collection [b]	Findings [c]				Quality Appraisal [d]
					Q1	Q2	Q3	Q4	
Steadman & Quine (2004)	- UK - University	T1: - n=159 (EG n=93, CG n=66) T2: - n=76 (EG n=46, CG n=30) - [20.6y±3.4, 18-35y]	Prospective randomized control design using Implementation Intentions	- T1: CG: Questionnaire and pamphlet EG: Questionnaire, pamphlet, and an item asking where and when they plan to perform TSE. - T2 (after 3 weeks) CG and EG: Questionnaire on whether they performed TSE and whether they intend to do so - Economic data: NR	- T1: on a scale of 0-9, 50.6% (n=80) scored below 3 on items related to TC causes and outcomes (M=3.62), 92.2% (n=147) did not know that TC is more prevalent among Caucasians	- T1: 46.8% (n=74) were not aware that most abnormalities are found during TSE	- T2: no difference between EG and CG in terms of intentions to perform TSE (p=NS)	- T2: 65.2% (n=30) of EG performed TSE compared to 40% in CG (n=12) ($\chi 2=4.61$, $p<0.05$)	Weak

Trumbo (2004)	- USA - University	- n=524 (EG n=165, CG n=359) - [21.2y, NR]	Quasi-experimental design using the Theory of Reasoned Action	- Intervention: EG watched a show that featured a celebrity discussing TC and TSE. CG did not watch the show. - T2 (after 4-6 months): a phone survey with both groups - Economic data: NR	-T2: on a scale of 0-10, EG had higher knowledge scores about TC (M=5.7) than the CG (M=5.2) ($p<0.001$)	- T2: EG had greater knowledge ($p.<0.001$) and a more positive attitude towards TSE ($p<0.01$)	-T2: EG had a greater intention to perform TSE ($R^2=0.01$, $p<.001$)	NR	Weak
Folkins et al. (2005)	- USA - Community settings for the deaf	- n=102 - [44.35y±17.39, 18-86y]	Pre and post-test survey design	- T1: survey about TC and prostate cancer - Intervention: video about TC and prostate cancer filmed in the American Sign Language - T2: survey immediately after the video	Knowledge TC risks such as age increased significantly from T1 (47.5%, n=48) to T2 (93.1%, n=94) up until T3 (84.2% n=80) ($p<0.05$)	NR	NR	NR	Weak

				- T3: survey two months after the video - Economic data: NR	Knowledge of TC treatment increased significantly between T1 (73%, n=73) and T2 (92%, n=92) (p<0.05)				
McCullagh et al. (2005)	- UK - 14 workplace and leisure sites	-n=874 (T1 n=518, T2 n=356) - [NR, 15-44y]	Quasi-experimental, pre and post-test design	- T1: Assessment of TC knowledge and TSE practices - Intervention: EG: Information about TSE using shower gel sachets and waterproof stickers and posters. CG: No intervention	- T1: on a scale of 0-5, the EG and CG had similar TC knowledge (Median score=3) - T2: EG scored significantly higher (Median score=4, p=0.014)	NR	NR	- T1: No difference in TSE practice between EG and CG (p=NR) - T2: EG scored higher than CG on TSE practice (p=0.006)	Moderate

				- T2 (after 4 weeks): EG and CG asked about TSE practices. EG asked whether they intend to practice TSE - Economic data: NR					
Shallwani et al. (2010)	- Pakistan - Community	- n=127 *males (n=57) - [36.5y±11.9, NR]	Pre and post-test study design	-T1: questionnaire about TSE knowledge and practice - Interventions: lectures, discussions, role-plays, poster presentations, pamphlets, booklets, screening sessions - T2 (after 3 months): questionnaire about TSE	NR	TSE knowledge increased significantly from 4% (n=3) at T1 to 72% (n=41) at T2 ($p<0.001$)	NR	TSE practices increased significantly from 2% (n=1) at T1 to 26% (n=15) at T2 ($p<0.001$)	Weak

