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What is lacking in current decision aids on cancer screening?

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Abstract

Recent guidelines on cancer screening have given not only more screening options but also conflicting recommendations. Thus, patients, with their clinicians' support, must decide whether to get screened or not, which modality to use, and how often to get screened. Decision aids could potentially lead to better shared decision making regarding screening between the patient and the clinician. We reviewed 73 decision aids on screening for breast, cervical, colorectal, and prostate cancers. The goal of this review was to assess the effectiveness of such decision aids, examine areas in need for more research, and determine how the decision aids can be currently applied in the real world setting. Most studies used sound study design. Significant variation existed in setting, theoretical framework, and measured outcomes. Just over a third of the decision aids

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included an explicit values clarification. Other than knowledge, little consistency was noted in which patient attributes were measured as outcomes. Few studies actually measured shared decision making. Little information was available on the feasibility and outcomes of integrating decision aids into practice. We discuss the implications for future research, as well as what the clinicians can do now to incorporate decision aids into their practice.

Keywords

Mass Screening; Decision Aid; Neoplasms; Decision Making

Introduction

In recent years, screening strategies for many conditions have become increasingly complex. Guidelines now recommend more options for cancer screening. Also, some guidelines have conflicting recommendations. Thus, patients, with their clinicians' support, must decide whether to get screened or not, which modality to choose, and how often to get screened. These considerations are foundational to informing patients' preferences, and make these decisions "preference-sensitive." Decision aids could be an ideal tool to help the patients understand their risks of getting a particular cancer, screening options available (including a possible option of not getting screened), recommended screening time intervals, and their own values and preferences for a particular option and outcome. Consequently, decision aids have proliferated in recent years. They usually include information on the disease/condition and the associated tests/treatments, probabilities of outcomes (benefits and harms) for each test/treatment option, and some form of values clarification exercise to help the patients determine which option would best match their values. They may also include guidance or coaching in the process of decision making [1]. They are not meant to replace the discussion between the patient and his/her clinician, but rather to complement it.

Cancer screening decisions are increasingly recognized as being preference-sensitive, due to the increased recognition of harms from sequelae of screening, the need to tailor screening recommendations to the patient's risk, multiple options available in some screening tests, and conflicting recommendations from the guidelines. The potential of harm from screening was highlighted recently when the United States Preventive Services Task Force (USPSTF) recommended against routine prostate cancer screening [2]. They made this recommendation while other guidelines had similarly weighed the benefits and harms of prostate cancer screening and instead of discouraging screening, stressed shared decision making between the patient and the clinician to decide whether to get screened or not [3]. Other cancer screenings involve preference-sensitive decisions as well, such as colorectal cancer screening, where options include stool blood test, flexible sigmoidoscopy, colonoscopy, and other modalities [4, 5]. Even screening for cancers traditionally without many options has become more complex, with some recent guidelines recommending shared decision making between the patient and clinician to determine whether to get screened for breast cancer or not for women between the ages 40 and 49 years [6], consideration of magnetic resonance imaging for women with high risk of breast cancer [7], and options of cytological testing every 3 years or cytological testing plus Human Papillomavirus testing every 5 years to screen for cervical cancer [8]. The purpose of this review is to summarize what is known about the effect of decision aids on cancer screening, and to explore areas where more information is needed to fully understand the impact of decision aids on the process and outcomes of shared decision making between the patient and the clinician.

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Methods

Screened Cancers

We focused our attention on cancers for which the national guidelines recommend screening the general population [4–8]. Thus, we selected the decision aids for screening of cancers for breast, cervical, and colon/rectum. In addition, we looked at genetic testing for women considered to be at high risk for breast cancer, since it was felt to be an important option for selected high-risk women desiring further screening evaluation for breast cancer. Finally, we included prostate cancer screening in our search, since all guidelines except those by the USPSTF recommend that at least a discussion occur between the patient and clinician to decide whether screening for prostate cancer would be warranted in the particular patient [2, 3].

Study Identification

The literature search was conducted for English language articles in five databases: MEDLINE (January 1980–May 2012); Cumulative Index to Nursing and Allied Health Literature (CINAHL; January 1980–May 2012); EMBASE (1980–May 2012); Cochrane Central Register of Controlled Trials (CCRCT; updated May 2012) and Science Citation Index (SCI; January 1980–May 2012). The MEDLINE, CINAHL, EMBASE and CCRCT searches were conducted via the Ovid interface. The majority of the topical search retrieval was obtained via MEDLINE using Medical Subject Headings, including *Breast Neoplasms; Colorectal Neoplasms; Uterine Cervical Neoplasms; Prostatic Neoplasms; Mass Screening; Decision Support Techniques; Decision Making; Decision Making, Computer-Assisted;* and *Decision Support Systems, Clinical*. In addition, limited text word searching was utilized. Corresponding key word searches with Boolean syntax were conducted in CCRCT and SCI.

Theoretical Framework

In order to provide a theoretical organizing framework for our evaluation of studies we have adapted the Integrative Model of Behavior by Frosch, which combines four theories most frequently applied in health behavior research in the past 30 years (Theory of Reasoned Action, Theory of Planned Behavior, Health Belief Model, Social Cognitive Theory) [9]. This theory combines measurable constructs of behavior (attitudes, perceived social norms, self-efficacy, behavioral intention) to the actual behavior. Because an important aspect of decision aids is the clarification of preferences and values, we have added that component, as well as how the subsequent patient/clinician discussion ensues in terms of shared decision making and patient/clinician concordance (match between the patient's preferred screening option and the clinician's recommended option) [10, 11]. Figure 1 illustrates our adapted framework with relevant examples. Applied to the topic of this review, use of decision aids to affect the patient's behavior on cancer screening, this theoretical framework provides a helpful structure for understanding where decision aids intervene and exert their influence on screening behavior. It influenced the selection of decision attributes evaluated. Our analysis focused on understanding the impact of the decision aid on patient's attributes, shared decision making, and patient/clinician concordance. Our model suggests that all of these are important to understanding the impact on patient screening behavior and determined the questions posed in the review.

Procedure

Two evaluators (MJ and MR) reviewed each of the identified articles independently to determine if the study was relevant to the topic. Publications were excluded if the article was a review, an opinion article, an abstract, descriptive of a new decision aid without an intervention/trial component, or measured for usability but not for effects on patient

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knowledge, attitude or behavior. Also, they were excluded if the study patients had an established cancer diagnosis, since our focus was on cancer screening. For the same reason, we excluded the study if it included treatment (e.g., prophylactic mastectomy) as an option. We selected the studies if the decision aid contained information on the disease/condition and the associated tests/treatments and probabilities of outcomes (benefits and harms) for each test/treatment option [1]. We excluded studies where the intervention was provided solely through a healthcare professional (e.g., a script), since decision aids by definition are separate tools that complement the patient/clinician discussion and aid in decision making. We did not directly contact the study authors but thoroughly reviewed the relevant articles for the original and detailed description of the decision aid intervention, and when necessary, reviewed the references for the original description of the intervention. Also, we directly accessed the decision aids if available. We included pre-/post-intervention and other nonrandomized designs as well as randomized controlled design, because we wanted to be as inclusive as possible to capture innovative decision aids. For that reason, we also included pilot studies as long as they had intervention and evaluation components. A number of publications were found that were duplicate reports of a single study or serial reports from the same study. In these cases, the study was counted as one, although all pertinent publications were reviewed. The cited literature referenced in relevant studies were also examined for possible additional studies.

Study Questions/Measures

We categorized the measures into the following:

1. Does the decision aid utilized in the study address the issues important to be addressed in a screening decision aid [1]?

   We determined whether the decision aid included the information on the cancer and the screening test options involved, probabilities of outcomes including benefits and harms for each option, explicit value clarifications exercise to help the patient determine which option would best match his/her values, and guidance or coaching in the process of decision making. For values clarification, we specifically looked for existence of a process (e.g., exercise) that would actively engage the patient in clarifying his/her values. For guidance or coaching, we looked for the specific ways in which the decision aid or the study addressed discussion with the clinician.

2. Does the study measure the effect of the decision aid on the patient attributes established in the theories of behavioral research?

   We determined whether the study measured patient's knowledge, attitude, perceived normative pressure, self-efficacy, preference clarification, and intent regarding the cancer and cancer screening test in question. Here, preference is different from values in that "preference" is defined as an actual preference for a certain option.

3. Does the study address the impact of the decision aid on the patient behavior in question?

   We determined whether the decision aid increased or decreased the patient uptake of the particular cancer screening test, and whether it was by subjective (e.g., patient self-report) or objective (e.g., chart review) report. Also, we determined whether the completed cancer screening test was the option that the patient had originally chosen at the time of the decision aid use.

4. Does the study address the effect of the decision aid on the subsequent discussion between the patient and his/her clinician?

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We determined whether the study addressed the subsequent discussion between the patient and his/her clinician (i.e., shared decision making) and whether it was affected by the decision aid use. We also determined whether there was concordance between the patient and the clinician, that is, whether they agreed on a particular cancer screening test option [11]. Additionally, we determined whether any other factors after the patient/clinician encounter (e.g., family members, media) were considered in having influenced patient's screening behavior.

5. Does the decision aid appear to be applicable in real-world practices?

   We determined the feasibility of applying the decision aid in real-world practice through the study's setting, patient selection, and whether the decision aid was stand-alone or done in conjunction with other clinical activities. We also determined whether the study addressed the ability of the decision aid to be used in repeat screening and whether cost analysis was performed.

