Postprint Version	1.0
Journal website	http://www.ijmijournal.com/article/S1386-5056(15)30080-0/abstract
Pubmed link	http://www.ncbi.nlm.nih.gov/pubmed/26806712
DOI	10.1016/j.ijmedinf.2015.12.013

Effects of eHealth for patients and informal caregivers confronted with cancer: A meta-review

Vina N. Slev[A, B, ,], Patriek Mistiaen[C], H. Roeline W. Pasman[A, B], Irma M. Verdonck-de Leeuw[D, E], Cornelia F. van Uden-Kraan[E], Anneke L. Francke[A, B, C]

a VU University Medical Center, Department of Public and Occupational Health, The EMGO Institute for Health and Care Research, Amsterdam, Netherlands
b Expertise Center for Palliative Care, Amsterdam, Netherlands
c NIVEL, Netherlands Institute for Health Services Research Utrecht, Netherlands
d VU University Medical Center, Department of Otolaryngology—Head & Neck Surgery, The EMGO Institute for Health and Care Research, Cancer Center Amsterdam (CCA), Amsterdam, Netherlands
e Vrije Universiteit Amsterdam, Department of Clinical Psychology, The EMGO Institute for Health and Care Research, Cancer Center Amsterdam (CCA), Amsterdam, Netherlands

Highlights

• Evidence for effects on perceived support, knowledge, and information competence.
• Indications of evidence for, among more, health status, and patient involvement
• Inconsistent findings for, among more, psychological outcomes and quality of life.
• No focus on informal caregivers, various disease stages, and specific tumour types.

ABSTRACT

Background: eHealth can be defined as information provision about illness or health care and/or support for patients and/or informal caregivers, using the computer or related technologies. eHealth interventions are increasingly being used in cancer care, e.g. to support patients and informal caregivers in managing symptoms and problems in daily life.

Objectives: To synthesize evidence from systematic reviews on the effects of eHealth for cancer patients or their informal caregivers.

Materials and Methods: A systematic meta-review, in the sense of a systematic review of reviews, was conducted. Searches were performed in PubMed, Embase, CINAHL, PsycINFO, and the Cochrane Library. All steps in the review process were either performed by two reviewers independently or checked by a second reviewer. Disagreements were resolved by consensus.

Results: Ten systematic reviews were included. All reviews focused on the effects of eHealth for patients and none on effects for informal caregivers. Except for one review of high methodological quality, all reviews were of

moderate methodological quality. Evidence was found for effects on perceived support, knowledge levels, and information competence of cancer patients. Indications of evidence were found for health status and healthcare participation. Findings were inconsistent for outcomes related to decision-making, psychological wellbeing, depression and anxiety, and quality of life. No evidence was found for effects on physical and functional wellbeing.

Conclusion: There is evidence for positive effects of eHealth on perceived support, knowledge, and information competence of cancer patients. For effects on other outcomes in cancer patients, findings are mainly inconsistent or lacking. This meta-review did not find relevant reviews focusing on or including the effects of eHealth on informal caregivers, which seems a rather unexplored area.

1. INTRODUCTION

Cancer and its treatment make a great demand on patients as well as on informal caregivers. Cancer patients often suffer from problems and symptoms such as pain, fatigue, depression, anxiety, and hopelessness [1]. In addition, their informal caregivers often experience a high care burden, psychological problems, and a decrease in social activities [2]. Professional support can help them in dealing with these symptoms and problems. However, given that many people prefer to keep control over their own life and in view of increasing healthcare costs, it is not self-evident that all support should be given in face-to-face contacts between professionals and care recipients. EHealth may complement or replace traditional professional support to some extent [3] and [4]. We define eHealth as the provision of information about illness or health care and/or support for patients and/or informal caregivers using computers or related technologies. Our definition is inspired by Eysenbach's well-known statement describing eHealth as "…an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and related technologies" [5].

Nowadays, various computer-based and internet-based eHealth interventions are available for patients and informal caregivers confronted with cancer. These interventions provide information about cancer and its treatment (e.g. www.oncolink.org), support in decision-making (e.g. www.prostaatkankerkeuzehulp.nl), support in self-management, (e.g. www.oncokompas.nl), support for physical and emotional problems (e.g. www.helpforcancercaregivers.com), and peer support (e.g. www.cancerstories.info). Given the growing importance of eHealth in modern health care, it is relevant to see what evidence already exists regarding the effects of eHealth in people confronted with cancer. Since several systematic reviews had already been published, we performed a meta-review in which we analyzed and synthesized the evidence from existing reviews. In this meta-review we address the following primary question:

1. What evidence can be derived from existing systematic reviews about the effects of eHealth for patients with cancer and/or their informal caregivers?

The secondary question is:

2. What specific types of eHealth interventions for patients with specific types of cancer and/or their informal caregivers are addressed in the relevant systematic reviews?

2. MATERIAL AND METHODS

2.1. Design
We conducted a meta-review, i.e. a systematic review of reviews. This review type is suitable for describing the quality, discerning the heterogeneity, and identifying lacunas in the current evidence base, since it synthesizes evidence from relevant previous systematic reviews [6].

2.2. Eligibility criteria
References were eligible for inclusion if they concerned a literature review that satisfies all of the following four criteria, namely if it:
1) reports on the effects of eHealth. As stated before, we define eHealth as the provision of information about illness or health care and/or support for patients or informal caregivers using computers or related technologies;

2) concerns the effects on adult patients diagnosed with cancer and/or their informal caregivers. Reviews that also include studies among non-cancer groups were only eligible for inclusion if they reported the effects on cancer patients separately;

3) is a systematic review. We considered a review 'systematic' if the following criteria were satisfied: (a) search terms are presented; (b) searches are done in Pubmed/Medline or Cancerlit and at least one other international literature database;

4) has an overall methodological score of ≥3 (see Section '2.5 Quality assessment').

2.3. Search methods and terms
First, we developed a search strategy for PubMed, which is available as supplementary material. Subsequently, we adapted the strategy for searches in Embase, CINAHL, PsycINFO, and The Cochrane Library. For the development and adaption of the search strategies, databases' thesaurus terms for eHealth, cancer, systematic review and meta-analysis or specific 'systematic review filters' were used, as well as free text words describing eHealth. The searches were performed on March 6th 2014.

2.4. Review selection
The review selection process consisted of three phases:

1) Screening of titles and abstracts. First, VNS and HRP independently screened the titles and available abstracts of a random selection of 10% of the references identified. The interrater agreement between the two reviewers about the final inclusion and exclusion was 100%. The interrater agreement about whether the three separate inclusion criteria were met was 99.59% on average. Next, the remaining 90% of the references were divided among VNS and HRP, who each screened the titles and available abstracts of 3600 references. Finally, they discussed the list of

references eligible for full text screening as well as references where it was not very clear whether they should be included or excluded.

2) The full texts of all references remaining after the first selection phase were then screened by VNS and ALF independently, using the first three inclusion criteria. The interrater agreement between the two reviewers was high: In 84% of the references they agreed about the final inclusion and exclusion. Discrepancies were discussed until consensus was reached.

3) Subsequently VNS and ALF independently assessed the methodological quality of the references remaining after the second selection phase (see Section '2.5 Quality assessment'). In accordance with the fourth criterion concerning the methodological quality, only studies with a methodological score of 3 or more were finally included. Also in this phase, discrepancies were discussed and resolved by consensus.

2.5. Quality assessment

After review selection, the methodological quality of the systematic reviews was assessed using the Quality Assessment Checklist for Reviews [7] and [8]. This checklist is one of the few for which the psychometric properties have been documented [9], and it has been used in other meta-reviews [10] and [11]. The overall scores on this checklist range from "extensive flaws" (score 1 or 2), to "major flaws" (score 3 or 4), "minor flaws" (score 5 or 6) and "minimal flaws" (score 7). We calculated the average overall score when the overall scores of the VNS and ALF differed by 1 point. Differences of 2 or more points were resolved by consensus. For the best evidence synthesis (see Section '2.7 Data synthesis'), we classified the scores into three quality categories: "high quality" (score 5–7), "moderate quality" (score 3–4.5) and "low quality" (score 1–2.5).

[TABLE 1]

2.6. Data extraction

A pre-defined data extraction form—encompassing such items as the review aim, cancer type, types of eHealth, and reported outcomes—was used to extract data from the reviews. VNS performed the data extraction and IMVdL or CFU independently cross-checked the extracted information. We only extracted data concerning the effects of eHealth on cancer patients and/or informal caregivers, although some of the reviews had a broader focus, e.g. chronic conditions (including cancer).

2.7. Data synthesis

We categorized outcomes into categories including "psychological wellbeing", "depression", "anxiety", "knowledge and information", and "decision-making". The categorization was based on the types of outcomes reported in the reviews. Pooling of results was impossible because of the large variety of methods used and eHealth interventions studied, and the lack of numeric results in the reviews. We did, however, indicate the level of evidence regarding the effects of eHealth on a specific outcome category, using the criteria displayed in Box 1. These criteria were inspired by the principles of best evidence synthesis in systematic reviews, as developed by Steultjens et al. [12]. However, we had to adjust the criteria of Steultjens et al. [12] since we conducted a systematic meta-review of reviews rather than a traditional systematic review of RCTs. Adjustments concerned redefining the levels of evidence

and corresponding criteria by taking into consideration the methodological quality of the included reviews rather than of the methodological quality of separate RCTs.

3. RESULTS

3.1. Results of review selection and quality assessment

Through the searches, we identified 8157 unique potentially relevant references (Fig. 1).

After examining the titles and available abstracts, 50 references remained for screening based on their full text versions. Thirteen review papers turned out to be eligible for inclusion, and were assessed on their methodological quality, subsequently.

Only one review [13] received a high quality rating, namely 5 points on the checklist used, indicating only minor flaws (Table 1).

Nine reviews [14], [15], [16], [17], [18], [19], [20], [21] and [22] were judged as likely to have major flaws (score range: 3–4.5). In general, these reviews scored best on items concerning the description and comprehensiveness of searches, and use of explicit inclusion and exclusion criteria. However, most reviews scored poorly on items referring to an independent reference selection and screening and items referring to a methodological appraisal or data synthesis.

Three reviews [23], [24] and [25] had a very low quality rating of 1 or 2, and were excluded (in accordance with Exclusion Criterion no. 4 described in Section '2.2 Eligibility criteria') in the end. Consequently, ten reviews remained for inclusion in this meta-review.

3.2. General and methodological characteristics of the ten reviews and their underlying studies

Table S1 provides an overview of the ten reviews' main general and methodological characteristics, such as the eligibility criteria used. Table S1 is available as a supplementary material. Only one review [14] explicitly mentioned family caregivers as well as patients in the inclusion criteria. All other reviews explicitly excluded studies about informal caregivers or did not make any statement regarding informal caregivers. Eight reviews exclusively included studies focusing on cancer patients (type unspecified) and two specifically included studies in breast cancer or prostate cancer populations [20] and [21]. Most of the reviews did not restrict their eligibility criteria to patients in a certain disease stage or clinical stage. Two reviews specified outcomes in their eligibility criteria, such as distress, emotional wellbeing, and depressive symptoms [13] and [15].

Table S1 also includes the main characteristics of the reviews' underlying studies. These studies were often RCTs or quasi-experimental studies among patients with breast cancer, prostate cancer, or colorectal cancer, or mixed groups of cancer patients. Only one underlying study also concentrated on patients' partners. There was also great variety regarding the disease stage or clinical stage; studies concerned newly diagnosed patients, patients under treatment, or post-surgery patients. There appeared to be some overlap in the underlying studies included in the ten reviews, since reviews often included the same underlying studies, such as studies of the eHealth intervention known as the Comprehensive Health Enhancement Support System for breast cancer patients (CHESS) [26], [27], [28] and [29].

[FIGURE 1]

3.3. Characteristics of the eHealth interventions

Most of the reviews did not clearly define what type of interventions they were interested in. Only Ryhanen et al. [20] gave a definition of the eHealth interventions they focused on, namely "Internet-based patient education as the use of the World Wide Web or with modem connections to a central server for communication for patient education" [20].

All reviews, except for one, included studies concerning internet-based and/or computer-based interventions (Table 2).Bender et al. [14] were the only ones who focused solely on smartphone applications.