				knowledge and practices - Economic data: NR					
Umeh & Chadwick (2010)	- UK - University	T1 & T2: - n=128 - [21.8y±3.87, 18-35y] T3: - n=74 - [21.93y±4.01, 18-34y]	Between-participant 2 (vulnerability) x 2 (severity) x 2 (self-efficacy) randomized factorial design using the Rogers Protection Motivation Theory	- T1: survey about TSE, clinical testicular exam and TSE attitudes and intentions - Intervention: participants assigned to 1 of 8 experimental groups that included different messages about TC and TSE, fact sheets recommending regular TSE, and testimony and photograph of a fictitious patient - T2 (after one month): participants e-mailed to assess	- T2: participants who read the low vulnerability information (M=19.31) and high severity condition information (M=19.34) perceived themselves to be more susceptible to TC than those who read the high vulnerability (M=16.3) and low severity information (M=16.27) ($p<0.05$)	- T2: participants exposed to the high self-efficacy message perceived themselves are more capable of performing TSE (M=22.16) than those who read the low-self efficacy message (M=19.31) Attitude towards TSE increased significantly	- T2: men in the high self-efficacy group and high-vulnerability group intended to perform TSE ($p<0.06$) Intentions to perform TSE increased significantly in T2 ($p<0.0001$)	- T1: 58.6% (n=75) performed TSE in the past year and had their testes checked by a clinician - T2: 75.7% (n=56) reported performing TSE in the past month Those in the high-efficacy condition had higher odds of performing TSE (OR=3.09)	Moderate

				their TSE practices - Economic data: NR		in T2 (p<0.0001)			
Kedzierewicz et al. (2011)	- France - Army	Part I: - n=400 - 31.3y, 21-44y] Part II: - n=360 - [NR, NR]	Pre and post-test prospective study design	- *Part I:* - T1: questionnaire about degree of willingness to have testicular exam performed by a physician - Intervention: survey to self-reflect on TC knowledge and TSE practice - T2 (time NR): questionnaire about degree of willingness to have testicular examperformed by a physician - *Part II:*	- *Part I:* - T1: 26.75% (n=107) received information about TC, 7.75% (n=31) were educated about TC risk factors, 63.3% (n=253) did not know about TC prognosis	- *Part I:* -T1: 16.3% (n=65) were educated about the importance of TSE, and 9.5% (n=38) have been taught how to perform TSE	- *Part I:* -T2: Mean degree of willingness did not increase significantly (M=7.09 at T1 and M=7.43 at T2) (p=NS). 2.75% (n=11) became less willing to have testicular palpation and 15% (n=60) became more willing to have testicular palpation - *Part II:* 14.17% (n=51) declined	- *Part II:* Of those who declined examination (n=51), 31.37% (n=16) accepted testicular palpation following the briefing	Weak

				Short medical briefing (time NR) - Economic data: NR			examination before the briefing		
Evans et al. (2012)	- UK - University	- n=443 (EG1 n=145, EG2 n=146, CG n=152) - [24y, 23-25y]	Randomized controlled trial using the Extended Parallel Process Model	- T1: TC knowledge and TSE practices assessed for all groups - Intervention: EG1: TC facts EG2: TC facts and TSE advice CG: no intervention - T2 (after 7 days): post-intervention questionnaire - T3 (5-7 days after T2): measure of TSE intentions	- T2: on a scale of 0-10, EG2 had the highest knowledge scores (Mean=8.9, CI=8.3-9.14) and the lowest perceived severity of TC (p=0.007)	- T2: EG2 had the highest TSE response efficacy (M=6.34, CI=6.19-6.49, p=0.023) and TSE self-efficacy (M=6.24, CI=6.06-6.42, p=0.004) EG2 reported significantly greater learning from the message (p=0.004),	EG2 had the greatest intentions to perform TSE at T2 (p=0.002) and T3 (p=0.011)	NR	Strong