Determination of Outcomes

For the outcomes, only the outcomes based on intention to treat were considered when the intention to treat numbers were available. Also, where p was available, only the outcomes that were statistically significant at $p<0.05$ or less were considered to be meaningfully different. Outcomes were compared between groups for the studies that were randomized or factorial in design. Outcomes were compared before and after the intervention for the studies with pre-/post-intervention design.

Specific Areas Addressed Based on the Five Questions

The two evaluators independently read each publication to determine each of the following areas.

1. Primary Author and Year
2. Target Cancer for Screening
3. Cancer Screening Options Addressed
4. Target Population and Characteristics (e.g., patient, clinician or both)
5. Study Design
6. Setting (e.g., community or academic)
7. Follow-up Duration
8. Content of the Decision Aid
   a. Theoretical framework
   b. Provision of information
   c. Risks and benefits
   d. Values clarification exercise
   e. Guidance on decision making and communication
   f. Provision of a no-screening option
   g. Discussion of when to stop screening
9. Patient Outcomes Assessed for the Decision Aid
   a. Knowledge

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b. Attitude

c. Subjective norm

d. Self-efficacy

e. Preference clarification

f. Intention

g. Screening behavior (also: whether it was self-report or observational review)

10. Patient/clinician Outcomes Assessed for the Decision Aid

    a. Shared decision making

    b. Concordance

11. Practice Outcomes Assessed for the Decision Aid

    a. Post-visit factors (e.g., effect of media, family and friends)

    b. Incorporation of the decision aid into practice (e.g., meaningful use)

    c. Effect of the decision aid on repeated screening

    d. Cost analysis

The evaluators met as a group to review their classifications, discussed any disagreements, and arrived at a consensus of opinion for all studies.

Results

Seventy-nine studies were identified that evaluated 73 decision aids meeting the criteria outlined above. Only two decision aids dealt with cervical cancer screening [12, 13]. Eighteen decision aids dealt with breast cancer screening, of which nine concerned mammography for the general population [14–23] and nine concerned genetic testing for those considered to be at high risk for breast cancer based on family history and other information [24–33]. Twenty-one decision aids dealt with colorectal cancer screening [34–54]. Twenty-nine decision aids dealt with prostate cancer screening [55–87]. Two decision aids dealt with both colorectal and prostate cancer screening [88, 89], and one decision aid dealt with all four cancer screenings: breast, cervical, colorectal, and prostate [90].

Characteristics of the Identified Studies

Table 1 summarizes the characteristics of the identified studies. For breast and prostate cancers, screening options were a single test, namely mammogram [14–23] or genetic (BRCA) testing [24–33] and prostate specific antigen (PSA) [55–87], respectively. The breast self-examination and clinical breast examination in one decision aid on mammogram screening were not considered options but rather came as a set with the mammogram [14]. Similarly, digital rectal examination and PSA in twelve of the 29 decision aids on prostate cancer screening were not options but considered as a set [58, 59, 61, 65, 69, 73, 75, 77–79, 82, 87]. The two decision aids on cervical cancer screening also dealt with a single test, cervical cytology (Papanicolaou smear) [12, 13]. Decision aids for colorectal cancer screening were the only ones that considered choosing among multiple screening test options. In these cases, options varied from just one (n=4 of 21 decision aids) [37, 45, 47, 49] to two (n=4) [39, 43, 48, 53] to three or more (n=13) [34–36, 38, 40–42, 44, 46, 50–52, 54]. One study explicitly compared a two-option decision aid, namely stool blood test and colonoscopy, to a five-option decision aid, which options included stool blood test, flexible

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sigmoidoscopy, stool blood test and flexible sigmoidoscopy, barium enema, and colonoscopy [41]. Of note, the newer screening tests of magnetic resonance imaging for women at high risk for breast cancer, human papilloma virus testing for cervical cancer screening, and computer tomography colonography and stool DNA testing for colorectal cancer screening have not yet been incorporated in the published decision aids.

Content of Decision Aids

Tables 2 summarizes the content of the decision aids used in the studies. Most decision aids utilized a theoretical framework (n=41 of 73 decision aids), particularly the transtheoretical model (n=11) [15, 18, 19, 22, 34, 38, 41, 42, 47, 50, 51, 54] and the Ottawa decision support framework (n=8) [21, 23, 31, 32, 48, 52, 82, 83]. Interestingly, most decision aids on prostate cancer screening (n=19 of 29 decision aids) [55–57, 60–68, 72–78, 84–86] and all decision aids on multiple cancer screening (n=3) [89–90] did not incorporate a theoretical framework. A few had adopted a formative approach (e.g., interviews, focus groups, and expert feedback; n=24 of 73 decision aids) [16, 17, 22, 29, 31, 32, 34, 36, 40, 42, 44, 46, 48, 52, 53, 55, 59, 60, 62, 63, 70, 71, 83, 88, 89], but others seemed to have moved relatively quickly from literature and expert review to creation of the tool and pre-testing.

Variation was seen in the methods of values clarification exercise, where the patient actively engages in a process where his or her values regarding the screening test(s) are clarified. The patient had to be actively involved in an exercise, such as writing out the pros and cons (in cases of paper-based decision aids) or clicking on choices (in case of web-based and other interactive decision aids). Less than half of the decision aids utilized these exercises (n=27 of 73 decision aids) [18, 19, 21–23, 25, 27, 28, 31, 32, 36, 38–40, 43, 45, 48, 49, 52, 54, 58, 65, 68, 69, 78, 80–84]. None of the two decision aids that addressed cervical cancer screening [12, 13] or the three decision aids that addressed multiple cancer screenings [88–90] incorporated them.

Variation was also seen in the methods of providing guidance on making decisions and communicating with the clinician. Some were simply a statement of recommendation to speak to a clinician [14, 18, 19, 21, 36, 40, 46, 52, 55, 58, 62–64, 66, 70–73, 77]. Others provided a list of questions to ask the clinician [17, 49, 84]; some of these provided a list customized to the patient [22, 31, 82]. Other studies attempted to facilitate communication through practice-based interventions, such as having the patient use the decision aid immediately before or during genetic counseling [30–32] or providing color codes in the chart to let the clinicians know of the patient's readiness for colorectal cancer screening [34, 41, 50, 51]. In all, 43 of 73 decision aids, including all three decision aids on multiple cancer screening [88–90], provided the guidance on communicating with clinicians. Neither of the two decision aids on cervical cancer screening provided it [12, 13].

Regarding provision of a "no screening" option, all decision aids involving breast cancer genetic testing [24–33] and all but two decision aids involving prostate cancer screening (including those targeting multiple cancers) [55–73, 75–86, 88–90] provided them. This is understandable, since the choice in these cases is to undergo the screening test or not. This option was also available in four of nine breast cancer mammogram screening [18–21, 23] and six of 21 colorectal cancer screening decision aids [35, 36, 42, 48, 49, 53]. Neither of the two cervical cancer screening decision aids provided it [12, 13]. Out of all decision aids, only one on mammogram screening [21] and one on prostate cancer screening [56, 57] dealt with when to stop screening.

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Patient Outcomes Assessed for the Decision Aids

Knowledge was assessed in a majority of the decision aids (n=52 of 73). Twelve decision aids had no effect on knowledge [15, 20, 29, 38, 41, 42, 47, 64, 70, 71, 76, 78, 87]. Attitude was assessed in 35 of 73 decision aids. There was no impact on attitude in four breast cancer mammogram decision aids [15, 18–20, 23]. Of the seven breast cancer genetic testing studies, one showed an increase [26] and two showed a decrease in perceived personal risk [24, 27, 28], one showed a decrease in positive belief [33], and one showed a decrease in worry [30]. The remaining two showed no difference [31, 32]. One decision aid on cervical cancer screening showed decreased perception of procedural and cognitive barriers and increased perceived benefit of Papanicolaou test [13]. Of the eight colorectal cancer screening decision aids for which attitude was measured [38, 42, 43, 45, 47, 49, 53, 54] there was little impact. Studies including a “no screening” option resulted in less clarity on perceived benefits [42] and less positive attitude overall to colorectal cancer screening [49]. The fourteen prostate cancer screening decision aids in which the attitude was measured, all but one containing a “no screening” option, showed overall a more negative attitude toward prostate cancer screening [59–61, 65, 68, 72, 76, 77, 80–82, 84–87]. Subjective norm, or perceived social pressure to engage or not to engage in a behavior, was addressed in just five of 73 decision aids [31, 32, 47, 54, 88]. All but one of them --subjective norm decreased with one decision aid on multiple cancer screening [88]-- showed no effect. Self-efficacy was addressed in ten of 73 decision aids. It was increased with five decision aids [13, 38, 54, 65, 82], decreased in two [60, 88], and not different in three [45, 65, 83].

Preference clarification was assessed in 31 of 73 decision aids [16, 21, 23, 31–33, 36, 40–43, 45, 48–50, 52, 53, 55, 60, 61, 64, 65, 68, 74, 76–78, 80–84]. In nineteen of these, preference clarification was assessed through decreased decisional conflict, greater values clarity (e.g., subscale of decisional conflict scale), or greater informed choice (combination of knowledge, values clarity, and intent) [21, 23, 31, 32, 36, 41, 42, 45, 48, 49, 53, 74–84].

Intention was measured in 40 of 73 decision aids. Nine decision aids led to increased intention to get screened; seven of these were on colorectal cancer screening [34, 38, 46, 48, 50, 52, 54], and one each was on cervical cancer screening [13] and prostate cancer screening [86]. Decreased intention to get screened was noted in thirteen decision aids: eight of these were on prostate cancer screening [55–57, 60, 62, 63, 66, 70, 71, 80, 81, 84], two on breast cancer genetic testing [29, 33], and one each on mammogram screening [23], cervical cancer screening [12], and multiple cancer screening [88]. No difference in intention was noted in eighteen decision aids [21, 24–28, 35, 41, 42, 45, 47, 65, 67, 68, 72, 76, 82, 83, 87].