Most eHealth interventions studied were multi-component with a mixture of information and support. In some cases, coping skills training [13], [14], [15] and [20] or monitoring and tracking features [14], [19] and [21] were also part of the content. Different forms of support were available like emotional and/or psychosocial support [15], [18], [21] and [22], reminders for appointments or medication [14], and psycho-educational strategies [21]. Support was provided through, for example, a 'chat functionality' with healthcare professionals or by other cancer patients (peer support) [13], [14], [15], [16], [17], [18] and [20]. The above-mentioned CHESS eHealth intervention is also multi-component and involves components like information, discussion groups, and treatment decision aids. Only Griffiths et al. [15] separately analyzed and compared single-component eHealth interventions versus multi-component interventions. Single-component eHealth interventions concerned internet support groups, for example, where participants could exchange personal stories.

[TABLE 2]

3.4. Effects of the eHealth interventions

All reviews except one [14] found studies concerning the effects of eHealth interventions. Bender et al. [14] did not find any study meeting their eligibility criteria, most likely due to their narrow focus on smartphone applications available in Canadian and French online application stores. The results of the nine remaining reviews are presented in Table S2 which is available as supplementary material. The reviews studied a variety of outcomes and were based on underlying studies using different, mostly multiple, points in time, varying from pre-test, post-test, and follow-up after nine months, to baseline, six weeks, and 12 weeks.

Since many different outcomes were reported, we consider only those outcome categories that are discussed in a majority of the reviews. The level of evidence for each outcome category is summarized in Table 3.

3.4.1. Effects on knowledge and information competence

Evidence exists for positive effects of eHealth interventions on knowledge and information competence (the ability to acquire information as well as to use the acquired information) [16], [18], [20] and [21].

[BOX 1]

Gysels and Higginson [16], who studied the effects of interactive multimedia programs, elaborated on a study describing increased knowledge levels about breast cancer and improvements in information competence in women with breast cancer

two months and five months after attending an internet support group, and on women who are non-Caucasian, uninsured or less educated. These findings appear to be supported by Ryhanen et al. [20]. Comparable results were yielded for prostate cancer patients. Hong et al. [18] found some evidence for improvements in information competence, information seeking, and information exchange in a patient population with various types of cancer.

3.4.2. Effects on perceived support
Evidence is also found for positive effects of eHealth interventions on perceived support [16], [17], [18], [19], [20], [21] and [22].
Table S2 shows that three reviews [17], [18] and [22] described positive effects on the provision of social support and one review [19] on the reduction in perceived needs for support. Two reviews specifically mentioned eHealth interventions positively influencing the provision of social support for breast cancer patients [16] and [20]. Salonen et al. [21] reported some improvement in informational support to prostate cancer patients and satisfaction with that support. Similar results for breast cancer patients were found by Hoey et al. [17].

3.4.3. Effects on decision-making
Findings concerning the effects of eHealth interventions on decision-making are inconsistent [16], [20], [21] and [22].
While two reviews [20] and [22] solely found positive effects, Gysels and Higginson [16] found mixed results for the effects of interactive multimedia technologies on decision-making by breast cancer patients regarding treatment, namely studies describing positive effects as well as studies describing no effects on breast cancer patients' satisfaction with decision making concerning treatment. Gysels and Higginson explained these mixed findings as a result of the differences between the studied eHealth interventions. Additionally, Salonen et al. [21] described the results of internet and computer-based programs for prostate cancer patients and found that these programs positively influenced not only levels of decision control, and patient involvement in decision-making but also decisional conflict.

3.4.4. Effects on healthcare participation and patient involvement
Indications of evidence exist for positive effects of eHealth interventions on healthcare participation and patient involvement in care [16], [17], [18], [20] and [22].
Results varied from positive effects to no effects, but mainly involved positive effects. Table S2 shows that positive effects on healthcare participation were experienced by breast cancer patients after two months of using an internet-based program [16], [17], [18] and [20] and by women with breast cancer who are non-Caucasian, uninsured, or less educated [16]. The effect on healthcare participation after two months, however, seemed to dissolve after five months [16]. There also appeared to be no effect on patient involvement during consultations for choosing breast cancer treatment [16]. Ventura et al. [22] described mixed results on healthcare participation but mostly positive ones.

[TABLE 3]

3.4.5. Effects on depression and anxiety
Inconsistent findings were yielded regarding depression [15], [16], [17], [18], [19], [20] and [21] and anxiety [16], [17], [19] and [20].

With regard to the effects on depression, Griffiths et al. [15], Hoey et al. [17], and Hong et al. [18] found positive effects from internet support groups and online cancer support and resources on symptoms of depression in breast cancer patients and survivors. These findings are likely to be strengthened by the result that showed internet support groups to be more successful for patients with breast cancer than for patients with other (non-cancer) diagnoses [15]. However, two reviews [16] and [18] also reported that the aforementioned finding is likely not to apply to recently diagnosed breast cancer patients [18] and women with early stage breast cancer [16]. Additionally, Griffiths et al. [15] reported no effects of multi-component internet support groups on breast cancer patients and head and neck cancer patients. With respect to prostate cancer patients, Salonen et al. [21] found positive results for internet and computer-based programs in reducing depression. Electronic symptom reporting in the context of consultation support appeared to reduce depression as well [19].

Four reviews reported varying results concerning effects on anxiety [16], [17], [19] and [20]. Ryhanen et al. [20] found no effect of internet and computer-based programs on anxiety among breast cancer patients. Gysels and Higginson [16] seem to contradict this result by reporting that the use of interactive multimedia programs during the discussion of diagnosis and treatment helped reduce anxiety among breast cancer patients. Internet peer support programs [17] and electronic symptom reporting [19] were also found to reduce anxiety in breast cancer patients and cancer patients in general respectively.

3.4.6. Effects on psychological wellbeing

Findings on the effects of eHealth interventions on psychological wellbeing and related outcomes are inconsistent [13], [15], [17], [18], [19] and [21].

Hoey et al. [17] and Hong et al. [18] found mixed effects and no effects respectively of online cancer support (from peers) on emotional wellbeing [17] and [18].

Johansen et al. [19] found underlying studies on electronic symptom reporting that demonstrated a positive impact from providing feedback on emotional wellbeing but they found no effect for electronic symptom reporting in general.

Psychological wellbeing was discussed in four reviews [13], [15], [18] and [21]. Beatty and Lambert [13] and Salonen et al. [21] present contradictory findings for the effects on psychological distress: Beatty and Lambert argue that online interventions had no impact while Salonen et al. see a positive impact.

3.4.7. Effects on quality of life and health status

Findings on the effects of eHealth interventions on quality of life are inconsistent [13], [16], [17], [18], [19], [21] and [22].

Some reviews found positive effects [16], [19] and [21], while others did not [13] and [17] or found mixed results [17] and [22]. For instance, Gysels and Higginson [16] found one study describing positive effects of internet support groups specifically for women with breast cancer and who are of color, uninsured, or with less education. Johansen et al. [19] described positive effects of electronic symptom reporting on the health-related quality of life. However, Hong et al. [18] studied online cancer support and found no effects on the health-related quality of life, while these authors did find positive effects on the self-reported quality of life. Ventura et al. [22] discussed comparable mixed results.

The four reviews reporting on outcomes relates to health status presented results that are inconsistent [13], [16], [18] and [22]. Two reviews [13] and [16] found positive effects. However, one review [22] described some studies with positive effects on general health and others with no effects on general health of internet or computer-based programs. Both Ventura et al. [22] and Hong et al. [18] found no effects on the self-rated health status.

3.4.8. Effects on physical and functional wellbeing
No evidence is found for effects of eHealth interventions on physical [13], [17] and [18] and functional wellbeing [18].
One review [18] found mixed results concerning physical wellbeing and another [17] found positive effects. Positive effects specifically concerned reductions in patients' reaction to pain. These findings, however, are contradicted by Beatty and Lambert's high quality review [13] that found no effects on physical wellbeing.
Functional wellbeing was mentioned in only one review and appeared not to be influenced two months after using an online cancer support program [18].

4. DISCUSSION
This meta-review shows that evidence exists for effects of eHealth on cancer patients' knowledge level, and information competence. Patients' knowledge levels increased as well as their ability to acquire information and to use the acquired information [16], [18], [20] and [21]. The use of eHealth also reduced patients' needs for support as it improved provision of support [16], [17], [18], [19], [20], [21] and [22]. Evidence regarding health status [13], [16], [18] and [22], healthcare participation and patient involvement in care is sparse [16], [17], [18], [20] and [22], since we found only indications for effects of eHealth on these outcomes. Although results described in the systematic reviews mainly concerned positive effects [13], [16], [17], [18], [20] and [22], they also reported studies showing no effects on mentioned outcomes. Findings are inconsistent with regard to effects on psychological outcomes (psychological wellbeing [13], [15], [17], [18], [19] and [21], depression [15], [16], [17], [18], [19], [20] and [21], and anxiety [16], [17], [19] and [20]), quality of life [13], [16], [17], [18], [19], [21] and [22], and decision-making about treatment or care [16], [20], [21] and [22]. For example, some systematic reviews described positive effects on patients' satisfaction with their decision about treatment, while other systematic reviews found mixed or no effects in this regard. Besides, evidence is lacking for effects on physical [13], [17] and [18] and functional wellbeing [18]. Remarkably, only one review [14] aimed to consider the effects of eHealth for informal caregivers as well as patients. Since this review did not find any effect studies at all, evidence for the effects of eHealth for informal caregivers could not be obtained. Moreover, of the three reviews that were excluded because of poor methodological quality, two [23] and [24] did not include studies on the effects of eHealth in informal caregivers of cancer patients. Nevertheless, we do have indications that some research into the effects of eHealth on informal caregivers has already been conducted, e.g. Farnham et al. [30], and Namkoong et al. [31].
The reviews included in our meta-review concerned internet-based and/or computer-based eHealth interventions, the only exception being Bender et al.'s [14] review, which looked at smartphone applications only. The eHealth interventions described in the ten reviews concerned both single-component interventions and multi-component interventions with content that varied considerably. Examples of single-

component interventions are websites that only provide information about the disease or treatments. Multi-component interventions, for example, offer information as well as the possibility to 'chat' with healthcare professionals. It is, however, difficult to conclude if the type of eHealth modality, e.g. internet-based or computer-based, moderates possible effects. Moreover, it is also often difficult to determine whether multi-component interventions are more effective than single-component interventions based on the existing systematic reviews. In the case of multi-component eHealth interventions, it is difficult to establish which particular component contributes most to an effect on a certain outcome. In this regard, Griffiths et al.'s [15] results are likely to be the most informative, since they separately reviewed the effects of single-component and multi-component interventions.

A surprising finding is that most of the reviews as well as the underlying studies did not focus on patients in a specific disease or treatment stage. Consequently, we do not know whether eHealth is equally effective for patients in the diagnostic, curative and palliative phase of cancer. The effects of eHealth might be different depending on patients' needs for information and support, which may vary during the disease and treatment trajectory. Cancer patients in the curative phase, for example, may be in more need of information about how to cope with late effects of surgery or chemotherapy, while patients with advanced cancer may want information about the self-management of pain and psychological distress. In future research (both at the level of separate intervention studies and the level of systematic reviews), more attention should be given to the effects of eHealth interventions in relation to the disease stage.

We also found that almost none of the reviews considered patients with specific tumor types, while there may be differences in patients' needs for information and support depending on their diagnosis. People with lung cancer for example, may be more in need of information about dyspnea while women with cervical cancer might appreciate information concerning infertility.

Additionally, we discovered a considerable overlap between four reviews in the underlying studies they included. This may be due to the fact that the Comprehensive Health Enhancement Support System for breast cancer patients is the most researched eHealth intervention among the available eHealth interventions. Hence, in some cases, the reported effects and evidence may apply more to breast cancer patients than to patients with other tumor types. This is all the more reason why future research should concentrate on specific tumor types.

Lastly, demographic characteristics such as age or education were not taken into account by the reviews, while such background characteristics might be important since older people or less educated people may have more difficulties with the use of eHealth.

More tailored eHealth interventions may yield stronger effects. However, more research is needed to confirm this hypothesis.

4.1. Strengths and limitations

The strengths of this meta-review are: (1) sensitive search strategies with few limitations and in a range of literature databases; (2) assessment of the methodological quality, which led to the exclusion of systematic reviews of poor quality; (3) a broad range of eHealth interventions and outcomes studied in the reviews included. The latter, however, is also a limitation as it shows heterogeneity.