				- Economic data: NR Spielberger State Trait Anxiety Inventory, The Breast Cancer Fear Scale, and Threat and Efficacy Perceptions measured at each time				
Brown et al. (2012)	- USA - Army	- n=92 (EG1 n=27, EG2 n=21, CG n=44) - [23.3y±3.57, 18-34y]	Post-test only design using the Health Belief Model instrument	- Intervention: EG1: Printed educational material and shower card about TSE EG2: Shower card about TSE and a 12-minute peer-taught video about TSE CG: No intervention	- T2: 92.6% (n=25) of EG1, 90.5% (n=19) of EG2, and 86.4% (n=38) of CG knew about TC. There was no significant difference between the groups regarding TC	- T2: 74.1% (n=20) of EG1, 95.2% (n=20) of EG2, and 75.6% (n=34) of CG knew about TSE. There was no significant difference between the groups regarding TSE	NR	- T2: 25.9% (n=7) of EG1, 33.3% (n=7) of EG2, and 20% (n=9) of CG performed monthly TSE. 51.9% (n=14) of EG1, 47.6% (n=10) of EG2, and 20% (n=9) of CG were never screened	Moderate

				- T2 (time NR): The Health Beliefs Survey for TC and TSE - Economic data: NR	knowledge (p=0.7) - Economic data: NR	knowledge (p=0.13) Overall, 93.5% (n=87) agreed that TSE improves chances of recovery and 74.2% (n=69) agreed that men do not perform TSE because they have now knowledge about this practice		for TC by a clinician	
Sacks et al. (2013)	- USA - Deaf and hearing community	- n=175 Deaf young adult males n=85 - [25.75y±5.56, NR] Hearing n=90	Pre-test post-test design	- T1:knowledge survey on TC - Intervention: general and TC education chapters of a video - T2 (immediately after the video):	- T1: Deaf men had less TC knowledge (p<.002) than hearing men. - T2: TC knowledge among deaf men (p<.001) and hearing men (p<.001)	NR	NR	NR	Weak

		- [22.70y±3.46, NR]		knowledge survey on TC - Economic data: NR	increased. Post-intervention, hearing men had a greater mean change in knowledge (M difference=3.82) compared to Deaf men (M difference=3.46)				
Wanzer et al. (2014)	- USA - University	- n=272 (EG=220, CG=52) - [NR, NR]	Pre-test post-test and post-test-only pre-experimental design using the Standard Model of Health Communication.	- T1 and T2 (after 2 weeks): Knowledge, awareness, behaviour and intentions in regard to TC assessed using the same tool. - Intervention: EG: exposed to Information disseminated across campus	- EG: TC awareness increased significantly from T1 to T2 (p<0.001) - T2: TC awareness in EG was higher than CG (p<0.001).	NR	- EG: intention to perform TSE within a month increased significantly from T1 to T2 (p<0.001) as compared to CG	- EG: compared to T1, there was a significant increase in monthly TSE (p<0.001) - T2: EG was more likely to perform TSE than the CG (p<0.001)	Moderate

	during TC events + messages about TC and TSE. CG: Not exposed to the campaign. - Economic data: description of the campaign	- T2: Significant increase in awareness among EG ($p<.001$)

[a] Sample size (n); [mean age in years (y)±standard deviation, age range in years(y)]; gender: males unless otherwise reported.

[b] Data collected using researcher designed questionnaires unless otherwise reported.

[c] What are the men's: (Q1) knowledge, awareness, and attitude towards TC?; (Q2) knowledge, awareness, attitude, towards TC screening?; (Q3) TC screening intentions?; (Q4) TC screening practices?

[d] Quality appraisal of the interventions using the quality assessment tool (QAT) for quantitative studies.[32]

Abbreviations: $\chi 2$, chi-square; CG, control group; CI, confidence interval; EG, experimental group; M, mean; NR, not reported; NS, not significant; OR, odds ratio; T1, time1; T2, time2; T3, time3; TC, testicular cancer; TSE, testicular self-examination.

Table 2. Level of Evidence Assessment

Outcomes	Number of participants (Studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall quality (GRADE)
TC awareness	3046 (ten studies)	Yes	No	No	Yes	Yes	+OOO Very low
TSE awareness	1750 (seven studies)	Yes	No	No	Yes	No	++OO Low
TSE intentions	1803 (six studies)	Yes	No	No	Yes	No	++OO Low
TSE practices	1929 (seven studies)	Yes	No	No	Yes	No	++OO Low

Abbreviations: TC, testicular cancer; TSE, testicular self-examination.