Screening behavior was assessed in 36 of 73 decision aids. Thirteen decision aids led to an increase in screening (seven colorectal [34, 39, 40, 44, 47, 50, 51], three prostate [58, 73, 87], two mammogram [14, 17], one cervical [13]), while five decision aids led to a decrease (three prostate [55, 62, 63, 84], one breast cancer genetic [30], one colorectal [49]). Eighteen decision aids showed no difference in screening.

Patient/clinician and Practice Outcomes Assessed for the Decision Aid

Many of the studies on decision aids did not address any of the issues related to shared decision making, concordance, post-visit factors, incorporation into practice, impact of the decision aid, and cost analysis. Eighteen of 73 decision aids were assessed for their effect on shared decision making. No trend for increased degree of shared decision making was noted in these eighteen studies. All studies utilized patient self-report and did not use observational measures, such as audio-recorded data, to assess shared decision making. Of note, none of the decision aids on mammogram or cervical cancer screening addressed shared decision making as a measure [12–23]. Concordance, or whether the patient and clinician agreed on a

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particular cancer screening test option, was addressed in just five of 73 decision aids [31, 32, 40, 52, 68]. It was high in the two decision aids on breast cancer genetic testing [31, 32], but only modest in the two decision aids on colorectal cancer screening [40, 52]. The single decision aid study on prostate cancer screening that addressed concordance noted that it was affected by the format of the decision aid [68].

Only two of 73 decision aid studies, both dealing with breast cancer genetic testing, considered post-visit factors as potential mediators of screening behavior [31, 32]. In both studies, patient's sharing of received materials with family was assessed, with one noting an increase [31] and the other noting no difference [32]. None of the decision aids were assessed for the effect of media, referral process for testing, and other factors that may have also affected screening. Eleven of 73 decision aids were also assessed for incorporation into practice: five on breast cancer genetic testing [25, 29–32], four on colorectal cancer screening [34, 41, 50, 51], and two on multiple cancer screening [89, 90]. The studies generally attempted to link a clinician visit to the decision aid through timing [30] or modifications to the patient's chart [31, 41, 50]. Four studies specifically dealt with how to incorporate the decision aid into usual practice [32, 51, 89, 90]. Only four of 73 decision aids were evaluated for cost of administration [22, 44, 54, 70, 71]. It varied considerably, from $2 per decision aid intervention administered for prostate cancer screening [70, 71], $53 per participant for colorectal cancer screening [54], $94 per additional patient screened for colorectal cancer [44], to $1116 or more per additional patient screened for breast cancer [22].

Discussion

Only 73 decision aids were found to have published data using our search strategies. This is a rather modest number given the many recommendations to use such tools [91, 92]. Most decision aids were evaluated with a sound research design, such as randomized controlled, 2×2 factorial, and Solomon four-group designs. The use of theoretical framework and the description of how the decision aid was developed were more variable. Our finding that just 41 of 73 decision aids (56%) used a theoretical framework is better than the findings from Durand's review, where seventeen of 50 studies (34%) were shown to have used a theoretical framework in the development of decision aids for screening and treatment [93]. However, the difference is likely due to the inclusion of other diseases and treatments in their review. When the studies in their review are limited to decision aids on cancer screening, eight of fifteen studies (53%) utilized a theoretical framework, a figure similar to ours. Having a theoretical framework is important to determine how and why a particular decision aid is effective, since it is from this framework that the measurable outcomes are derived. The presence of a framework, however, did not necessarily mean that the development of the decision aid was well described. In particular, less than a third of the studies contained enough information for the reviewers to be able to determine that a formative approach had been adopted.

The reviewed decision aids uniformly provided information about the cancer and screening tests and the benefits and risks of each screening option. In contrast, just over a third of the decision aids provided explicit values clarification exercises. Values clarification may be explicit, in that patient actions is required through an exercise, such as writing down pros and cons, answering surveys to create tailored messages, and analytical hierarchy process. It could also be implicit, such as when comparing the options in a table. It is currently unclear whether the explicit method is superior to the implicit method, although there is emerging evidence that the former may be better [94]. Regarding the provision of guidance on making decisions and communicating with the clinician, only few decision aids provided recommendations tailored to the patient. This may be better provided as part of a practice-

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based intervention, where the decision aid is just one of interventions, rather than attempting to put everything into a stand-alone tool [90].

Other than the decision aids on breast cancer genetic testing and prostate cancer screening, where the decision in question is to be screened or not, few studies provided the option of "no screening." For the decision aids on cancer screening established to be effective (e.g., cervical cancer screening, colorectal cancer screening), whether to include the option of no testing may be a delicate balance between patient autonomy and beneficence [95]. Interestingly, of the six colorectal cancer screening decision aids that had included this option, only one showed a clear decrease in screening uptake [49]. This may have occurred, because the decision aid in question provided a choice of getting a stool blood test vs. not getting one, whereas in the other five studies, the "no screening" option was listed along with two or more screening options. Thus, the study by Smith is similar to the studies of decision aids on breast cancer genetic testing and prostate cancer screening, which have been shown to decrease the test uptake. It is of interest to note that the decision aid that specifically addressed how the inclusion of a "no screening" option along with multiple screening options for colorectal cancer affected patient intent showed no difference, but also showed that the patients presented with a "no screening" option felt less clarity in making a decision [42].

Few studies included information on when to stop screening. For breast cancer genetic testing, this is understandable, since it is a one-time only test. For others, recommendations on what age to stop screening did not become available until the recent guidelines. Also, since most studies focused on a single decision making event and not multiple decisions over time, and typically had a cap on maximum age for inclusion, the issue may not have been relevant. From the perspective of incorporating a decision aid into daily practice, it may be more feasible to have a separate discussion on when to stop screening prompted through a clinician reminder system [96].

Other than knowledge, there was little consistency in the patient attributes measured as outcomes in the studies. The attributes in the Health Belief Model (e.g., perceived benefit, perceived risk) were used most frequently when assessing the positive or negative attitudes toward screening. Subjective norm and self-efficacy were rarely measured. These measures would be important in determining the contribution of the decision aids in the decision autonomy of the patients after their use. For example, patients who perceive greater social pressure (either through their family, peers, or clinician) may still be affected by others' advice after using the decision aid.

Preference clarification was most commonly assessed by the Decisional Conflict Scale [97]. This scale includes subscales of "informed" and "values clarity," which may be particularly relevant when measuring the effects of decision aids. Some studies have adopted an informed choice measurement, which is felt to be a better measure of decision quality and combines the scores of knowledge, values clarity, and intent or behavior [98]. This measurement may be increasingly adopted in the future studies on decision aids.

Just half of the studies actually measured screening uptake as an outcome. Of these, over half were by patient self-report after a variable period of time. This may be problematic, since patients tend to over-report screening behavior [99, 100]. Other studies used patient intention rather than screening uptake as the final outcome, which has even lower correlation with actual behavior than self-report [101]. Of note, ten of 73 decision aids had neither intention nor behavior as the outcome [15, 16, 20, 43, 64, 75, 77, 78, 85, 89]. There is little justification not to measure one or both of these outcomes at this time.

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Few studies have actually addressed the patient/clinician communication subsequent to the decision aid use. Since the decision aids are purported to improve shared decision making, it is surprising that there are few objective data to support such claims [1, 102]. The studies that did measure some component of shared decision making based their measurements on patient self-report. Unfortunately, they are not considered to be sufficiently objective measures compared to third-observer instruments such as OPTION, Decision Support Assessment Tool, or the Informed and Shared Decision Making instrument [103–107]. The use of these measures would require recording of the patient/clinician encounter, which would also make them available for qualitative and mixed-methods analyses, enriching the findings. Intriguing questions that may be answered through these processes include: How is patient/physician communication affected by the use of decision aids? Is sharing decision making between the patient and physician always positively impacted by decision aids? Are there instances where patient activation by decision aids may be deleterious (e.g., patient strongly inclined to use stool blood test for colorectal cancer screening but the physician strongly recommends colonoscopy; frustrated, the patient decides not to get screened)?

Even rarer than the measurement of shared decision making was the measurement of concordance. Since shared decision making allows for a decision to be deferred when an agreement is not met, it would be important to assess whether the decision aid led to increase in agreement between the patient and the clinician. Current cancer screening literature, particularly colorectal cancer screening, reveals a potential negative impact on shared decision making as the clinicians increasingly prefer colonoscopy as the test of choice, to the exclusion of considering patient preference [108]. Thus, whether patients activated through decision aids could steer the clinicians toward a more shared decision making approach and increased concordance would be an important outcome measure. Post-visit factors, such as the influence of media and family and the ease of the referral process for subsequent testing, were addressed so rarely as to be inconsequential.

The study settings and populations in which the decision aids were utilized were sufficiently variable. Thus, these decision aids would likely lead to similar results in other settings. More problematic was that the decision aids tended to be stand-alone and not integrated into the daily practice routine. This would likely limit the practical use of these decision aids. When intention to treat analysis is adopted, many studies show a very small to negligible effect by the decision aids, due to the low usage by the patients. Additionally, studies have shown that although clinicians like the concept of decision aids, they actually rarely use them in settings that are conducive to shared decision making and where publicly accessible decision aids are available [109]. Unless the decision aids incorporate risk assessment and tailor their values clarification exercises accordingly (e.g., moving from multiple options in average risk to recommending colonoscopy in increased risk patients in colorectal cancer screening), or a reminder system exists that could link patients to decision aids based on their profile, clinicians may perceive the decision aids to be too cumbersome. These barriers may not be overcome unless a more comprehensive, practice-based approach is adopted [110–113]. An excellent example of using a practice-based approach in a real-world setting is a recent publication from a large health system in Washington State. Their organizational effort to implement decision aids for hip and knee arthritis and joint replacement surgery was associated with 26 percent fewer hip replacement surgeries, 38 percent fewer knee replacements, and 12–21 percent lower costs over six months [114]. Currently, only one study has attempted at an improvement in cancer screening through practice-wide intervention, including use of decision aids [90].