Therefore, findings have to be interpreted with prudence. We decided to perform a meta-review since we believed many systematic reviews concerning eHealth for patients and informal caregivers had already been published. While this assumption was correct for patients, it was not for informal caregivers. None of the reviews we looked at studied eHealth targeting informal caregivers. Given this, it may have been more sensible to separately review eHealth for informal caregivers in a systematic review instead of a meta-review.

5. CONCLUSIONS

This meta-review based on systematic reviews found evidence for the effect of eHealth on cancer patients' knowledge, information competence, and perception of the support they received. For effects on other patient outcomes the evidence is inconsistent, limited, or seems to point to no effect.

None of the systematic reviews focused on eHealth for informal caregivers of cancer patients. Future systematic reviews should provide insight into the effects of eHealth in informal caregivers in particular. To further demonstrate effects in patients and/or informal caregivers, researchers should separately analyze and compare single-component and multi-component eHealth interventions. Additionally, future reviews should focus more on comparing the effects of eHealth in different groups of patients, distinguished by treatment stage (curative or palliative) and tumor types, for instance.

Summary points

What was already known on the topic
• eHealth might complement professional face-to-face support to people confronted with cancer.
• A variety of eHealth interventions for people confronted with cancer and which focuses on information provision and (peer) support in managing physical and emotional problems, decision-making, and self-management, have already been developed.
• Several systematic reviews on effects of eHealth have already been published. A comprehensive overview of evidence for effects of eHealth on cancer patients and their informal caregivers is absent.
What this study added to our knowledge
• Paucity of high quality systematic reviews.
• Demonstration of (lack of) evidence for effects of eHealth on different outcomes like perceived support, knowledge and information competence, psychological outcomes and decision-making.
• Identification of lacunas in the existent evidence base regarding effects on:
        • informal caregivers of cancer patients;
• patients with specific tumor types;
• cancer patients in a specific treatment or disease stage.
• Recommendation to focus future research on the identified lacunas and separately study different types of eHealth interventions, like single-component and multi-component eHealth interventions.

CONFLICT OF INTEREST
None.

APPENDIX A. SUPPLEMENTARY DATA

The following are Supplementary data to this article:

REFERENCES

[1] J.E. Esther Kim, M.J. Dodd, B.E. Aouizerat, et al. A review of the prevalence and impact of multiple symptoms in oncology patients J. Pain Symptom Manag., 37 (April (4)) (2009), pp. 715–736 http://dx.doi.org/10.1016/j.jpainsymman.2008.04.018

[2] A. Girgis, S. Lambert, C. Johnson, et al. Physical, psychosocial, relationship, and economic burden of caring for people with cancer: a review J. Oncol. Pract., 9 (July (4)) (2013), pp. 197–202 http://dx.doi.org/10.1200/JOP.2012.000690

[3] A.G. Ekeland, A. Bowes, S. Flottorp Effectiveness of telemedicine: a systematic review of reviews Int. J. Med. Inform., 79 (November (11)) (2010), pp. 736–771 http://dx.doi.org/10.1016/j.ijmedinf.2010.08.006

[4] A.D. Black, J. Car, C. Pagliari, et al. The impact of eHealth on the quality and safety of health care: a systematic overview PLoS Med., 8 (January (1)) (2011), p. e1000387 http://dx.doi.org/10.1371/journal.pmed.1000387

[5] G. Eysenbach What is e-health? J. Med. Internet. Res., 3 (June (2)) (2001), p. e20 http://dx.doi.org/10.2196/jmir.3.2.e20

[6] V. Smith, D. Devane, C.M. Begley, et al. Methodology in conducting a systematic review of systematic reviews of healthcare interventions BMC Med. Res. Methodol., 11 (2011), p. 15 http://dx.doi.org/10.1186/1471-2288-11-15

[7] A.D. Oxman, G.H. Guyatt, J. Singer, et al. Agreement among reviewers of review articles J. Clin. Epidemiol., 44 (1991), pp. 91–98 http://dx.doi.org/10.1016/0895-4356(91)90205-n

[8] A.D. Oxman, G.H. Guyatt Validation of an index of the quality of review articles J Clin Epidemiol, 44 (1991), pp. 1271–1278 http://dx.doi.org/10.1016/0895-4356(91)90160-b

[9] P. Katrak, A.E. Bialocerkowski, N. Massy-Westropp, et al. A systematic review of the content of critical appraisal tools BMC Med. Res. Methodol., 4 (2004), p. 22 http://dx.doi.org/10.1186/1471-2288-4-22

[10] P. Mistiaen, A.L. Francke, E. Poot Interventions aimed at reducing problems in adult patients discharged from hospital to home: a systematic meta-review BMC Health Serv. Res., 7 (2007), p. 47 http://dx.doi.org/10.1186/1472-6963-7-47

[11] A.L. Francke, M.C. Smit, A.J. de Veer, et al. Factors influencing the implementation of clinical guidelines for health care professionals: a systematic meta-review BMC Med. Inform. Decis. Mak., 8 (September (38)) (2008) http://dx.doi.org/10.1186/1472-6947-8-38

[12] E.M. Steultjens, J. Dekker, L.M. Bouter, et al. Occupational therapy for stroke patients: a systematic review Stroke, 34 (3) (2003), pp. 676–687 http://dx.doi.org/10.1161/01.STR.0000057576.77308.30

[13] L. Beatty, S. Lambert A systematic review of internet-based self-help therapeutic interventions to improve distress and disease-control among adults with chronic health

conditions Clin. Psychol. Rev., 33 (June (4)) (2013), pp. 609–622
http://dx.doi.org/10.1016/j.cpr.2013.03.004

[14] J.L. Bender, R.Y. Yue, M.J. To, et al. A lot of action, but not in the right direction: systematic review and content analysis of smartphone applications for the prevention, detection, and management of cancer J. Med. Internet Res., 15 (December (12)) (2013), p. e287 http://dx.doi.org/10.2196/jmir.2661

[15] K.M. Griffiths, A.L. Calear, M. Banfield Systematic review on Internet Support Groups (ISGs) and depression (1): Do ISGs reduce depressive symptoms? J. Med. Internet Res., 11 (September (3)) (2009), p. e40 http://dx.doi.org/10.2196/jmir.1270

[16] M. Gysels, I.J. Higginson Interactive technologies and videotapes for patient education in cancer care: systematic review and meta-analysis of randomised trials

Support Care Cancer, 15 (1) (2007), pp. 7–20 http://dx.doi.org/10.1007/s00520-006-0112-z

[17] L.M. Hoey, S.C. Ieropoli, V.M. White, et al. Systematic review of peer-support programs for people with cancer Patient Educ. Couns., 70 (3) (2008), pp. 315–337
http://dx.doi.org/10.1016/j.pec.2007.11.016

[18] Y. Hong, N.C. Peña-Purcell, M.G. Ory Outcomes of online support and resources for cancer survivors: a systematic literature review Patient Educ. Couns., 86 (3) (2012), pp. 288–296 http://dx.doi.org/10.1016/j.pec.2011.06.014

[19] M.A. Johansen, E. Henriksen, A. Horsch, et al. Electronic symptom reporting between patient and provider for improved health care service quality: a systematic review of randomized controlled trials. part 1: state of the art J. Med. Internet Res., 14 (5) (2012), p. e118 http://dx.doi.org/10.2196/jmir.2214

[20] A.M. Ryhänen, M. Siekkinen, S. Sirkku Rankinen, et al. The effects of Internet or interactive computer-based patient education in the field of breast cancer: a systematic literature review Patient Educ. Couns., 79 (1) (2010), pp. 5–13
http://dx.doi.org/10.1016/j.pec.2009.08.005

[21] A. Salonen, A.M. Ryhänen, H. Leino-Kilpi Educational benefits of Internet and computer-based programmes for prostate cancer patients: a systematic review Patient Educ. Couns., 94 (January (1)) (2014), pp. 10–19 http://dx.doi.org/10.1016/j.pec.2013.08.022

[22] F. Ventura, J. Ohlén, I. Koinberg An integrative review of supportive e-health programs in cancer care Eur. J. Oncol. Nurs., 17 (August (4)) (2013), pp. 498–507
http://dx.doi.org/10.1016/j.ejon.2012.10.007

[23] P. Dumrongpakapakorn, K. Hopkins, P. Sherwood, et al. Computer-mediated patient education: Opportunities and challenges for supporting women with ovarian cancer Nurs. Clin. North Am., 44 (September (3)) (2009), pp. 339–354
http://dx.doi.org/10.1016/j.cnur.2009.06.008

[24] G. Eysenbach The impact of the internet on cancer outcomes CA Cancer J. Clin., 53 (2003), pp. 356–371 http://dx.doi.org/10.3322/canjclin.53.6.356

[25] P. Klemm, D. Bunnell, M. Cullen, et al. Online cancer support groups: a review of the research literature Comput. Inform. Nurs., 21 (May-Jun (3)) (2003), pp. 136–142

[26] D.H. Gustafson, R. Hawkins, S. Pingree, et al. Effect of computer support on younger women with breast cancer J. Gen. Intern. Med., 16 (7) (2001), pp. 435–445
http://dx.doi.org/10.1046/j.1525-1497.2001.016007435.x

[27] D.H. Gustafson, F.M. McTavish, W. Stengle, et al. Use and impact of ehealth system by low-income women with breast cancer J. Health Commun., 10 (Suppl. 1) (2005), pp. 195–218 http://dx.doi.org/10.1080/10810730500263257

[28] B.R. Shaw, J.Y. Han, T. Baker, et al. How women with breast cancer learn using interactive cancer communication systems Health Educ. Res., 22 (1) (2007), pp. 108–119
http://dx.doi.org/10.1093/her/cyl051

[29] M. Wise, J.Y. Han, B. Shaw, et al. Effects of using online narrative and didactic information on healthcare participation for breast cancer patients Patient Educ. Couns., 70 (3) (2008), pp. 348–356 http://dx.doi.org/10.1016/j.pec.2007.11.009

[30] S. Farnham, L. Cheng, L. Stone, et al. HutchWorld: clinical study of computer-mediated social support for cancer patients and their caregivers. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2002:ACM.

[31] K. Namkoong, L.L. DuBenske, B.R. Shaw, et al. Creating a bond between caregivers online: effect on caregivers' coping strategies J. Health Commun., 17 (2) (2012), pp. 125–140 http://dx.doi.org/10.1080/10810730.2011.585687
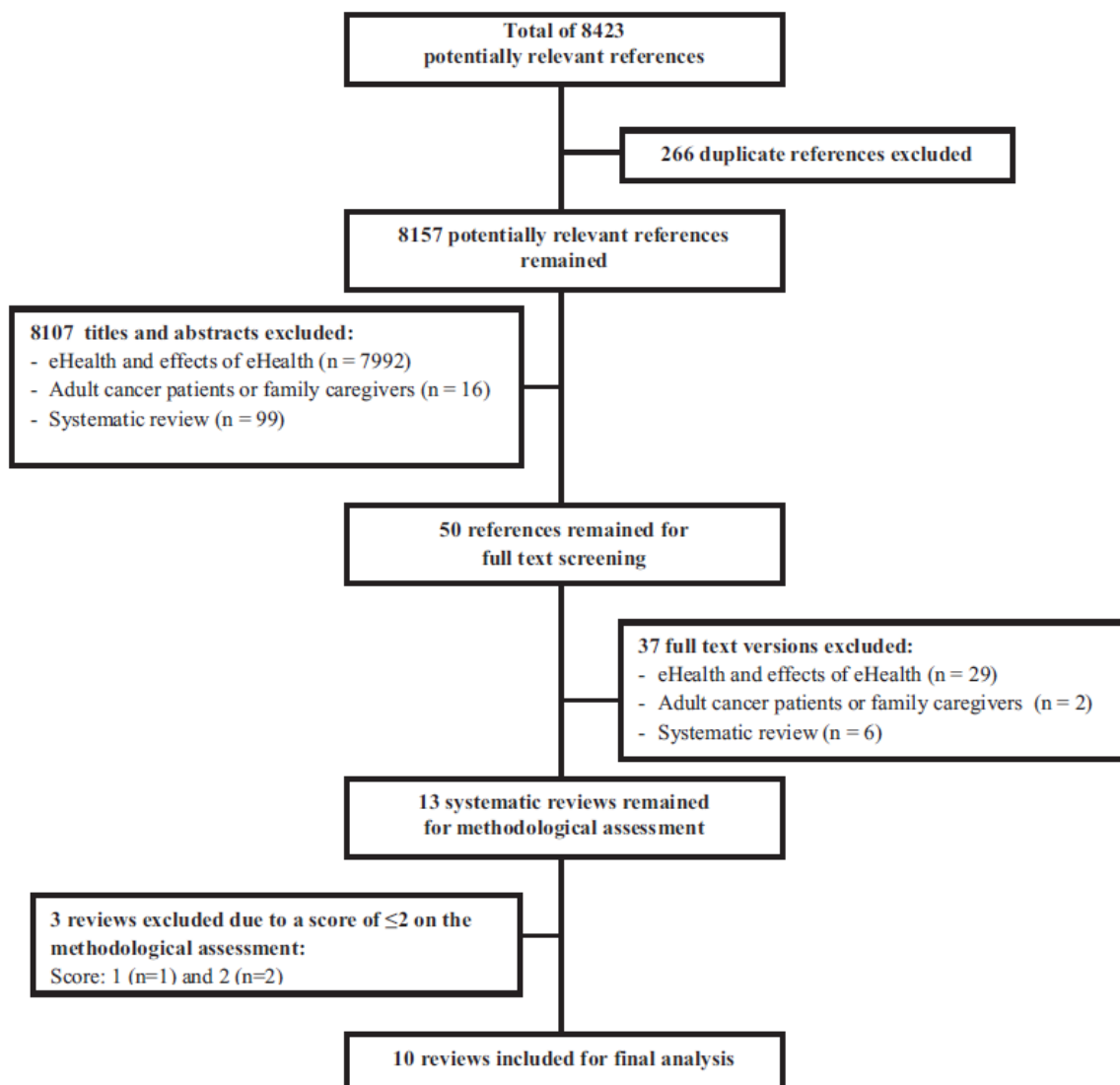
TABLES AND FIGURES