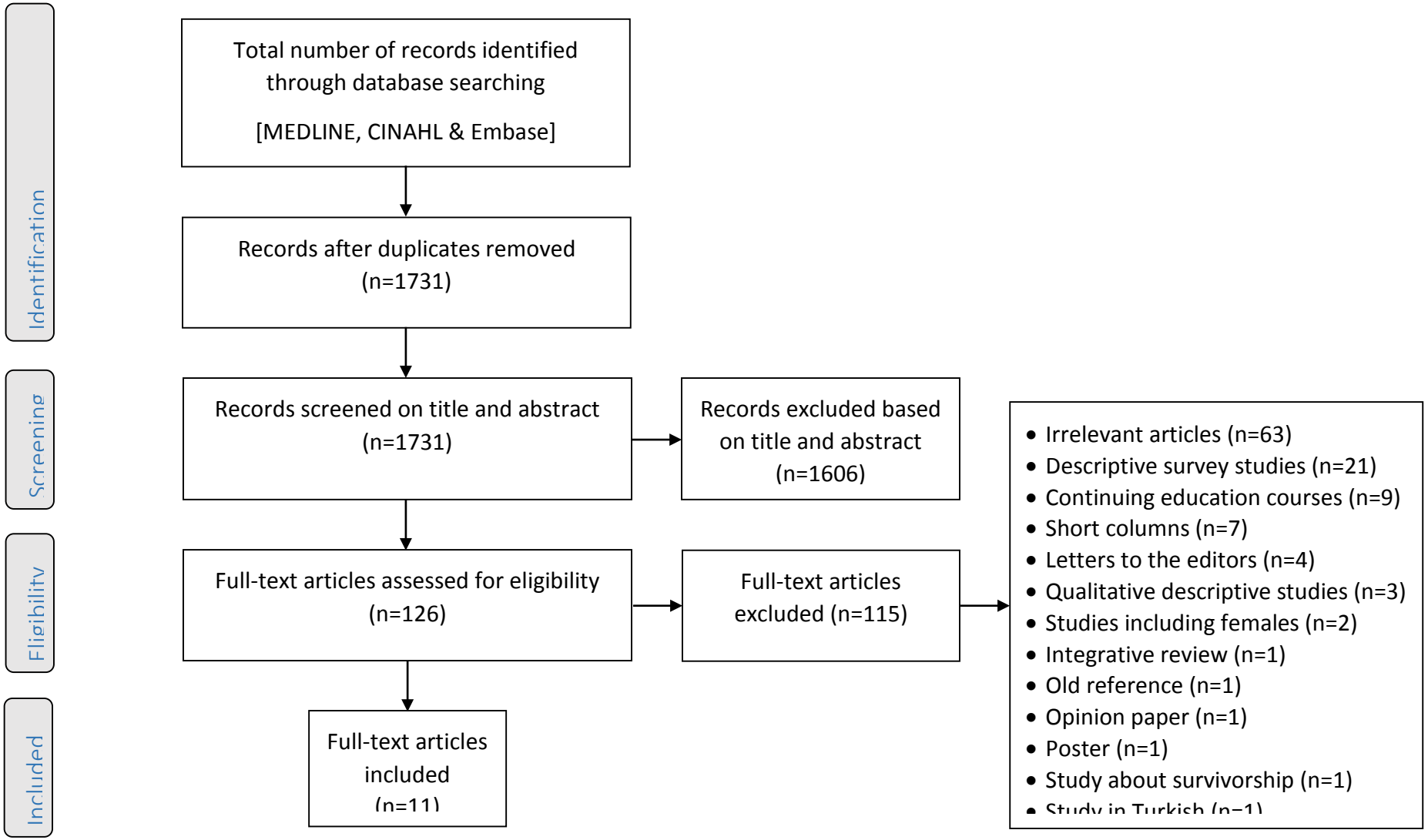

Figure. Study Identification, Screening, and Selection Process