What Can Practicing Physicians Do?

First, physicians need to accept that cancer screening has elements that are sensitive to patient preferences and choice. Second, it would be helpful for the physicians to know how

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to access useful decision aids. An example is the repository of decision aids available from the Ottawa Hospital Research Institute in Canada. Their website (http://decisionaid.ohri.ca/AZlist.html) contains links to high quality decision aids in various topics, including screening for all of the cancers discussed in this review. Third, many organizations offer free information to the patients in a way that may still provide them with desired information on how the cancer screening tests work and their risks and benefits. An example would be the American Cancer Society website (http://www.cancer.org), which provides the latest information on screening for breast, cervical, colorectal, and prostate cancers, among others. The barrier is how and when one uses these existing tools in a busy day. It will likely be either before or after the visit, thus unloading time and effort from the visit itself. Fourth, the state-of-the-art interactive decision aid may not be feasible in a real world practice setting at this time. This reality may be reflected in the fact that many of even the more recent studies use print rather than web-based decision aids.

With the increasing use of electronic medical records linked to patient portals, as well as advances in mobile phones and their apps, decision aids that are accessible and easily understandable may become more available in a timely manner to the patients in the near future. The features used to evaluate the studies in this review would serve as an excellent checklist of physicians to use when examining such tools.

Limitations

First, despite an exhaustive attempt to identify all published English language studies on this topic, due to the differences in current indexing practices in and among the electronic databases, we cannot ensure that we have examined all of the published English language works in this area. Some studies were published in abstracts only and could not be included due to lack of detail. Second, there are likely to be unpublished studies relevant to this area. It is unknown if the results of these studies would sway the assessment given that most unpublished studies contain negative findings. Third, the published data lacked significant details of how the decision aids work. We searched for relevant articles on their development and accessed the original tools if available, but this was possible in only a minority of the cases. It may be that some decision aids actually possess the features that we had concluded as lacking. Fourth, the published data lacked detailed information on how the decision aids were developed and how the outcomes measures were determined. Because of this, we did not rigidly apply the International Patient Decision Aids Collaboration (IPDAS) criteria to the decision aids. Of note, IPDAS is an internationally recognized scoring system of decision aid quality [115]. It measures the quality of the decision aids in ten dimensions, including information provided, description of probabilities, and availability of decision guidance. It is increasingly influential in determining how decision aids should be developed. Finally, our approach to evaluating these studies highlights the vast array of complex data that needs to be gathered and analyzed to adequately address the topics that were considered. For many investigators, collecting such quantity and diversity of data may have been beyond their funding, resources, or skill set. It also may not be well reviewed at study sections that place a priority on focused research questions. In addition, many investigators' research team lacks expertise in certain areas not addressed. The collection of adequate data also may create too much burden on the study participants, which would limit accrual and follow-up. Thus, the ideal studies would be a series of studies expanding the focus and further refining the intervention, which we did not find.

Unique Features of Our Review

Many high quality reviews are available on decision aids [1, 116, 117]. Our review is unique, because it focused on cancer screening and measurable outcomes based on a theoretical framework. In particular, our review elucidated that few decision aids on cancer

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screening actually evaluated their effect on patient's entire decision making process, including shared decision making, and reaching concordance with their clinician. Our review showed where further research is needed, as we detail below. Among the most important would be: having a theoretical framework so that appropriate outcomes are measured, objective assessment of shared decision making, and attention to applicability in other settings.

Suggestions for Future Research

1. A strong theoretical framework should support the decision aid and guide its development as well as measurement outcomes. There should be a clear correlation between the theoretical framework and the measured outcomes.
2. There should be more studies that critically compare explicit vs. implicit values clarification.
3. An objective measure of screening uptake (e.g., paper chart review, extraction of electronic health record data) should be adopted to assess the effectiveness of the decision aid.
4. Shared decision making between the patient and the clinician should be recorded and objectively measured by validated tools.
5. Other potential mediators that temporally occur after the patient's decision aid use, such as media and family influence, should be considered.
6. How decision aids would fare as part of meaningful use in primary care practices should be assessed through better integration into practice and a broader, practice-based approach to measure effectiveness.
7. To address applicability in real-world settings, studies should continue to be performed in heterogeneous community practice settings, utilizing practice-based research networks.
8. Long-term effectiveness and viability should be addressed, including the effect on repeated screening and cost-effectiveness and cost-benefit analyses.
9. With the advent of more options in breast and cervical cancer screening and the need for even better informed and shared decision making in prostate cancer screening with the advent of conflicting guidelines, there are even more opportunities for decision aids to be useful in the setting of cancer screening.

Conclusion

Decision aids are here to stay. Although much research needs to be done to determine what really makes for an effective decision aid, practical applications are already occurring. Many decision aids are now available free of charge. Clinicians are encouraged to explore them, select those that fit best with their current understanding of the topic in question, and apply them to their practice workflow in a creative way.

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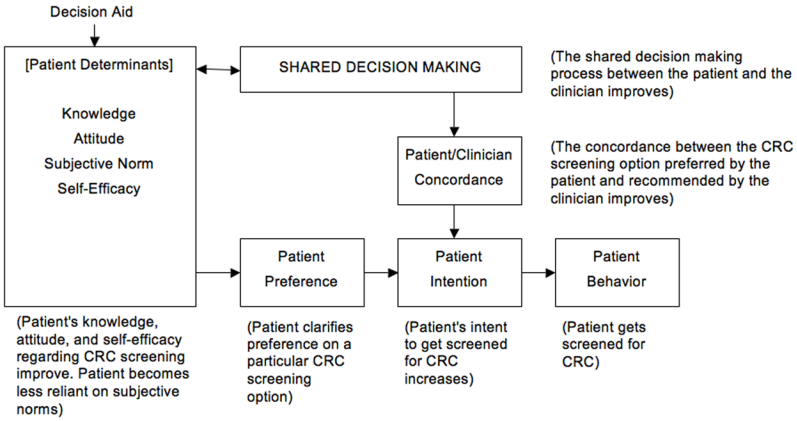

Figure 1.

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Table 1

Characteristics of Identified Studies on Decision Aids

Author & Year*	Screening Options	Target Population**	Design	Setting	Follow-up Duration
Breast Cancer Mammogram Screening (n=9)					
Kadison 1998 [14]	BSE, CBE, MMG	Women aged 22–75 years	Longitudinal uncontrolled study: Interactive voice response risk assessment (initially n=343; follow-up n=189)	2 companies in US	8 months
Street 1998 [15]	MMG	Women aged 40–75 years	RCT: Computer-based multimedia DA (n=54) vs. print DA (n=54)	2 primary care clinics in US	Immediate
Lawrence 2000 [16]	MMG	Women aged 49–89 years	One-time uncontrolled intervention: Print DA (n=103)	1 medical school, 1primary care clinic, & 1 community center in US	Immediate
Valdez 2001 [17]	MMG	Hispanic women aged ≥40 years	Parallel-group randomized experimental design (pre- vs. post): Computer kiosk-based DA (n=269)	5 clinics and 1 community-based organization in US	4 months
Rimer 2001 [18], 2002 [19]	MMG	Women aged 40–44 and 50–54 years	3-arm RCT: Tailored print newsletter + telephone counseling (n=339) + tailored print newsletter (n=374) + usual care (n=378)	1 state-based health insurance membership in US	24 months
Lewis 2003 [20]	MMG	Women aged 35–49 years	3-arm RCT: Positive video (n=64) vs. neutral video (n=54) vs. negative video (n=60)	University-based general medicine clinic in US	Immediate
Mathieu 2007 [21]	MMG	Women aged 70–71 years	RCT: Print DA (n=367) vs. Usual care (n=367)	Communities in Australia	1 month
Vernon 2008 [22]	MMG	Women aged ≥52 years	3-arm RCT: Tailored print + targeted print intervention (n=1803) + targeted print intervention only (n=1857) + usual care (n=1840)	National veteran registry in US	2 years
Mathieu 2010 [23]	MMG	Women aged 38–45 years	RCT: Immediate web-based DA (n=189) vs. delayed web-based DA (n=223)	Online recruitment in Australia	Immediate
Breast Cancer Genetic Testing (n=9)					
Lerman 1997 [24]	BRCA testing	Women aged 18–75 years with family history of breast or ovarian cancer	3-arm RCT: Print DA + counseling (n=122) + print DA (n=114) only vs. waiting list control (n=164)	2 cancer centers in US	1 month
Green 2001 [25]	BRCA testing	Women aged 19–59 years with family history of breast cancer	3-arm RCT: Interactive, multi-media CD-ROM DA + counseling (n=29) vs. counseling (n=29) vs. usual care (n=14)	1 federal research facility in US	Immediate
Schwartz 2001 [26]	BRCA testing	Ashkenazi Jewish women aged 18–83 years	RCT: Print DA (n=191) vs. Usual care (n=190)	Religious organization in	1 month