Table 1: Methodological assessment scores.

Reference	Methodological assessment scores
Beatty and Lambert [13]	5
Bender et al. [14]	3
Griffiths et al. [15]	3
Gysels and Higginson [16]	4,5
Hoey et al. [17]	4,5
Hong et al. [18]	3
Johansen et al. [19]	3,5
Ryhanen et al. [20]	3,5
Salonen et al. [21]	3,5
Ventura et al. [22]	3

FIG. 1. FLOWCHART OF REVIEW SELECTION PROCESS.

Box 1: Principles of Best Evidence Synthesis Evidence

Consistent effects on a specific outcome in at least one high quality systematic review, based on at least two underlying effect studies.
This is under the condition that no more than two moderate quality systematic reviews or no other high quality systematic review report conflicting findings.
OR
Consistent effects on a specific outcome in at least three moderate quality systematic reviews, based on at least two underlying effect studies per systematic review.
This is under the condition that no high quality systematic review or no more than two other moderate quality systematic reviews report conflicting findings.

Indications of evidence

Consistent effects on a specific outcome in one high quality systematic review, based on one underlying effect study.
This is under the condition that no more than two moderate quality systematic reviews and/or no other high quality review report conflicting findings.
OR
Consistent effects on a specific outcome in one moderate qual- ity systematic reviews.
This is under the condition that no high quality systematic review and/or no more than two other moderate quality sys- tematic reviews report conflicting or inconsistent findings.

Inconsistent findings

Inconsistent effects on a specific outcome, when findings of a (number of) high quality systematic review(s) are being contra- dicted by a (number of) other high quality systematic review(s). OR
Inconsistent effects on a specific outcome, when findings of a (number of) moderate quality systematic review(s) are being contradicted by a (number of) other moderate quality system- atic review(s).

No evidence

No effects on a specific outcome when a (number of) high quality systematic review(s) did not find effects.
This is under the condition that no other (number of) high qual- ity systematic review(s) or no more than two moderate quality systematic reviews report conflicting findings.
OR
No effects on a specific outcome when three or more moderate quality systematic reviews did not find effects. This is under the condition that no other systematic review reports conflicting findings.

No research found

None of the included reviews examined effects on a specific
outcome.

Table 2
Characteristics of eHealth interventions in reviews included.

Reference and score methodological assessment	Type of eHealth interventions	Content of eHealth interventions	eHealth intervention period	Organizational setting of eHealth interventions
Beatty and Lambert [13] 5	* Internet-based cognitive-behavior therapy * Website: asynchronous bulletin board; un-moderated forum.	Information provision * Information provision: common symptoms and side-effects (self-help). Support * Online peer-support (peer support) Other * Six coping-skills training exercises based on Cognitive Behavior Therapy principles (self-help).	* 12 wks	Not reported
Bender et al. [14] 3	Examples of 8/295 cancer-focused smartphone applications, categorized per purpose: - *awareness*: Pink Ribbon Breast Cancer Wallpaper; - *information provision*: Cancer iOncolex; - *fundraising*: The Ride to Conquer Cancer; - *promotion organizations*: Conquer Cancer Foundation; - *early detection*: Skin Cancer- The Most Accurate Skin Cancer Detector on iPhone; - *disease management*: Cancer Net; - *prevention*: iEat for Life: Prostate Cancer; - *peer support*: Breast Cancer Connect Methods per purpose: - *awareness*: text, images, games, interactive activities (Quiz); - *information provision*: text, eBook, images, videos, search functionality; - *fundraising*: fundraising tools; - *early detection*: text, images, videos, monitoring tools: capture, track images; risk score questionnaires; - *promotion organizations*: text; - *disease management*: appointment tools, lab results storage, self-monitoring/tracking tools, communication tools, question list guidance patient-healthcare professional communication, recording possibilities; - *prevention*: text; images; interactive activities (Quiz); - *peer support*: asynchronous communication tools, GPS locator tracking other members, text, audio. * Top three multimedia formats: visual media-only (36.7%, 108/295); text-only (28.9%, 83/295); text and visual media (22.6%, 65/295). * Combination multi-media content (31.5%, 93/295)	Information provision * Information provision: disease, diagnosis, symptoms, treatment, prevention, screening, alternative therapy, managing physical, behavioral, psychosocial aspects, charitable organizations. * Communication with healthcare team * Promotion exercise * Promotion healthy eating behaviors Support * Reminders; screening, medication, appointments * Online peer support; personal stories. Other * Skills training/Instructions * Monitoring screening results * (physical and psychosocial) Symptom and medication, medical costs tracking.	Not reported	Not reported
Griffiths et al. [15] 3	Internet Support Group: single component interventions: - Web-based structured newsgroup moderated psychologist; topic discussion, once a week - Chat room sessions with experienced leader therapist and 24h access bulletin board - Public bulletin board, moderated - Public bulletin board, no information about moderator status - Public bulletin board Internet Support Group: multi component interventions: - Bulletin board, moderated by health professional and art/poetry forum - Peer-to-peer forum, e-mail communication, electronic questionnaire	Single-component interventions Support: * Providing emotional support * In some instances, content was not explicitly reported. Multi-component interventions Information provision * Information provision * Information + monitoring via electronic questionnaire. Support * Peer support * Self-management advice Other * Structured coping skills exercises (stress management, assertiveness + structured problem solving training).	Various: * 12 wks * 16 wks, 1,5 hrs. chat room * 6-8 mths * variable duration membership: mean 247 days; 44-1001 days * 6 wks	Not reported

Table 2 (*Continued*)

Reference and score methodological assessment	Type of eHealth interventions	Content of eHealth interventions	eHealth intervention period	Organizational setting of eHealth interventions
Gysels and Higginson [16] 4,5	* Comprehensive Health Enhancement Support System (CHESS); 'Take-away tool' providing cancer information, decision making + emotional support * Computer-based information system; Device for improvement of information transfer and facilitating consent process, during consultation. It provides: general information (intervention 1); personalized information via link between device and patients' medical records (1/2 of patients also accessed general information) (intervention 2) * Interactive video disk; Device for improvement of information transfer, during consultation. Provides cancer information, treatment choices, explores issues of uncertainty, variations in practice. Operated step-by-step under professional's supervision * Interactive multimedia program/computer-assisted instruction; Proactive device delivered before and for preparation of consultation. Presentation of information in following formats: text, graphics, narration, music, audio and video clips * Interactive decision board during consultations; Device for improvement of information transfer, during consultation. Visual aid with written and graphical information. Operated step-by-step under professional's supervision	Information provision * Some form of research-based information * Research-based information: explanation relevant terms and concepts; current literature overview; explanation of RCTs; 'Instant Library' with scientific and popular press articles. Support * Decision-making tools: Tailored information based on patient provided personal details. Information on treatment options, risks and benefits, clarification of values and understanding outcomes * Forms of video segments of experiences of others * Provision of support groups or expert advice * Awareness raising/empowerment by: repeatedly encouraging to take active role in decision making and disease management; identification of resources like descriptions and contacts services.	Not reported	Various: * Home-based * Before consultation * During consultation
Hoey et al. [17] 4,5	* Peer-support programs * (Facilitated) Bulletin board * Chat room format * Structured group, professionally facilitated * Asynchronous support groups	Support * Peer support	Various: * Ongoing, 24h * 24h, 1 yr * 24h, 12 wks * 24h, 6 mths * 1 p wk, 16 wks	* Home * In some instances, organizational setting was not reported
Hong et al. [18] 3	* Home-based computer system (CHESS) * (Privately accessed) online bulletin boards * Online cancer forum * Internet/online/electronic support group * General Internet use: especially online/offline communication stimulated by online communication and online information seeking * Internet Discussion group * Online breast cancer discussion board * Peer support system: online discussion, chat room, personal message system (for intervention group) * Online coping group specifically designed for study * E-mail list; breast cancer and cancer-related * Newly designed website (Virtual Cancer Internet Community) * Peer-led and unstructured interventions * Structured intervention and moderated by professional	Information provision * Information provision on cancer and decision making. Support * Online cancer support; mostly online social (emotional or informational support). * Peer support	Various: * 1,5h/wk, 16 wks * 12 wks * 90 min/wk, 30 wks * 27 wks * In some instances, intervention period was not reported	Not reported

Table 2 (*Continued*)

Reference and score methodological assessment	Type of eHealth interventions	Content of eHealth interventions	eHealth intervention period	Organizational setting of eHealth interventions
Johansen et al. [19] 3,5	* Electronic Self-Report Assessment-Cancer (ESRA-C): color graphical summary of participant's self-reported symptoms and quality of life issues with predetermined thresholds flagged was printed and handed to clinician immediately before targeted clinic visit. No recommendations offered * Touch-screen survey filled out before oncologist visit. Computer scored answers. Printed summary of report in patient's file for consideration during consultation. Suggested strategies for managing identified issues were included * All patients scheduled for outpatient visit used system on tablet computer for reporting symptoms and preferences before consultation. For clinicians, system highlighted patient experienced symptoms incl. severity, degree of bother, importance for patients. Information was printed and handed to the patient and clinician * Use of "Choice"; interactive tailored patient assessment tool, touchpad tablet PC, for symptom assessments prior to inpatient and outpatient visits. Assessment summary, displaying patient's self-reported symptoms, problems and distress in rank order of patient's need for support, provided to physicians and nurses * Completion of touch-screen Health-related quality of life questionnaires in waiting room before every encounter. Summary handed to physicians. * Mobile phone system (ASyMS) used in morning, evening and any time patients felt unwell on days 1–14 following first 4 chemotherapy cycles. Completion electronic symptom questionnaire on mobile phone, incl. temperature. Patients immediately received written feedback on mobile phone. Clinicians were advised to contact patients within 1 h after receiving red alert. The system's alert to physician is based on risk model Device: * Computer/tablet * Mobile phone	Support * Enhancing patient–provider communication with electronic self-report assessment for cancer. * Supporting shared decision making * Improving communication and patient well-being * In some instances, content was not reported. Other * Monitoring: management of chemotherapy-related toxicity.	Various: * 2 visits (before treatment, 4–6 wks later) * Before visit, 4 times * 1 consultation * Up to 1 yr (once per encounter during treatment, once week during hospital stay, once outpatient visit in up to 4 visits) * Approx. 6 mths * 4 cycles chemotherapy (12–16 wks)	Various: * Inside Clinic * Outside/home