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Author & Year*	Screening Options	Target Population**	Design	Setting	Follow-up Duration
Green 2004 [27], 2005 [28]	BRCA testing	Women aged 24–77 years with personal or family history of breast cancer	RCT: Interactive, multi-media CD-ROM DA + counseling (n=106) vs. counseling(n=105)	5 university hospitals & 1 community hospital in US	6 months
Miller 2005 [29]	BRCA testing	Women aged ≥18 years	RCT: Print DA vs. usual care (total n=279)	1 federal research facility in US	6 months
Wang 2005 [30]	BRCA testing	Women aged 22–76 years	2×2 factorial design: CD-ROM DA + counselor feedback (n=50) vs. CD-ROM DA only (n=50) vs. counselor feedback only (n=49) vs. usual care (n=48)	1 university-based cancer clinic in US	Immediate
Wakefield 2008a [31]	BRCA testing	Women aged ≥18 years with family history of breast/ovarian cancer	RCT: Print DA (n=73) vs. Control pamphlet (n=72)	5 cancer clinics in Australia	6 months
Wakefield 2008b [32]	BRCA testing	Women aged ≥18 years with family history of breast/ovarian cancer	RCT: Detailed print DA (n=73) vs. Contorl pamphlet (n=75)	5 cancer clinics in Australia	6 months
Gray 2009 [33]	BRCA testing	Women aged 18–70 years with personal/family history of breast or ovarian cancer	3-arm RCT: Website with risk information on BRCA testing attributed to experts (n=98) vs. not attributed (n=93) vs. no risk information (n=93)	1 university-based research facility in US	Immediate
Cervical Cancer Screening (n=2)					
Adab 2003 [12]	Cervical cytology	Women aged 20–64 years	RCT: Leaflet with risks & uncertainties (n=155) vs. standard leaflet (n=145)	3 general practices in United Kingdom	Immediate
Park 2005 [13]	Cervical cytology	Women of unknown ages	Nonequivalent, control group, post-test only design: DA (n=48) vs. usual care (n=48)	1 church in Korea	Immediate
Colorectal Cancer Screening (n=21)					
Pignone 2000 [34]	SBT, FS, SBT+FS	Men & women aged 50–75 years	RCT: Video DA (n=125) vs. usual care (n=124)	3 community primary care practices in US	3–6 months
Wolf 2000 [35]	SBT, FS, SBT+FS	Men & women ≥65 years	3-arm RCT: Absolute risk script (n=136) vs. relative risk script (n=130) vs. control script (n=133)	4 general internal medicine practices (1 university, 3 community) in US	Immediate
Dolan 2002 [36]	SBT, FS, SBT+FS, BE, COL	Men & women aged 50–83 years	RCT: Print DA (n=50) vs. Usual care (n=47)	1 community and 1 university-based internal medicine clinc in US	Immediate
Zapka 2004 [37]	FS	Men & women aged 50–74 years	RCT: Educational video (n=450) + mailing vs. no video (n=488)	5 primary care practices in US	6 months
Jerant 2007 [38]	SBT, FS, COL	Men & women aged ≥50 years	RCT: Tailored multimedia computer program (n=24) vs. non-tailored program (n=25)	6 community family practices in US	Immediate
Myers 2007 [39]	SBT, SBT+FS	Men & women aged 50–74 years	4-arm RCT: Tailored print + phone counseling (n=386) vs. tailored print	1 university-based family practice in US	24 months

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Author & Year*	Screening Options	Target Population**	Design	Setting	Follow-up Duration
			(n=386) vs. non-tailored print (n=387) vs. usual care (n=387)		
Ruffin 2007 [40]	SBT, FS, SBT+FS, BE, COL	Men & women never screened for CRC, aged 50–70 years	RCT: Interactive website (n=87)vs. standard website (n=87)	3 communities (urban, suburban, rural) in US	24 weeks
Griffith 2008a [41]	SBT, FS, SBT+FS, BE, COL (SBT, COL in 2-option)	Men & women aged 48–75 years	RCT: 5-option DVD DA (n=25) vs. 2-option DVD DA (n=37)	1 university-based research facility in US	Immediate
Griffith 2008b [42]	SBT, FS, SBT+FS, BE, COL	Men & women aged 50–85 years	RCT: 5-option + no screening option video DA (n=57) vs. 5-option video DA (n=49)	3 communities in US	Immediate
Katsumura 2008 [43]	SBT, COL	Men & women aged 40–59 years	RCT: Internet-based information + risk information (n=146) vs. internet-based information only (n=139)	1 internet community in Japan	Immediate
Lewis 2008 [44]	SBT, FS, COL	Men & women aged 50–75 years	RCT: Mailed print DA (n=137) + waiting list control (n=100)	University-based general medicine clinic in US	5 months
Trevena 2008 [45]	SBT	Men & women aged 50–74 years	RCT Print DA (n=157) vs. government guidelines (n=157)	6 community family practices in Australia	1 month
Makoul 2009 [46]	SBT, FS, COL	Hispanic men & women aged 50–80 years	Pre-test/post-test design: Computer kiosk DA (n=270)	2 community clinics in US	Immediate
Manne 2009 [47]	COL	Men & women with family history of CRC	3-arm RCT: Tailored print + telephone counseling (n=112) vs. tailored print (n=161) vs. standard print (n=139)	26 medical centers in US	6 months
Lewis 2010 [48]	SBT, COL	Men & women aged 75–95 years	One-time uncontrolled intervention: Print DA (n=46)	1 senior center in US	Immediate
Smith 2010 [49]	SBT	Men & women with low educational attainment, aged 55–64 years	3-arm RCT: Print & DVD DA + question prompt list (n=196) vs. print & DVD DA only (n=188) vs. standard information (n=188)	Community in Australia	3 months
Miller 2011 [50]	SBT, FS, COL	Men & women aged 50–74 years	RCT: Web-based DA (n=132) vs. usual care (n=132)	1 community internal medicine clinic in US	24 weeks
Pignone 2011 [51]	SBT, FS, SBT+FS, BE, COL	Men & women aged 52–80 years	Clustered RCT: DVD/VHS DA (n=211) + academic detailing of practices vs. usual care (n=232)	32 primary care practices participating in a single health insurance plan in US	12 months
Schroy 2011 [52]	SBT, FS, SBT+FS, BE, COL	Men & women aged 50–75 years	3-arm RCT: DVD DA + personalized risk assessment (n=223) vs. DVD DA (n=212) vs. usual care (n=231)	1 university-based internal medicine clinic & 1 community health center in US	Immediate
Steckelberg 2011 [53]	SBT, COL	Men & women aged 50–75 years	RCT: Print DA with risk information (n=785) vs. print standard information (n=792)	Health insurance membership in Germany	6 months

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Author & Year*	Screening Options	Target Population**	Design	Setting	Follow-up Duration
Vernon 2011 [54]	SBT, FS, BE, COL	Men & women aged 50–70 years	3-arm RCT: Tailored website (n=413) vs. non-tailored website (n=398) vs. usual care (n=413)	1 university-based clinic in US	24 months
Prostate Cancer Screening (n=29)					
Flood 1996 [55]	PSA	Men aged ≥50 years	RCT: Educational videotape (n=184) vs. control videotape (n=188)	1 university hospital in US (free screening program and clinic)	Immediate
Wolf 1996 [56], 1998 [57]	PSA	Men aged ≥50 years	RCT: Scripted DA (n=103) vs. usual care (n=102)	4 university-affiliated primary care practices in US	Immediate
Myers 1999 [58]	PSA, DRE	Men aged 40–70 years	RCT: Print information + tailored information (n=192) vs. print information (n=221) only	1 university-based clinic in US	1 year
Schapira 2000 [59]	PSA, DRE	Men aged 50–80 years	RCT: Print DA with detailed risk description (n=122) vs. print information without (n=135)	1 VA clinic in US	2 weeks
Frosch 2001 [60]	PSA	Men aged ≥50 years	2×2 factorial design: Shared decision making video + discussion on risks and benefits (n=42) vs. video only (n=46) vs. discussion only (n=45) vs. usual care (n=43)	1 community hospital in US	Immediate
Wilt 2001 [61]	PSA, DRE	Men aged ≥50 years	RCT: Mailed print DA (n=180) + survey vs. usual care (n=195)	1 VA primary care clinic in US	1 year
Volk 1999 [62], 2003 [63]	PSA	Men aged 45–70 years	RCT: Video DA before doctor visit (n=80) vs. information booklet 2 weeks after doctor visit (n=80)	1 university-based family medicine clinic	1 year
Frosch 2003 [64]	PSA	Men aged ≥50 years	RCT: Web-based DA (n=114) vs. video DA (n=112)	1 community hospital in US	Immediate
Gattellari 2003 [65]	PSA, DRE	Men aged 40–70 years	RCT: Print DA (n=126) vs. conventional pamphlet (n=122)	13 general practices in Australia	3 days
Ruthman 2004 [66]	PSA	Men aged 50–80 years	Staged 2-group pre-/post-test quasi-experimental design: Video DA (n=52) vs. usual care (n=52)	1 VA clinic in US	Immediate
Sheridan 2004 [67]	PSA	Men aged 45–85 years	One-time uncontrolled intervention with pre-/post-tests: print DA (n=188)	1 university-based internal medicine clinic in US	Immediate
Gattellari 2005 [68]	PSA	Men aged 50–70 years	3-arm RCT: Video DA (n=141) vs. print DA (n=140) vs. conventional leaflet (n=140)	1 large community in Australia	≥7 days
Myers 2005 [69]	PSA, DRE	African American aged 40–69 years	RCT: Print DA + educational session (n=121) vs. print DA only (n=121)	3 community primary care practices in US	6–11 months
Partin 2004 [70], 2006 [71]	PSA	Men aged ≥50 years	3-arm RCT: Video DA (n=308) vs. print DA (n=295) vs. usual care (n=290)	4 VA clinics in US	1 year

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Author & Year*	Screening Options	Target Population**	Design	Setting	Follow-up Duration
Watson 2006 [72]	PSA	Men aged 40–75 years	RCT: Print DA + survey (n=980) vs. usual care (n=980)	11 general practices in United Kingdom	Immediate
Kripalani 2007 [73]	PSA, DRE	Men aged 45–70 years	3-arm RCT: Detailed educational print (n=101) vs. simple educational print (n=101) vs. usual care (n=101)	1 academic teaching hospital in US	Immediate
Krist 2007 [74]	PSA	Men aged 50–70 years	3-arm RCT: Web-based DA (n=226) vs. print DA (n=196) vs. usual care (n=76)	1 community family practice in US	2 weeks
Ellison 2008 [75]	PSA, DRE	African American men aged 40–65 years	RCT: Web-based DA tailored to family history of prostate cancer (n=46) vs. web-based non-tailored DA (n=41)	1 annual mason convention in US	Immediate
Ilic 2008 [76]	PSA	Men never screened for prostate cancer, aged >45 years	3-arm RCT: Web-based education (n=56) vs. video-based education (n=55) vs. print-based education (n=50)	5 states in Australia	1 week
Stephens 2008 [77]	PSA, DRE	African American men aged 40–70 years and non-African American men aged 50–70 years	Solomon 4-group design: Pre-test + print DA + post-DA process measures + post-test (n=50) vs. DA booklet + post-DA process measures + post-test (n=50) vs. pre-test + post-test (n=50) vs. post-test only (n=50)	10 urban professional research facilities in US	Immediate
Volk 2008 [78]	PSA, DRE	African American men aged 40–70 years, non-African American men aged 50–70 years	RCT: Computer-based interactive DA (n=224) vs. print DA + CD (n=226)	2 primary care clinics in US	2 weeks
Weinrich 2008 [79]	PSA, DRE	African American men aged 40–70 years, Caucasian men aged 50–70 years	Post-intervention, quasi-experimental design: Enhanced DA (print DA + physician and peer pictures and statements; n=120) vs. print DA only (n=110)	4 urban communities in US	Immediate
Frosch 2008 [80], (Bhatnagar 2009 [81])	PSA	Men aged ≥50 years	2×2 factorial design: Didactic DA + chronic disease trajectory (n=152) vs. DA only (n=155) vs. chronic disease trajectory only (n=153) vs. control (public websites on prostate cancer; n=151)	1 community hospital in US	2–3 weeks
Allen 2009 [82]	PSA, DRE	African American men ≥50 years	Pre-/post-test quasi-experimental design: Computerized-tailored DA (n=108)	Multiple community settings in US	Immediate
Allen 2010 [83]	PSA	Men aged ≥45 years	RCT: Computerized-tailored DA (n=398) vs. no intervention (n=414)	12 work sites in US	3 months
Joseph-Williams 2010 [84]	PSA	Men never screened with PSA, aged 50–75 years	4-arm RCT: Web-based DA (n=129) vs. print DA (n=126) vs. surveys only (n=127) vs. usual care (n=132)	1 community in United Kingdom	6 months
Rubel 2010 [85]	PSA	Non-African American men aged 50–70 years	Solomon 4-group design: Pre-test + print DA + post-test (n=50) vs. print DA + post-test (n=50) vs. pre-test + post-test (n=50) vs. post-test only (n=50)	5 professional research facilities in US	Immediate

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Author & Year*	Screening Options	Target Population**	Design	Setting	Follow-up Duration
Van Vugt 2010 [86]	PSA	Men never screened with PSA, aged 55–65 years	One-time uncontrolled intervention with pre-/post-tests: print DA (n=729)	1 city in Netherlands	Immediate
Capik 2012 [87]	PSA, DRE	Turkish men aged 41–65 years	Pre-/post-test longitudinal study: web-assisted education and reminders (n=110)	2 public institutions in Turkey	6 months
Multiple Cancer Screening (n=3)					
Frosch 2008 [88]	Prostate: PSA; colorectal: not specified	Men and women aged ≥50 years except African American men, who were aged ≥45 years	Sequential distribution of information brochure and video DA: video DA (n=100) vs. information brochure (n=107)	13 community-based primary care practices in US	Immediate
Brackett 2010 [89]	Prostate: PSA; colorectal: not specified	Men aged 50–75 years for prostate cancer; men & women aged 50–75 years for CRC	4 video DA distribution methods: Automatic pre-visit DA mailing (n=1625), pre-visit video DA mailing upon request (n=84), post-visit video DA offered by medical assistant (n=724), post-visit video DA offered by physician (n=52)	1 rural university hospital and 1 rural VA hospital in US	Immediate
Krist 2012 [90]	Prostate: PSA; breast, cervical, colorectal: not specified	Men & women aged 18–75 years	RCT: Interactive preventive health record that includes DAs pertinent to the patient's indicated cancer screening (n=2250) vs. usual care (n=2250)	8 primary care practices in US	16 months

Abbreviations:

BE: Barium Enema

BSE: Breast Self-Examination

CBE: Clinical Breast Examination

COL: Colonoscopy

CRC: Colorectal Cancer

DA: Decision Aid

DRE: Digital Rectal Examination

FS: Flexible Sigmoidoscopy

MMG: Mammogram

PSA: Prostate Specific Antigen

RCT: Randomized Controlled Trial

SBT: Stool Blood Test

US: United States

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VA: Veterans Administration

* Listed in ascending order of the year of publication for each cancer.

** All target populations were patients, not clinicians.

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Table 2

Content of Decision Aids

Author & Year*	Theoretical Framework	Description of Development	Provision of Information	Risks & Benefits	Values Clarification Exercise	Guidance on Decision Making & Communication	Addresses Option of No Screening	Addresses When to Stop Screening
Breast Cancer Mammogram Screening (n=9)								
Kadison 1998 [14]	None	Literature review, peer-review, pre-test	Yes	No	No	Yes	No	No
Street 1998 [15]	Transtheoretical model, elaboration likelihood model	Pilot test	Yes	No	No	No	No	No
Lawrence 2000 [16]	None	Content development by multidisciplinary team and lay women; reliability & validity testing	Yes	Yes	No	No	No	No
Valdez 2001 [17]	Social learning theory	Expert consultation, key informant interviews, focus groups	Yes	No	No	Yes	No	No
Rimer 2001 [18], 2002 [19]	Transtheoretical model, precaution adoption process model	Tailored messages based on baseline survey findings	Yes	Yes	Yes	Yes	Yes	No
Lewis 2003 [20]	None	Literature review, pre-test	Yes	Yes	No	No	Yes	No
Mathieu 2007 [21]	Ottawa decision support framework	Markov model, pilot test	Yes	Yes	Yes	Yes	Yes	Yes
Vernon 2008 [22]	Transtheoretical model, health belief model, social cognitive theory, theory of planned behavior	Targeted: Focus groups Tailored: Tailored messages based on baseline survey findings	Yes	Yes	Yes	Yes	No	No
Mathieu 2010 [23]	Ottawa decision support framework	Markov model, pilot test	Yes	Yes	Yes	Yes	Yes	No
Breast Cancer Genetic Testing (n=9)								
Lerman 1997 [24]	Behavioral models of decision-making	Structural protocol	Yes	Yes	No	No	Yes	No
Green 2001 [25]	None	Provides same information as the genetic counselors	Yes	Yes	Yes	Yes	Yes	No
Schwartz 2001 [26]	None	N/A	Yes	Yes	No	No	Yes	No
Green 2004 [27], 2005 [28]	None	Provides same information as the genetic counselors	Yes	Yes	Yes	No	Yes	No
Miller 2005 [29]	Cognitive-social health processing model	Formative evaluation: Interviews, focus groups	Yes	Yes	No	Yes	Yes	No
Wang 2005 [30]	None	Collaboration between content experts and health-related media experts	Yes	Yes	No	Yes	Yes	No
Wakefield 2008a [31]	Ottawa decision support framework	Content analysis, pilot test	Yes	Yes	Yes	Yes	Yes	No
Wakefield 2008b [32]	Ottawa decision support framework	Content analysis, pilot test	Yes	Yes	Yes	Yes	Yes	No
Gray 2009 [33]	Cognitive-social theory	Literature review, expert consultation, pre-test	Yes	Yes	No	No	Yes	No