Table 2 (*Continued*)

Reference and score methodological assessment	Type of eHealth interventions	Content of eHealth interventions	eHealth intervention period	Organizational setting of eHealth interventions
Ryhanen et al. [20] 3,5	Internet education programs * Comprehensive Health Enhancement Support System (CHESS) * Self-guided Internet-Based Coping-skills training program to manage symptoms of treatments Different educational interactive computerized programs * Options for Treating Breast Cancer * The information and decision profiles * Breast Cancer Genetics Computer Program * The Computerized Decision Aid * Interactive Digital Education Aid * Retratos de la Vida Real (Photographs of Real Life) * Common use of Internet Computer-based (interactive or multimedia) programs * Interactive soap opera * CD-ROM * Interactive multimedia program * Interactive computer system/interface Internet-based programs * Home computer with modem connection to a central server for communication * (a series of) Webpage(s) * Common use of Internet * Possibilities to chat with other patients or pose questions to health professionals (Internet-based programs) * Text related to breast cancer * Images and sound * Audio and videos * Decision aids * Users able to affect progression of the program	Information provision * Patient education/information provision: breast anatomy, disease, treatment, heredity, prevention, screening. Support * Decision-making with different treatment options/intention to go genetic testing. * Peer-support like stories of other breast cancer patients. Other * Exercises	Not reported	Not reported
Salonen et al. [21] 3,5	* Patient Information Programme: computer program, touchscreen or mouse format * Virtual Conversations model: voice-activated interactive computer system. Virtual communication with virtual doctor * Multimedia program: internet or CD-ROM * IT-based informational support: CD-ROM and websites * Interactive Health communication: CD-ROM and websites * Nurse-Driven Intervention: video * Internet: website, Database of Individual Patient Experiences-website * Multimedia features integrate audio, video and computer technology	Information provision * Comprehensive and reliable information provision * Majority of eHealth interventions: providing questions and answers. * Providing knowledge * List of variety of reputable cancer websites. Cancer specialized CD-ROM. * List reputable cancer websites, either breast/prostate cancer. Cancer specialized CD-ROM. * Modules for prostate and breast cancer. Also module hypertension, testis cancer, cervix, bowel. Support * Help with (informed) decision-making treatment * Providing psychosocial support * Providing symptom management strategies * Psycho educational strategies Other * Tracking quality of life-problems and psycho-educational strategies with an assessment * Measuring decision and information preferences	Various: * Multiple viewing; every month during 6 mths, unlimited access, 8 wks period * Single viewing * In some instances, intervention period was not reported	Various: * Clinical environment; hospital * Patients' homes * Partners and spouses in same room, without each other's input * In some instances, organizational setting was not reported

Table 2 (*Continued*)

Reference and score methodological assessment	Type of eHealth interventions	Content of eHealth interventions	eHealth intervention period	Organizational setting of eHealth interventions
Ventura et al., [22] 3	* Prostate Interactive Educational System (PIES); construction not based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and computer-based feedback only * Comprehensive Health Enhancement Support System (CHESS); construction based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and both human and computer-based feedback * Virtual Conversations; construction not based on needs assessment of target population, user-driven, contains audio, video and computer-based feedback only * Interactive Digital Education Aid (IDEA); construction based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and no interactivity in form of feedback * Computerized Multimedia Interactive Patient Education Aid (CPtDA); construction not based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and computer-based feedback only * Interactive Shared Decision-Making (DM) Program; construction not based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and no interactivity in form of feedback * Multimedia Education Program (MEP); construction not based on needs assessment of target population, not user-driven, contains audio, video, pictures/graphics and no interactivity in form of feedback * Oncology Interactive Educational Series (OIES); construction not based on needs assessment of target population, user-driven, does not contain text, audio, video, pictures/graphics and interactivity in form of feedback * CD-ROM Educational Aid; construction not based on needs assessment of target population, user-driven, contains audio, video, pictures/graphics and no interactivity in form of feedback * Help with Adjustment to Alopecia by Imaging Recovering (HAAIR); construction not based on needs assessment of target population, user-driven, contains video and computer-based feedback only. Other multimedia features are not applicable. * The Interactive Breast Cancer CDROM; construction based on needs assessment of target population, user-driven, contains text, audio, video and computer-based feedback only * The Understanding Cancer CD-ROM; construction not based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and computer-based feedback only * WebChoice; construction based on needs assessment of target population, user-driven, contains text, audio, video, pictures/graphics and both human + computer-based feedback * Computerized Educational Tool; construction based on needs assessment of target population, user-driven, contains text and no interactivity in form of feedback * "A Guide to Your Visit"; construction not based on needs assessment of target population, not user-driven, contains audio, video and interactivity in form of feedback not applicable * Interactive Videodisc Module; construction not based on needs assessment of target population, user-driven, contains audio, video and no interactivity in form of feedback * Almost all interventions had format of computer-based tool and were user-driven * Five underlying studies: intervention based on needs assessment of target population, CHESS, IDEA, The Interactive Breast Cancer CD-ROM, WebChoice and The Computerized Educational Tool	Information provision * Informational support Support * Emotional support * Social support * Decision-making * Self-care	Not reported	Various: * Research center * All places * All places and research center

Table 3
Best evidence synthesis.

Reference	Salonen et al. [21] moderate quality	Beatty and Lambert [13] high quality	Ventura et al. [22] moderate quality	Bender et al. [14] moderate quality	Johansen et al. [19] moderate quality	Hong et al. [18] moderate quality	Ryhanen et al. [20] moderate quality	Griffiths et al. [15] moderate quality	Hoey et al. [17] moderate quality	Gysels and Higginson [16] moderate quality	
Outcome category											Level of Evidence
Knowledge and Information	+ (3)					+ (3) no effects (1)	+ (9)			+ (5)	Evidence
Support	+ (2)		+ (1) no effects (1)		+ (1)	+ (7)	+ (3)		+ (1)	+ (1)	Evidence
Decision making	+ (3) − (1)		+ (6)				+ (2)			+ (2) no effects (2)	Inconsistent findings
Healthcare participation and Patient involvement			+ (3) no effects (1)			+ (1)	+ (6)		+ (1)	+ (1) no effects (2)	Indications of evidence
Depression	+ (4)				+ (1)	+ (4) − (1) no effects (1)	no effects (2)	+ (4) no effects (2)	+ (3)	no effects (1)	Inconsistent findings
Anxiety					+ (1)		no effects (2)		+ (2)	+ (1) − (1) no effects (2)	Inconsistent findings
Psychological wellbeing	+ (3)	no effects (1)			+ (1) no effects (1)	+ (9) − (1) no effects (4)		+ (1)	+ (1) − (1)		Inconsistent findings
Quality of life	+ (2)	no effects (1)	+ (4) no effects (1)		+ (1)	+ (1) − (1) no effects (1)			no effects (1)	+ (1)	Inconsistent findings
Health status		+ (1)	+ (4) no effects (2)			no effects (1)				+ (1)	Indications of evidence
Physical wellbeing		no effects (1)				+ (1) no effects (1)			+ (1)		No evidence
Functional wellbeing						no effects (1)					No evidence

+ Positive effects; −Negative effects; () Number of underlying studies in review included.

Supplementary material; Search strategy PubMed

For the development and adaption of the search strategies, databases' thesaurus terms for eHealth, cancer, systematic review and meta-analysis or specific 'systematic review filters' were used, as well as free text words describing eHealth.

Search Strategy for PubMed

(telecommunications[Majr] OR "Medical Informatics/education"[Mesh] OR "Medical Informatics/nursing"[Mesh] OR "Medical Informatics/psychology"[Mesh] OR Computer Communication Networks[Majr] OR educational technology[Majr] OR Biomedical technology[Majr] OR Mobile applications[MeSH Terms] OR electronic health records[Majr] OR Health Records, Personal[MeSH Terms] OR Telenursing[MeSH Terms] OR telemedicine[tiab] OR tele?medicine[tiab] OR telehealth[tiab] OR ehealth[tiab] OR e?health[tiab] OR mhealth[tiab] OR m?health[tiab] OR "mobile health" OR telecare[tiab] OR tele?care[tiab] OR ecare[tiab] OR e?care[tiab] OR app care OR teleconsult*[tiab] OR tele?consult*[tiab] OR econsult*[tiab] OR e?consult*[tiab] OR videoconsult* OR video?consult*[tiab] OR telecommunicat*[tiab] OR tele?communicat*[tiab] OR ecommunicat* OR e?communicat*[tiab] OR electronic communicat* OR videocommunicat* OR video?communicat*[tiab] OR telemonitor*[tiab] OR tele?monitor*[tiab] OR e?support[tiab] OR telesupport[tiab] OR "health technology" OR "health care technology" OR wireless[tiab] OR telenurs*[tiab] OR tele?nurs*[tiab] OR "mobile applications" OR e?coach*[tiab] OR elearn*[tiab] OR e?learn*[tiab] OR web?base*[tiab] OR email*[ti] OR e?mail*[ti] OR smartphon*[tiab] OR smart?phon*[tiab] OR mobile phone* OR "tablet computer" OR "tablet computers" OR iphone*[tiab] OR ipad*[tiab] OR text?messag*[tiab] OR internet*[ti] OR online*[tiab] OR "health 2.0" OR tele?health[tiab])

AND

(cancer[Majr] OR neoplasms[Majr] OR medical oncology[Majr] OR carcinoma[Majr] OR Sarcoma [Majr] OR metastasis[Majr] OR cancer*[tiab] OR neoplasm*[tiab] OR "medical oncology"[tiab] OR

oncolog*[tiab] OR tumor*[tiab] OR carcinom*[tiab] OR metastas*[tiab] OR Sarcom*[tiab] OR leukem*[tiab] OR leucem*[tiab] OR hodgkin*[tiab] OR lymphom*[tiab])

AND

(((((Meta-Analysis[ptyp] OR Review[ptyp] OR systematic[sb]))) OR ((systematic review[ti] OR meta-analysis[pt] OR meta-analysis[ti] OR systematic literature review[ti] OR (systematic review[tiab] AND review[pt]) OR consensus development conference[pt] OR practice guideline[pt] OR cochrane database syst rev[ta] OR acp journal club[ta] OR health technol assess[ta] OR evid rep technol assess summ[ta] OR drug class reviews[ti]) OR (clinical guideline[tw] AND management[tw]) OR ((evidence based[ti] OR evidence-based medicine[mh] OR best practice*[ti] OR evidence synthesis[tiab]) AND (review[pt] OR diseases category[mh] OR behavior and behavior mechanisms[mh] OR therapeutics[mh] OR evaluation studies[pt] OR validation studies[pt] OR guideline[pt] OR pmcbook)) OR ((systematic[tw] OR systematically[tw] OR critical[tiab] OR (study selection[tw]) OR (predetermined[tw] OR inclusion[tw] AND criteri*[tw]) OR exclusion criteri*[tw] OR main outcome measures[tw] OR standard of care[tw] OR standards of care[tw]) AND (survey[tiab] OR surveys[tiab] OR overview*[tw] OR review[tiab] OR reviews[tiab] OR search*[tw] OR handsearch[tw] OR analysis[tiab] OR critique[tiab] OR appraisal[tw] OR (reduction[tw] AND (risk[mh] OR risk[tw]) AND (death OR recurrence))) AND literature[tiab] OR articles[tiab] OR publications[tiab] OR publication[tiab] OR bibliography[tiab] OR bibliographies[tiab] OR published[tiab] OR unpublished[tw] OR citation[tw] OR citations[tw] OR database[tiab] OR internet[tiab] OR textbooks[tiab] OR references[tw] OR scales[tw] OR papers[tw] OR datasets[tw] OR trials[tiab] OR meta-analy*[tw] OR (clinical[tiab] AND studies[tiab]) OR treatment outcome[mh] OR treatment outcome[tw] OR pmcbook) NOT (letter[pt] OR newspaper article[pt] OR comment[pt]))))

Table S1 General and methodological characteristics of reviews included

General and methodological characteristics of reviews included					General and methodological characteristics of underlying studies in review	
Reference, first author's country of origin, score meth. assessment	Information sources and dates of coverage	Review objectives	Review's eligibility criteria	Synthesis of results	Number and design	Population
Beatty et al. 2013 Australia [13] 5	* Embase (period ?) * MEDLINE (period ?) * PsycINFO (period ?) * CINAHL (1980 - Dec. 2011) * Reference lists of included studies.	To update evidence and to review application of internet to psychological treatment of distress	Inclusion criteria: Published (or in-press) 1980 - December 2011; Adults (18>) with a chronic physical health condition; Self-help internet-based psychosocial therapeutic interventions; Outcome measure: distress, quality of life or wellbeing; RCT, quasi-randomized trial, feasibility RCT study; English language. Exclusion criteria: Conditions included in DSM-IV; Interventions providing information/education only, without therapeutic component; Studies examining computer-based support groups; Case-series and single group pre-post studies.	* Narrative synthesis	* 23 studies included. Only 1 concerned cancer patients. * design: quasi experimental. * conditions: eHealth intervention vs waitlist control group	* population: adult patients with a variety of chronic diseases. Only one study concerned cancer patients: * tumor type: breast * disease/clinical stage: already diagnosed * gender: only female
Bender et al. 2013 Canada [14] 3	*Canadian and French mobile application markets:* * iPhone (App Store) * Android (Google Play) * BlackBerry (App World) * Nokia/Symbian (Ovi) *Date of searches: February 14, 2012 *Health literature databases:* * MEDLINE (1990-June 18, 2012)	To characterize purpose and content of cancer-focused smartphone applications available for use by the general public and evidence on their utility or effectiveness.	*Mobile application market* Inclusion criteria: focus on cancer; focus on cancer patients or survivors, their family caregivers or the general public concerned about cancer; English-language interface; Available for smartphones. Exclusion criteria: Only available on tablet computers; Aimed at health care professionals; Applications related to smoking cessation, radiation exposure, or general symptom management applications. *Health literature search* Inclusion -part 1: Description of evaluation of mobile phone applications for cancer patients/survivors, family caregivers, or the general public; Inclusion of original data on use of mobile phone applications by cancer patients/survivors, family caregivers or the general public; English language. Inclusion final analysis: Description of evaluation of a cancer-focused smartphone applications. Exclusion final analysis: Description of evaluation of: -basic mobile phone and personal digital assistant	* Coding scheme for describing purpose of applications, based on seven identified categories of applications. * Applications coded into one category based on their main purpose as describes in store description.	* 295 cancer-focused smartphone applications found. * No studies concerning evaluation of cancer-focused smartphone applications found.	* population: different groups of people: patients; cancer survivors; family caregivers; general public * tumor type: breast; skin; prostate; lung; colorectal; pancreatic; cervical; ovarian; testicular; liver; kidney; brain; pediatric cancers; hematologic cancers; female cancers; cancer in general. * disease/clinical stage: no explicit stage defined. * gender: no explicit focus reported.

	* Embase * The Cochrane Library; all databases * Dates of coverage: 1990- June 24, 2012 * Reference lists from eligible articles and recent reviews.		interventions -reliability of paper vs mobile phone-based assessments; Evaluations of applications tested exclusively on laptops, netbooks or tablet computers.			
Griffiths et al. 2009 Australia [15] 3	* PubMed * PsycINFO * The Cochrane library * Dates of coverage: period before Aug. 2007 * Dates of searches: May 2005 and July 2007 * Reference lists of included studies.	To provide comprehensive overview of effects of Internet Support Groups on depressive symptoms	Inclusion criteria stage 1: Peer- to-peer interaction; At least one of following: online/electronic support groups, online/electronic social or peer support, online/computer-based communication or interaction, collaborative virtual environments or interventions; Support "group" was health/psychology related or article measured health/psychology related outcome in relation to a support group. Inclusion criteria stage 2: Study employed online peer-to-peer support group; Study incorporated either a depression outcome or involved unipolar depression Internet Support Group. Inclusion criteria stage 3: Study reported either quantitative or qualitative empirical data. Exclusion criteria stage 4: No depression outcome or study did not concern Internet Support Group exclusively devoted to depression; Duplicates after second search; Non-English language.	* Possible role of different characteristics and quality explored by comparing samples which reported to have yielded positive statistically significant results with those that did not: Series of Fisher exact tests and Mann-Whitney tests. Data analyzed at comparison rather than study level. * For descriptive purposes, where possible, Cohen's d standardized effect sizes calculated. * Uncontrolled studies: pre-post standardized effect size calculated from mean pre-test and post-test scores and standard deviations. * Controlled studies, study effect size: difference between pre-post effect size control group and pre-post effect size intervention group calculated. * When only t test value for dependent (or equivalent) samples available: no effect size estimated. * When only baseline adjusted means + baseline adjusted difference in change available: no effect sizes calculated.	* 28 studies included. 7 concerned cancer patients and had various designs. * design: RCT (n=2); controlled trial (n=1); pre-post study (n=4). * conditions (n=3): eHealth intervention vs: wait-list control (n=2); treatment as usual (not further specified, n=1). * control intervention period varied: 12 wks (n=2); 6 wks (n=1). * control group: patients with breast cancer (n=1); patients with breast cancer diagnosed in past 32 mths (n=1); patients with head- and neck cancer (n=1). * gender control group: female (n=2); not reported (n=1).	* population: people with a variety of chronic diseases. 7 studies concerned cancer patients. * tumor type: breast (n=6); head or neck-cancer (n=1). * disease/clinical stage: - breast cancer: diagnosed past 32 mths (n=1) - head or neck-cancer: post-surgery (n=1); no report of stage (n=5). * gender: only female (n=6); not reported (n=1). * other: Inclusion of some rural residents (n=1); Participants joined 1 of 5 frequently used bulletin boards <8 wks previous to participation in study (n=1); Participants joined 1 of 4 frequently used bulletin boards <8 wks previous to participation in study (n=1); Participants who have previously posted on Breast Cancer bulletin board during a particular 1-wk period (n=1); Financial incentive given to patients for participation (n=1).

Gysels & Higginson 2007 UK [16] 4,5	* MEDLINE (1966-wk 3 of April 2006) * Embase (1980 – wk 18 2006) * CINAHL (1982 – wk 3 of April 2006) * Cochrane Database of Systematic Reviews * Cochrane Central Register of Controlled Trials * Dates of coverage: wk 3 of April 2006 * Reference lists of included studies. * Expert panel's advice on recently published articles or ongoing research.	To assess benefits of interactive multimedia technologies and videotapes for patient education	Inclusion criteria: RCTs; Patient education to improve knowledge, satisfaction, decision making, treatment choice or care management; Videotape or computer programs; Cancer care; Only diagnostic screening procedures. Exclusion criteria: Studies involving hypothetical choices, informed consent to take part in clinical trial, decisions regarding preventive screening or public health measures; Interventions intended for other purposes than treatment decision making and informed consent; Interventions experimenting with Internet; Focus on children; Non-intervention studies.	* Meta-analysis: when sufficient comparable outcome data ≥2 studies; heterogeneity testing using the χ2 test; random-effects model applied. * Continuous data summarized as weighted mean differences with 95% confidence intervals. * Dichotomous data summarized as odds ratios with 95% confidence intervals. * Analysis of continuous + dichotomous data altogether: Effect sizes for all outcomes calculated by dividing estimated mean difference or difference in proportions, by sample standard deviation.	* 9 studies included. 6 concerned effects of eHealth interventions. * design: RCT. * conditions: eHealth intervention vs: reading material: Susan Love's Breast Book (n=1); usual care: standard information and (face-to-face) care from multidisciplinary team (n=1); standard education (n=1); brochure (n=1); face-to-face medical consultation (n=1); information booklets (n=1). * gender control group: female (n=4); mixed (n=2).	* population: patients (n=6) * tumor type: breast (n=4); various (n=1); referred for colonoscopy; not specified (n=1). * disease/clinical stage: - breast cancer: newly diagnosed (n=1); recently diagnosed (n=1); stage I / II (n=1); histologically confirmed axillary node-negative breast cancer and primary surgery at first consultation for adjuvant systemic therapy (n=1). - various types: started radical radiotherapy (n=1). - referred for colonoscopy: undergoing colonoscopy (n=1). * age: <60 years (n=1); not reported (n=5). * gender: female (n=4); not reported (n=2).
Hoey et al. 2008 Australia [17] 4,5	* CINAHL * MEDLINE * PsycINFO * Dates of coverage: (1980-April 2007) * Reference lists of included studies. * Key researchers were contacted for identification additional publications.	To identify different peer support models and examine research assessing their effectiveness	Inclusion criteria: English language; Description of specific program where peers provided direct support to people with cancer; Peer who has been diagnosed and/or treated for cancer; Primary program purpose: to provide support to cancer patients. Exclusion criteria: Not specific peer-support program; Focus on children or adolescents; Educational or therapeutic course run by professionals (incl. supportive expressive therapy); No primarily focus on peer support; Peer support from someone other than person with cancer; No sufficiently detailed program description; Not possible to determine how peer provided support; Not possible to determine if peer support provider had experienced cancer; Editorial or letter concerning program; First-person account of an experience.	* Selected papers classified into one of following pre-determined categories: - non-research theoretical or service usage; papers describing proposed model or specific program+papers no data containing apart from service usage data - one group descriptive; describing program with data collection, one group only and no experimental design) - non-randomized comparative studies - randomized controlled trials.	*44 studies included. 7 concerned effects of eHealth interventions. * designs: qualitative (n=4):- telephone interviews (n=2) - face-to-face + online interviews (n=1) - content analysis posted messages (n=1); RCTs (n=2). * conditions: eHealth intervention vs: providing information in form of booklet concerning breast cancer (n=1); wait-list control (n=1). *control group: not explicitly reported (n=2).	* population: patients (n=7) * tumor type: breast (n=7) * gender: female (n=7)

Hong et al. 2012 USA [18] 3	* PsycINFO * ERIC * MEDLINE via PubMed * Dates of coverage: ? * Reference lists of included studies.	To systematically review existing studies on outcomes concerning online support or resources	Inclusion criteria: Empirical data (either qualitative or quantitative methods) on use online cancer support/resources; Reported outcome measures; Focus on adult cancer survivors; English language; Peer-reviewed articles published before July 2010. Exclusion criteria: Descriptive studies which did not report outcomes; No focus on cancer survivors; Focus on computer-based resources (without access to Internet); review studies; theoretical articles.	Not reported	* 24 studies included. * design: cross-sectional survey/interview (n=15): focus groups, in-depth interviews, ethnographic case studies, pre-post studies (n=5); RCTs (n=4). *conditions: online educational control condition (n=1); not reported (n=3). * control group: patients (n=4) * gender control group: female (n=3); not reported (n=1).	* population: patients (n=24) * ethnicity: - majority: Caucasian people; - low income woman; African Americans breast cancer (n=1); Latino immigrants breast cancer (n=1). * tumor type: breast (n=16); colorectal (n=1); prostate/breast (n=1); various types (n=6) * disease/clinical stage: majority of studies: various disease/clinical stages, from patients undergoing treatment to survivors post-treatment; - breast cancer: survivors (n=16); early stage in treatment (n=1); recently diagnosed (n=1); metastatic (n=1); not reported (n=13); colorectal cancer: early stage (n=1); not reported (n=7) * age: <65 yrs. (n=3); not reported (n=19). * gender: female (n=16); male (n=1); mixed (n=2); not reported (n=5).
Johansen et al. 2012 Norway [19] 3,5	Via Ovid: * MEDLINE * Embase * PsycINFO * Cochrane Central Register of Controlled Trials * IEEE Xplore * Dates of coverage: (1990-November 2011) * Date of searches: May 2011 and 2 updates in October and November 2011	To create comprehensive an overview of knowledge focusing on electronic communication between patient and provider to improve health care service quality, and to clarify what has been investigated so far regarding different patient groups, health service innovations, research targets and relevant electronic symptom reporting	Inclusion criteria: original study; patients or parents; Electronically reported symptoms or health information to clinical health care personnel or system, where receiver processed and interpreted data and provided feedback; Reported information had to concern symptoms and health status at time of reporting or during preceding few days; RCT comparing electronic symptom reporting vs control where symptom or health information was not received by health care professionals or systems. Exclusion criteria: Retrospective questionnaires, prevalence surveys, general screening on Internet, tests of medications; Electronic communication requiring simultaneous presence of patient and health care personnel; automatic biometric measurements; voice diary.	* Qualitative content analysis of data * Qualitative analysis of study as whole * Quantitative analysis applied: not reported	* 29 studies included. 6 concerned cancer patients. * design: RCT * conditions: eHealth intervention vs: electronic Self-Report Assessment-Cancer: color graphical summary of participant's self-reported symptoms and quality of life issues with predetermined thresholds flagged. No summary handed to clinician (n=1); Touch-screen survey filled out before oncologist visit. Computer scored answers. No results made available to oncologist (n=1); All patients scheduled for outpatient visit used system on tablet computer	* population: people with different illnesses. 6 studies concerned cancer patients: * tumor type: leukemia/Lymphoma (n=1); breast, lung/colorectal cancer (n=1); not reported (n=4). * disease/clinical stage: not reported * mean age years 67.7 (n=5): 18–86 (mean 54), 23–77 (mean 56.3), ≥18: mean Intervention: 50.- Control: 49 (I+C/2 = mean 49.5) range not reported: (mean 54.9) , >18 (mean 56); mean age not reported, 20–85 years (n=1). * gender: mixed (n=6);