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Author & Year*	Theoretical Framework	Description of Development	Provision of Information	Risks & Benefits	Values Clarification Exercise	Guidance on Decision Making & Communication	Addresses Option of No Screening	Addresses When to Stop Screening
Cervical Cancer Screening (n=2)								
Adab 2003 [12]	None	Added information on risks and uncertainties to the National Health Service Cervical Screening Programme leaflet	Yes	Yes	No	No	No	No
Park 2005 [13]	Health belief model, theory of reasoned action, self-efficacy theory	Developed from focus groups	Yes	Yes	No	No	No	No
Colorectal Cancer Screening (n=21)								
Pignone 2000 [34]	Transtheoretical model	Patient preference checking, focus groups	Yes	Yes	No	Yes	No	No
Wolf 2000 [35]	None	Physician panel, pilot testing	Yes	Yes	No	No	Yes	No
Dolan 2002 [36]	Analytic hierarchy process	Structured interviews, feasibility testing	Yes	Yes	Yes	Yes	Yes	No
Zapka 2004 [37]	PRECEDE/PROCEED model, social cognitive theory	Literature review	Yes	Yes	No	No	No	No
Jerant 2007 [38]	Transtheoretical model	Personally tailored feedback messages	Yes	Yes	Yes	No	No	No
Myers 2007 [39]	Preventive health model	Tailored messages based on baseline survey findings	Yes	Yes	Yes	No	No	No
Ruffin 2007 [40]	Elaboration likelihood model	Developed empirically from 10 focus groups and 30 patient interviews	Yes	Yes	Yes	Yes	No	No
Griffith 2008a [41]	Transtheoretical model	Previous DA, literature review, usability testing	Yes	Yes	No	Yes	No	No
Griffith 2008b [42]	Transtheoretical model	Previous DA, literature review, focus groups, expert/patient review	Yes	Yes	No	Yes	Yes	No
Katsumura 2008 [43]	Analytic hierarchy process	Construction of decision model	Yes	Yes	Yes	No	No	No
Lewis 2008 [44]	None Decision Aid Standard	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	No	No
Trevena 2008 [45]	Theory of planned behavior	Incorporated research-derived expert & lay beliefs	Yes	Yes	Yes	Yes	No	No
Makoul 2009 [46]	Extended parallel process model	Patient interviews & focus groups, usability testing	Yes	Yes	No	Yes	No	No
Manne 2009 [47]	Health belief model, transtheoretical model, dual process theory	Construction of tailored messages	Yes	Yes	No	No	No	No
Lewis 2010 [48]	Ottawa decision support framework	Literature review, patient interviews, cognitive testing	Yes	Yes	Yes	No	Yes	No
Smith 2010 [49]	None	Specific design for adults with low literacy skills, using plain language and basic design, focus groups	Yes	Yes	Yes	Yes	Yes	No
Miller 2011 [50]	Transtheoretical model	Previous DA, literature review, usability testing	Yes	Yes	No	Yes	No	No

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Author & Year*	Theoretical Framework	Description of Development	Provision of Information	Risks & Benefits	Values Clarification Exercise	Guidance on Decision Making & Communication	Addresses Option of No Screening	Addresses When to Stop Screening
Pignone 2011 [51]	Transtheoretical model	Previous DA, literature review, usability testing	Yes	Yes	No	Yes	No	No
Schroy 2011 [52]	Ottawa decision support framework	Literature review, existing DA review, expert opinion, focus groups, usability testing	Yes	Yes	Yes	Yes	No	No
Steckelberg 2011 [53]	United Kingdom Medical Research Council framework for complex intervention	Literature review, focus groups, expert review	Yes	Yes	No	No	Yes	No
Vernon 2011 [54]	Transtheoretical model	Intervention mapping, incorporating theory and empiric evidence	Yes	Yes	Yes	No	No	No
Prostate Cancer Screening (n=29)								
Flood 1996 [55]	None	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes	No
Wolf 1996 [56], 1998 [57]	None	Physician panel review, pilot testing	Yes	Yes	No	No	Yes	Yes
Myers 1999 [58]	Preventive health model	Tailored messages based on baseline survey findings	Yes	Yes	Yes	Yes	Yes	No
Schapira 2000 [59]	Health belief model	Focus groups	Yes	Yes	No	No	Yes	No
Frosch 2001 [60]	None	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes	No
Wilt 2001 [61]	None	Expert review, content validity check, readability pre-testing	Yes	Yes	No	No	Yes	No
Volk 1999 [62], 2003 [63]	None	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes	No
Frosch 2003 [64]	None	Conversion of a video DA (Frosch 2001) to web-based DA	Yes	Yes	No	Yes	Yes	No
Gattellari 2003 [65]	None	Literature review, pilot testing	Yes	Yes	Yes	Yes	Yes	No
Ruthman 2004 [66]	None	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes	No
Sheridan 2004 [67]	None	Literature review, cognitive interviewing and feedback	Yes	Yes	No	No	Yes	No
Gattellari 2005 [68]	None	Literature review, pilot testing	Yes	Yes	Yes	Yes	Yes	No
Myers 2005 [69]	Preventive health model	Tailored messages based on baseline survey findings	Yes	Yes	Yes	Yes	Yes	No
Partin 2004 [70], 2006 [71]	Social cognitive theory	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes	No
Watson 2006 [72]	None	Expert review, field testing	Yes	Yes	No	Yes	Yes	No
Kripalani 2007 [73]	None	Multi-disciplinary team design, pilot testing	Yes	Yes	No	Yes	Yes	No

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Author & Year*	Theoretical Framework	Description of Development	Provision of Information	Risks & Benefits	Values Clarification Exercise	Guidance on Decision Making & Communication	Addresses Option of No Screening	Addresses When to Stop Screening
Krist 2007 [74]	None	Expert review	Yes	Yes	No	No	No	No
Ellison 2008 [75]	None	Based on Cochrane Review's definition of DA	Yes	Yes	No	No	Yes	No
Ilic 2008 [76]	None	N/A	Yes	Yes	No	No	Yes	No
Stephens 2008 [77]	Prostate cancer screening decisional conflict model	Created by the Centers for Disease Control & Prevention	Yes	Yes	No	Yes	Yes	No
Volk 2008 [78]	None	Integration of didactic soap-opera episodes with interactive learning modules	Yes	Yes	Yes	No	Yes	No
Weinrich 2008 [79]	Social learning theory	Previous research findings, community feedback	Yes	Yes	No	Yes	Yes	No
Frosch 2008 [80], (Bhatnagar 2009 [81])	Chronic disease model	Literature review, healthcare professional feedback, patient usability testing	Yes	Yes	Yes	No	Yes	No
Allen 2009 [82]	Ottawa decision support framework	Expert opinion & published research findings	Yes	Yes	Yes	Yes	Yes	No
Allen 2010 [83]	Ottawa decision support framework	Expert opinion, International Patient Decision Aid Standards, focus groups, usability testing	Yes	Yes	Yes	Yes	Yes	No
Joseph-Williams 2010 [84]	None	Expert review, field testing	Yes	Yes	Yes	Yes	Yes	No
Rubel 2010 [85]	None	Created by the Centers for Disease Control & Prevention	Yes	Yes	No	No	Yes	No
Van Vugt 2010 [86]	None	Based on screening results of 6288 men	Yes	Yes	No	No	Yes	No
Capik 2012 [87]	Health belief model	Literature review	Yes	No	No	Yes	No	No
Multiple Cancer Screening (n=3)								
Frosch 2008 [88]	None	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes (for prostate cancer screening)	No
Brackett 2010 [89]	None	Literature review, patient focus groups, patient & expert review	Yes	Yes	No	Yes	Yes (for prostate cancer screening)	No
Krist 2012 [90]	None	Efficacy, adoption and dissemination trials	Yes	Yes	No	Yes	Yes (for prostate cancer screening)	No

*Listed in ascending order of the year of publication for each cancer.

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Table 3

Patient Outcomes Assessed for the Decision Aids

Author & Year**	Knowledge	Attitude	Subjective Norm	Self-Efficacy	Preference Clarification	Intention	Screening Behavior
Breast Cancer Mammogram Screening (n=9)							
Kadison 1998 [14]	N/A	N/A	N/A	N/A	N/A	N/A	Self-report: Increased BSE, CBE, but MMG not increased
Street 1998 [15]	No difference	No difference in personal importance or anxiety	N/A	N/A	N/A	N/A	N/A
Lawrence 2000 [16]	N/A	N/A	N/A	N/A	Less preference on MMG, weaker feeling towards their own decision regarding MMG	N/A	N/A
Valdez 2001 [17]	N/A	N/A	N/A	N/A	N/A	N/A	Self-report: 51% had completed or scheduled MMG
Rimer 2001 [18], 2002 [19]	Increased for tailored print + telephone counseling vs. usual care; not increased for tailored print vs. usual care	Increased risk perception	N/A	N/A	N/A	N/A	Self-report: No difference
Lewis 2003 [20]	No difference	No change or difference in perception of benefits & harms	N/A	N/A	N/A	N/A	N/A
Mathieu 2007 [21]	Increased	N/A	N/A	N/A	Greater values clarity and informed choice	No difference	Self-report: No difference
Vernon 2008 [22]	N/A	N/A	N/A	N/A	N/A	N/A	Self-report: No difference
Mathieu 2010 [23]	Increased	No difference in perceived benefits & harms or anxiety	N/A	N/A	No difference in informed choice	Decreased	N/A
Breast Cancer Genetic Testing (n=9)							
Lerman 1997 [24]	Increased	Decreased perceived personal risk; increased perceived limitations; no difference in perceived benefits	N/A	N/A	N/A	No difference	N/A
Green 2001 [25]	Increased	N/A	N/A	N/A	N/A	No difference	N/A
Schwartz 2001 [26]	Increased	No difference in perceived benefits; increased perceived risk	N/A	N/A	N/A	No difference	N/A