.3 % (n=5).					for reporting symptoms and preferences before consultation. For clinicians, system highlighted patient experienced symptoms incl. severity, degree of bother, importance for patients. Information was not printed, not provided to the patient and clinician (n=1); Use of "Choice": interactive tailored patient assessment tool, touchpad tablet PC, for symptom assessments prior to inpatient and outpatient visits. Assessment summary, displaying patient's self-reported symptoms, problems and distress in rank order of patient's need for support, was not provided to clinicians (n=1); - attention-control group: Completion of touch-screen Health-related quality of life questionnaires in waiting room before every encounter. No summary provided to physicians. AND - control group: no touch-screen measurement of Health-related quality of life questionnaires before clinic encounters (n=1); standard care (n=1). * organizational setting control conditions varied: Inside Clinic (n=5); outside/home (n=1). * control intervention period varied: 2 visits (before treatment, 4–6 wks later) (n=1); before visit, 4 times (n=1); 1 consultation (n=1); up to 1 yr (once per encounter during treatment, once week during hospital stay, once outpatient visit in up to 4 visits) (n=1); approx. 6 mths (n=1); 4 cycles chemotherapy (12–16 wks) (n=1) * control group: patients (n=6). * gender control group: not	female, mean 61.3 % (n=5): female 59.5%, female 59%, female 38%, female 73%, female 76.8%; female % not reported (n=1).

					reported (n=6).	
Ryhanen et al. 2010 Finland [20] 3,5	* Cochrane Database of Systematic Reviews (Issue 4, 2008) * CINAHL (1982–2008) * MEDLINE (1950–2008) * PsycINFO (1995–2008) * ERIC (1966–2008) * ScienceDirect (1994–2008) * Social Science Citation Index (1956–2008) * Education Research Complete (1990–2008)	To provide a description of internet and interactive computer-based patient educational programs and analyze their effectiveness	Inclusion criteria: RCTs, clinical trials and quasi experimental studies; English language; Internet-based patient education as use of World Wide Web or with modem connections to central server for communication for patient education; Use of computer with CD-ROMs. Exclusion criteria: Use of computer for generating written patient education materials and e-mails; Use of computer by health care professionals; Solely examining support groups' efficiency; Focus solely on breast cancer screening.	Not reported	*14 studies included. * design varied: RCTs (n=9); clinical trials (n=2); quasi-experimental (n=3). * conditions: eHealth intervention vs: brochure (n=1); traditional manner (n=1); discussion of general issues with registered nurse (n=1); eHealth intervention + oral negotiations by counselors vs oral negotiations by counselors (n=2); standard face-to-face prevention consultation (n=1); eHealth intervention + standard patient education vs standard patient education (n=1); lay book (n=1); - eHealth intervention (general internet use and for breast health issues) vs no using internet, - eHealth intervention (general internet use) vs not using internet (n=1); eHealth intervention (internet use for breast health issues) vs not using Internet for breast health issues (n=1); no educational interventions named, being in a waiting-list (n=1); status before use intervention (n=3). * control group: patients (n=12); low risk and high risk patients (n=2); high-risk prognosis; younger and older women (n=1); minority and Caucasian group mixed (n=2). * age control group: mean age in years: 52.4 (24-71).	* population: patients (n=11); low risk and high risk patients (n=2); women with high-risk prognosis (n=1). * ethnicity: Caucasian, African American, Hispanic American (n=1); Caucasian and African American (n=1); Spanish speaking (n=1) * tumor type: breast (n=14) * disease/clinical stage: already diagnosed (n=6); newly diagnosed (n=1); under treatment (n=1); stage I or II (n=1); stage I or II after receiving biopsy results (n=1); without evidence of recurrent or previous breast cancer (n=1); women with family or personal histories of breast cancer (n=2): high-risk patients, low-risk patients; high-risk prognosis (n=1). * mean age in years: 52.6 (23-77) * gender: female (n=14) * other: Financial incentive given to patients for participation (n=1)
Salonen et al. 2014 Finland [21] 3,5	* Ovid MEDLINE (1948–2011) * Ovid Nursing Database (1948–2011) * Cochrane (1991–2011) * CINAHL (1996–	To evaluate benefits of best available evidence for Internet use or use of computer-based programs for cancer-related information, emotional or spiritual	Inclusion criteria: quantitative or qualitative design; prostate cancer patients; English language; Use of computer/Internet/websites with CD-ROMs, when programs were interactive; Outcome was reported qualitatively or quantitatively. Exclusion criteria: Dissemination of prostate cancer	Not reported	*18 studies included. 9 concerned effects of eHealth interventions. * designs: RCTs (n=2); pre-post-quasi-experimental (n=2); quasi-experimental (n=1); pre-	* population: patients (n=8); patients and spouses/partners (n=1) * ethnicity: Caucasian (Asian people possibly included); English speaking (French speaking people possibly

	2011) * PsycINFO (1997–2011). * Reference lists of included studies.	support	risks and screening information; Examination of information resources in prostate cancer treatment; Descriptive studies not reporting outcomes; review studies or theoretical articles.		post studies (n=2); qualitative studies (n=2): - face-to-face interview (n=1), - in-depth interviews (n=1). * conditions: eHealth intervention vs standard care (not further specified, n=1); not reported (n=4). * control group: not explicitly reported (n=5).	included). * tumor type: (localized) prostate cancer (n=6); prostate cancer and breast cancer (n=3). * disease/clinical stage: often recently diagnosed. * mean age years 64.1 (n=6): 62.4, 62.2, 65.7, 66.7, 62.3, mean intervention: 62.3 mean control: 67.8 (I+C/2 = mean 65.05); age not reported (n=3). * gender: male (n=5); mixed (n=4).
Ventura et al., 2013 Sweden [22] 3	* PubMed (1950-2012) * CINAHL (1982-2012) * PsycINFO (1872-2012) * Reference lists of included studies.	To gather more knowledge of the design of supportive eHealth interventions and to analyze and synthesize that knowledge in a potential explanatory model for those interventions	Inclusion criteria: participants > 18 years; diagnosed with cancer; starting/undergoing/completed treatment; supportive eHealth systems designed and implemented/facilitated by health professionals; all interventions using videos, CDs or DVDs; Interventions constituted educational and/or support tools. Exclusion criteria: Tools developed for pre-disease period; descriptive analyses of health information websites; Report on development (phase I) or exclusively on usability, acceptability, feasibility (phase II).	* Data analysis: ordering, coding and categorization of primary studies. * Results were summarized and integrated into conclusion regarding research problem. * Data analysis led to identification of patterns, themes and relationships that were synthesized in potential explanatory model	*29 studies included. * design: one group studies (n=11); experimental design (n=18): two arms studies (n=13), three arms studies (n=2), four arms studies (n=3). * conditions: not reported (n=29). * control group: probably healthy women (n=1); not explicitly reported (n=28).	* population: patients (n=29): Underserved (n=4); low literate, multi-ethnic (n=1); Low-income (n=1); Women with hair loss (n=1); Outpatients (n=1). * tumor type: breast (n=18); prostate (n=2); colorectal (n=2); papillary thyroid (n=1); Various types (n=3): prostate and breast cancer; not reported (n=3). * disease/clinical stage: -breast cancer: newly diagnosed (n=10); recently diagnosed (n=2); stage I + II (n=1); under treatment (n=1); not reported (n=7). - prostate cancer: newly diagnosed (n=4). - papillary thyroid cancer: recently diagnosed (n=1). - colorectal cancer: post-operative with stoma (n=1); not reported (n=1). - starting chemo (n=1). - under cancer treatment/chemo (n=2). * age: <60 years (n=1); not reported (n=28). * gender: female (n=19); male (n=2); mixed (n=3); not reported (n=5). * other: Home interventions: Researchers made it possible to borrow computer and Internet charges were paid for during intervention period

Table S2 Outcomes, Effects, Conclusions

Reference and score methodological assessment	Time measurements	Outcomes	Results concerning effects of eHealth	Review's conclusions and reflections concerning effects of eHealth on cancer patients
Beatty et al. 2013 [13] 5	* Pre-test and post-test after 12 wks	* Distress * Quality of life * Wellbeing	Psychological wellbeing *No effects on:* * psychological distress * emotional wellbeing Physical wellbeing *No effects* Quality of life *No effects* Health status *Positive effects on:* * global perceived health for people with poor baseline levels	Conclusion * Moderate evidence was found for chronic pain-related distress; however, limited research conducted among cancer patients currently precludes conclusions from being drawn. Reflections * Conclusions concerning lack of evidence for effects on cancer patients might be premature given that only one study was conducted. This limits ability to draw conclusions. * Waitlist designs are weaker as control participants are less likely to seek constructive action compared to alternative control-groups, as they anticipate future therapeutic input. * Tentative evidence was found for online interventions leading to significant improvements of physical symptom/disease-control in cancer patients.
Bender et al. 2013 [14] 3	not applicable	All potentially relevant outcomes	No research found * No studies concerning evaluation of cancer-focused smartphone applications were found.	Conclusion * Considerable number of cancer-focused applications available. * Lack of evidence base in favor of applications, despite mobile devices offering remarkably low-cost, real-time ways to encourage preventive strategies, monitor behaviors, symptoms physiological indicators and provide interventions. * Focus of future efforts should be on improving and consolidating evidence on utility, safety, effectiveness of mobile cancer applications into a whitelist for public consumption. Reflections * Majority targeted breast cancer or cancer in general * Increasing number available health apps * Cancer apps on their own have limited potential value in delivering health behavior-changing interventions. * Focus raising awareness /provision educational information Minority od applications combined information provision with skill-building tools assisting in performance of preventive, detection or self-management behaviors. * Limited use of smartphone's technical capabilities, e.g. audio recording, self-monitoring using photos and automated sensing for tracking . Majority uses textual entry or touch screen completion. * Limited use of assistance through mobile sensing platforms of smartphones in automated logging symptoms or health behaviors. * Effective self-management requires effective communication with + support from healthcare team. Limited use features facilitating communication with healthcare team. Restricted to tools identification, prioritizing questions and journaling apps to take notes. * Limited use of advantage of smartphone's social networking capabilities. * Lack of evidence on effectiveness and description of procedures/data sources is worrisome. * Over-representation of breast cancer apps, under-representation of prostate, lung, and colorectal apps. * Current lack of synthesis of regulations on development, evaluation, reporting standards and criteria for selecting health applications. * Applications potentially cause distress and harm if provided advice is misleading and unsupervised.