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Author & Year**	Knowledge	Attitude	Subjective Norm	Self-Efficacy	Preference Clarification	Intention	Screening Behavior
Green 2004 [27], 2005 [28]	Increased in low risk group; no difference in high risk group	Greater decrease in absolute risk perception in low risk group; no difference in high risk group; no difference in decrease in relative risk perception; greater decrease in anxiety	N/A	N/A	N/A	No difference	Self-report: No difference
Miller 2005 [29]	No difference	N/A	N/A	N/A	N/A	Decreased in average risk, increased in high risk	N/A
Wang 2005 [30]	Increased	Worry declined	N/A	N/A	N/A	N/A	Chart audit: Decreased
Wakefield 2008a [31]	Increased	No difference in distress (e.g., intrusive & avoidant thoughts, anxiety, depression)	No difference in perceived family involvement in decision-making	N/A	No difference in Decisional Conflict Scale except for Informed subscale (more informed); no difference in informed choice or decisional regret	N/A	Self-report: No difference
Wakefield 2008b [32]	Increased	No difference in distress (e.g., intrusive & avoidant thoughts, anxiety, depression)	No difference in perceived family involvement in decision-making	N/A	No difference in Decisional Conflict Scale except for Informed subscale (more informed) and Clear Values subscale (clearer values); no difference in informed choice or decisional regret	N/A	Self-report: No difference
Gray 2009 [33]	N/A	Decrease in positive beliefs; no difference in trust in internet testing or belief that internet testing is wise	N/A	N/A	Increased preference for clinic testing rather than direct-to-consumer testing	Decreased	N/A
Cervical Cancer Screening (n=2)							
Adab 2003 [12]	N/A	N/A	N/A	N/A	N/A	Decreased	N/A
Park 2005 [13]	Increased	Decreased perception of procedural barriers & cognitive barriers; increased perceived benefit of Pap test; no difference in perceived susceptibility & seriousness	N/A	Increased	N/A	Increased	Self-report: Increased
Colorectal Cancer Screening (n=21)							
Pignone 2000 [34]	N/A	N/A	N/A	N/A	N/A	Increased	Chart review: Screening ordering & completion increased

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Author & Year**	Knowledge	Attitude	Subjective Norm	Self-Efficacy	Preference Clarification	Intention	Screening Behavior
Wolf 2000 [35]	Increased	N/A	N/A	N/A	N/A	No difference	N/A
Dolan 2002 [36]	N/A	N/A	N/A	N/A	Decisional conflict decreased	N/A	Chart review: No difference
Zapka 2004 [37]	N/A	N/A	N/A	N/A	N/A	N/A	Self-report: No difference
Jerant 2007 [38]	No difference	No difference in perceived benefits & barriers	N/A	Increased	N/A	Increased	N/A
Myers 2007 [39]	N/A	N/A	N/A	N/A	N/A	N/A	Review of chart, billing, laboratory database: Increased
Ruffin 2007 [40]	N/A	N/A	N/A	N/A	Increased	N/A	Self-report: Increased
Griffith 2008a [41]	No difference	N/A	N/A	N/A	No difference in decisional conlict & satisfaction	No difference	N/A
Griffith 2008b [42]	No difference	Less clarity on benefits & downsides with DA that included “no screen” option	N/A	N/A	Less clarity on help in making a decision with DA that included “no screen” option	No difference	N/A
Katsumura 2008 [43]	N/A	Higher priority on “avoiding disadvantage” in Internet-based information plus risk	N/A	N/A	Less preference for COL	N/A	N/A
Lewis 2008 [44]	N/A	N/A	N/A	N/A	N/A	N/A	Chart review: Increased
Trevena 2008 [45]	Increased	No difference in anxiety	N/A	No difference in perceived behavioral control	Increase in decisions that were informed and had clear values	No difference	Self-report: No difference
Makoul 2009 [46]	Increased	N/A	N/A	N/A	N/A	Increased	N/A
Manne 2009 [47]	Not a mediator	Not mediators: perceived risk, severity, preventability	Not mediators: physician & family support	N/A	N/A	Partial mediator: decisional balance	Self-report with clinician confirmation: Increased
Lewis 2010 [48]	Increased	N/A	N/A	N/A	Decisional conflict decreased	Increased	N/A
Smith 2010 [49]	Increased	Less positive; No difference in worry about CRC	N/A	N/A	Increased informed choice; decreased decisional conflict; no difference in decisional satisfaction or confidence	N/A	Laboratory database: Decreased
Miller 2011 [50]	N/A	N/A	N/A	N/A	Report of test preference increased	Increased	Chart review: Screening ordering & completion increased
Pignone 2011 [51]	N/A	N/A	N/A	N/A	N/A	N/A	Self-report: Increased

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Author & Year**	Knowledge	Attitude	Subjective Norm	Self-Efficacy	Preference Clarification	Intention	Screening Behavior
Schroy 2011 [52]	Increased	N/A	N/A	N/A	No difference between 2 DA groups	Increased	N/A
Steckelberg 2011 [53]	Increased	Less positive	N/A	N/A	Increased informed choice	N/A	Self-report: No difference
Vernon 2011 [54]	Increased	Increased pros; decreased cons; no difference in worry	No difference in social influence	Increased	N/A	Increased	Self-report: No difference
Prostate Cancer Screening (n=29)							
Flood 1996 [55]	Increased	N/A	N/A	N/A	Greater preference for conservative treatment	Decreased	Chart review: Decreased
Wolf 1996 [56], 1998 [57]	N/A	N/A	N/A	N/A	N/A	Decreased	N/A
Myers 1999 [58]	N/A	N/A	N/A	N/A	N/A	N/A	Review of chart & billing data: Increased screening adherence
Schapira 2000 [59]	Increased	Decrease in perceived benefit	N/A	N/A	N/A	N/A	Chart review: No difference
Frosch 2001 [60]	Increased	Less concern about prostate cancer	N/A	Less confidence about their decision	Greater preference for conservative treatment	Decreased	N/A
Wilt 2001 [61]	Increased	No difference in screening belief	N/A	N/A	No difference in preference for conservative treatment	N/A	Laboratory database: No difference
Volk 1999 [62], 2003 [63]	Increased at 2 weeks and at 1 year	N/A	N/A	N/A	N/A	Decreased	Self-report: Decreased
Frosch 2003 [64]	No difference	N/A	N/A	N/A	Less preference for conservative treatment	N/A	N/A
Gattellari 2003 [65]	Increased	No difference in worry about dying from prostate cancer	N/A	More likely to report ability of making informed choice	No difference in overall decisional uncertainty	No difference	N/A
Ruthman 2004 [66]	Increased	N/A	N/A	N/A	N/A	Less likely to prefer PSA screening	N/A
Sheridan 2004 [67]	Increased	N/A	N/A	N/A	N/A	No change in interest in prostate cancer screening	N/A

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Author & Year**	Knowledge	Attitude	Subjective Norm	Self-Efficacy	Preference Clarification	Intention	Screening Behavior
Gattellari 2005 [68]	Increased in print DA vs. video DA and leaflet	No difference in worry about developing prostate cancer	N/A	No difference in perceived ability to make informed choice	No difference in overall decisional uncertainty Less interest in PSA screening	No difference	N/A
Myers 2005 [69]	N/A	N/A	N/A	N/A	N/A	N/A	Chart review: No difference
Partin 2004 [70], 2006 [71]	No difference	N/A	N/A	N/A	N/A	Decreased	Chart review: No difference
Watson 2006 [72]	Increased	More negative attitude toward PSA screening	N/A	N/A	N/A	No difference	N/A
Kripalani 2007 [73]	N/A	N/A	N/A	N/A	N/A	N/A	Chart review: Increased PSA ordering
Krist 2007 [74]	Increased	N/A	N/A	N/A	No difference in Decisional Conflict Scale	N/A	Self-report & clinician report: No difference
Ellison 2008 [75]	Increased	N/A	N/A	N/A	N/A	N/A	N/A
Ilic 2008 [76]	No difference	No difference in anxiety	N/A	N/A	No difference in decisional conflict	No difference	N/A
Stephens 2008 [77]	Increased	Increased risk perception	N/A	N/A	Feeling more informed, to have clearer values, and to make more effective decision	N/A	N/A
Volk 2008 [78]	No difference	N/A	N/A	N/A	Decreased decisional conflict	N/A	N/A
Weinrich 2008 [79]	Increased	N/A	N/A	N/A	N/A	N/A	Chart review: No difference
Frosch 2008 [80], (Bhatnagar 2009 [81])	Increased for DA but not chronic disease trajectory	No difference in concern	N/A	N/A	Greater decrease in decisional conflict; no difference in preference for conservative treatment	Greater decrease in DA only and chronic disease trajectory only groups to get PSA screening but not combined vs. control	N/A
Allen 2009 [82]	Increased	No difference in risk perception	N/A	Increased	Decreased decisional conflict	No change in decisional stage	N/A
Allen 2010 [83]	Increased	N/A	N/A	No difference	No difference in decisional conflict; no change in decisional consistency (match between values and preference for screening)	Increased decisional stage; no change in desire for screening	N/A

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Author & Year**	Knowledge	Attitude	Subjective Norm	Self-Efficacy	Preference Clarification	Intention	Screening Behavior
Joseph-Williams 2010 [84]	Increased	More negative attitude toward PSA screening; no difference in anxiety	N/A	N/A	Decreased decisional conflict	Decreased	Chart review: Decreased
Rubel 2010 [85]	Increased	No difference in positive or negative schema; no difference in risk perception	N/A	N/A	N/A	N/A	N/A
Van Vugt 2010 [86]	Increased	Decreased in perceived risk; more negative attitude toward PSA test	N/A	N/A	N/A	Increased	N/A
Capik 2012 [87]	No difference	Increased susceptibility; decreased barrier; no change in benefit or seriousness	N/A	N/A	N/A	No change	Self-report: Increased
Multiple Cancer Screening (n=3)							
Frosch 2008 [88]	Increased	No difference	Decreased	Decreased	N/A	Decreased	N/A
Brackett 2010 [89]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Krist 2012 [90]	N/A	N/A	N/A	N/A	N/A	N/A	Self-report: No difference in individual cancer screenings; increased for overall delivery of preventive services

Abbreviations:

COL: Colonoscopy

CRC: Colorectal Cancer

DA: Decision Aid

N/A: Not Addressed

PSA: Prostate Specific Antigen

* Listed in ascending order of the year of publication.