Griffiths et al. 2009 [15] **3**	Various: * Baseline, wks * Baseline, 16 wks, 20 wks * "Baseline", 6 mths post "baseline" * Analysis mood; First online post, Last online post * Baseline, 6 wks, 3 mths	* Depression	Depression and anxiety *Positive effects on:* * reduction of depressive symptoms (single-component interventions) *No effects on:* * depressive symptoms in baseline adjusted mean at 12 wks (multi-component intervention) * depressive symptoms in baseline adjusted difference at 6 wks and 3 mths (multi-component intervention) Psychological wellbeing * possibly small association between board use and improved mood (single-component intervention) Other * breast cancer Internet Support Groups are more successful than Internet Support Groups focusing on other diagnoses (Fisher exact test, P = .02)	Conclusion * There is a need for high-quality research on effect of Internet Support Groups on depression outcomes. Reflections * Baseline measures of depression were not predictive dropout * Predictors for non-adherence: poorer coping anxiety, more fatalistic, less pain interference in life, less perceived change in relationships/personal strength * No baseline differences in demographics, clinical characteristics, depression severity, posttraumatic growth/psychosocial well-being between completers and non-completers. * There is a paucity of high-quality studies: Minority consisted of controlled studies. * Results yielded about breast cancer Internet Support Groups being more successful than other types of Internet Support Groups, requires further investigation. Women with breast cancer are known for increased risk of depression. If found effective, breast cancer Internet Support Groups could provide an important mental health self-care and prevention tool for women with breast cancer. However, status of current results are unclear given majority of findings being derived from one research group and underlying studies being typically of low quality.
Gysels & Higginson 2007 [16] **4,5**	Various: * Pre- test + 2 post-test surveys (2 + 5 mths follow-up) * In some instances, time measurement was not reported	* Knowledge * Satisfaction * Decision making * Treatment choice * Care management	Knowledge and information *Positive effects on:* * information competence after 2 mths at breast cancer patients * information competence after 5 mths at breast cancer patients * information competence for women with breast cancer and of color, uninsured or those with less education * knowledge at breast cancer patients after receiving information about breast cancer treatment * knowledge at patients who started radical radiotherapy after receiving personalized information * overall information comprehension by colonoscopy patients Support *Positive effects on:* * social support after 5 mths at breast cancer patients * social support for women with breast cancer and of color, uninsured or those with less education Decision making *Positive effects on:* *satisfaction with decision making concerning treatment by breast cancer patients *No effects on:* * decision making concerning treatment by breast cancer patients * satisfaction with treatment decision of breast cancer patients Healthcare participation and patient involvement *Positive effects on:* * healthcare participation after 2 mths at breast cancer patients * healthcare participation for women with breast cancer and of color, uninsured or those with less education *No effects on:* * healthcare participation by breast cancer patients, after 5 mths * patient involvement in consultations for choosing breast cancer treatment	Conclusion * Claims of reprioritizing patient education as essential element of patients' management requires evaluation of interventions at different patient groups and in variety of circumstances. * Educational technology as effective and, in most outcomes, superior to traditional methods. They achieved knowledge improvement. * The interventions did not increase anxiety, and in two interventions, lower levels of anxiety were reported. * Computer interventions have a variable impact on patient involvement in decision making. * Inconsistencies are due to diversity in interventions undertaken. * Included studies present only preliminary evaluations. * Various ways of delivering interventions may affect patient responses and thus the extent of personal communication with health professional are one of factors affecting patient responses. Reflections * Studies are heterogeneous in design, instruments tested, content provided, populations examined, outcomes measured and results obtained. Therefore it is difficult to give general answers regarding effective use of the interventions. * Various ways of delivering interventions may affect patient responses: some interventions were administered with assistance of a health professional during consultation. Advantage: Professional can probe somebody's information requirements, thoughts, mood which a machine is not able to do. Disadvantage: focus on medical encounter and danger that complexity of decision-making process may be overlooked. * Pre-consultation devices still directed towards clinical encounter. However, it allows patients more independence, and better preparation. * Take-away/ in-home instruments have advantage that they are available when and where needed. Less focus on specific decisions and recognize information need outside formal healthcare episodes.

			Depression and anxiety *Positive effects on:* * reduction of anxiety at breast cancer patients during discussion of diagnosis and treatment *Negative effects on:* * anxiety level at 3 mths at patients who started radical radiotherapy, after receiving general information *No effects on:* * depression scores of breast cancer patients during discussion of diagnosis and treatment * anxiety at colonoscopy patients Quality of life *Positive effects on:* * quality of life for women with breast cancer and of color, uninsured or those with less education Health status *Positive effects on:* * mental health score of breast cancer patients suggesting improvement of health status	
Hoey et al. 2008 [17] 4,5	Various: * 6 mths post, 1 yr following * 4 mths post, 8 mths period * Baseline, 16 wks, 20 wks * 3 mth period (monitoring), post-test (Scale) * Baseline, 2, 5 mths post-test *Baseline, 12 wks post-test	All potentially relevant outcomes	Support *Positive effects on:* * increase informational and social support post intervention Healthcare participation and patient involvement *Positive effects on:* * increase in healthcare participation at 2 mths Depression and anxiety *Positive effects on:* * reduction in depression * reduction in anxiety * reduction in fear Psychological wellbeing *Positive effects on:* * increase in experience of positive changes *Negative effects on:* * increase in emotional suppression Physical wellbeing *Positive effects on:* * reduction in reaction to pain Quality of life *No effects* Empowerment and coping *Positive effects on:* * participation empowered women through: 1. knowledge, 2. sharing experiences, 3. new social world, 4. social intimacy.	Conclusion: Overall conclusion concerns peer support programs in general: * Very little research has specifically explored effectiveness of peer support programs improving psychological outcomes for cancer patients other than breast cancer patients. Therefore, it may not be appropriate to generalize findings to other cancer populations. * Possible that peer support programs are less likely to impact adjustment and quality of life of breast cancer patients, while an abundance of support is already available for this patient group. * Perhaps new, innovative peer-support programs might be beneficial for other cancer patient groups, particularly those for whom a great deal of support is not available. * Some of mentioned methodological limitations compromise confidence in findings. * RCTs with sufficient statistical power for determining small-moderate effect sizes are particularly lacking. * Given limited level 1 evidence on efficacy of peer-support programs, further research is needed determining whether peer support actually assists cancer patients in adjusting to diagnosis. * Review suggests priority should be given to group Internet peer-support programs, when considering ways of offering peer support. Reflections * It is not possible to determine whether psychosocial benefits are related to group Internet format or to some other factor. * Some peer support programs tested in the RCTs went for a longer time-period than other . An extended period of time may be required to develop relationships and build sufficient rapport to enable people to gain psychosocial benefits from peer support. * RCTs did not find significant effects on quality of life and coping. This might be result of wide range of outcomes used. Some outcomes are possibly not suitable assessing effectiveness of peer support. * No RCTs screened patients' psychological adjustment/motivation seeking support prior program. Recruiting people with low levels of psychological distress or who are not open to receiving support, possibly limits potential psychosocial improvements and impact on treatment effect sizes.

			Stress *Positive effects on:* * reduction in stress * reduction in perceived stress * reduction in post-traumatic stress Social interaction *Positive effects on:* * sense of altruism * sense of reward from helping others * group cohesion Hope *Positive effects on:* * perceived hope Sense of helplessness, indifference and uncertainty *Positive effects on:* * reduction in sense of helplessness and indifference * reduction in uncertainty Universality *Positive effects on:* * sense of universality Other * Overall, results indicate that Internet peer support provided encouragement, empowerment, information and a sense of cohesion. * Reported positive effects on reducing depression, perceived stress and symptoms of post-traumatic stress suggest that program is possibly effective in reducing psychological distress among breast cancer patients.	
Hong et al. 2012 [18] **3**	Various: * Pre-test, post-test, 2-5 mths follow-up * Pre-test, post -test, 1 mth * 12 wks follow-up * 12 wks follow-up, 12 mths * Pre-test, post-test, 6 mths * 1, 6, 12 mths follow-up * 4 mths, 12 mths *In some instances, time measurement was not reported * follow-up pre-post studies variation 1-6 mths. Most 1-3 mths.	All potentially relevant outcomes	Knowledge and information *Positive effects on:* * information seeking * information exchange * health information competence *No effects on:* * barriers to information Support *Positive effects on:* * social support * treatment support * advocacy * greater perceived social support Healthcare participation and patient involvement *Positive effects on:* * healthcare participation	Conclusion: * Existing studies show promise for achieving positive effects. * There is inconclusive evidence partly due to lack of rigorous evaluation studies. * There is a call for more studies on online cancer support based on more rigorous design methodology, larger study populations including various cancer survivors and underserved communities. Reflections * Rather limited amount of studies reported outcomes concerning online support for cancer survivors. * There is need for more rigorous studies that evaluate outcomes of online cancer support or resources. * Future studies need to focus on other cancer survivors and males. * Generalizing findings to other cancer survivors could be difficult, because of disproportionate focus on women with breast cancer. * Few studies focus on underserved communities like minorities or people with low social economic status. * Important to assess effects of online resources on other languages. * Cultural appropriateness and literacy must also be considered. * Larger studies need to be developed. * Future studies need to employ more rigorous evaluation design with long-term follow-up periods. * Call for more studies that design online cancer support tailored to different disease

| | | | | Depression and anxiety
Positive effects on:
* depression/ mental health outcomes

Negative effects on:
* depression

No effects on:
* depression

Psychosocial and psychological wellbeing:
Positive effects on:
* psychosocial wellbeing
* psychological wellbeing in intervention and control group
* reduction of negative emotions
* catharsis
* emotional wellbeing

Negative effects on:
* emotional suppression

No effects on:
* psychosocial outcomes
* psychological wellbeing
* no positive effects on mood disturbance
* emotional wellbeing

Physical wellbeing
Positive effects on:
* reaction to pain

No effects on:
* physical wellbeing

Functional wellbeing
No effects

Quality of life
Positive effects on:
* self-reported quality of life

Negative effects

No effects on:
* health-related quality of life

Health status
No effects
* no positive effects on self-rated health status

Empowerment and coping
Positive effects on:
* empowerment | stages and which incorporate good quality measures, quantity and approach of online support.
* Reported outcomes limited to mainly psychological ones.
* It is important to evaluate other aspects like information support and personal empowerment.
* It is important to evaluate clinical outcomes.
* Evidence regarding outcomes is inconclusive; 4 RCTs reported insignificant or negative outcomes which might be attributed to methodological flaws. Despite, most participants reported positive online experiences.
* Data are especially needed on mechanisms of online support, psychosocial wellbeing and how online information affects decision making.

* Understudied is impact of different modalities of online access on use of online cancer support.
* Need for studies that focus on online cancer support for other cultures, especially for developing countries. |

			No effects on:
			* coping
			* no positive effects on cancer adjustment
			
			Stress
			Positive effects on:
			* stress reduction
			
			No effects
			
			Cancer trauma
			Positive effects on:
			* cancer trauma measures
			* posttraumatic growth
			
			Social interaction
			Positive effects on:
			* altruism
			* personal contacts
			* group cohesion
			* loneliness
			* intimacy
			* social interaction
			
			Hope
			*Positive effect*s
			
			Universality
			Positive effects on:
			* universality
			
			Other
			* Cancer survivors were more likely to offer support than asking for it. Technical support was more frequently offered than emotional support
			* Empowerment occurred via information exchange, emotional support and sharing experiences.
			* Minorities reported greater benefits than Caucasian people.
			* Most studies found positive effects.
			* n=5 pre-post studies; n=1 showed mixed outcomes. Specifically after 2 mths CHESS exposure report of better social support, fewer negative emotions, better healthcare participation and health information competence; However, no effects reported on functional and emotional wellbeing or barriers to information
			* n=4 RCT studies; n=0 showed positive outcomes for intervention compared to control group.
			  - 27-wks online support system led to no positive effects on mood disturbance, cancer adjustment or self-related health status. However, psychological wellbeing improved in both intervention and control group
			  - 12-wks online coping group showed no effect on health-related quality of life or psychological and physical wellbeing. However, a trend of better emotional wellbeing intervention was observed.
			  - intervention group of online peer support showed more psychological distress and poorer quality of life. There were no differences in perceived social support, self-efficacy or hope	

Johansen et al. 2012 [19] 3,5	Various: *Equal to duration/frequency of intervention. * 2 visits (before treatment, 4–6 wks later) * Before visit, 4 times * 1 consultation * Up to 1 yr (once per encounter during treatment, once week during hospital stay, once outpatient visit in up to 4 visits) * Approx. 6 mths * 4 cycles chemotherapy (12–16 wks)	All potentially relevant outcomes	<u>Support</u> *Positive effects on:* * reduction on perceived needs. However, no difference between intervention group and control group. <u>Depression and anxiety</u> *Positive effects on:* * reductions of anxiety levels and depression. However, no difference between intervention group and control group. <u>Psychological wellbeing</u> *Positive effects on:* * positive effect on emotional well-being was associated with data feedback *No effects on:* * no association between better emotional wellbeing and instrument completion <u>Quality of life</u> *Positive effects on:* * clinically meaningful improvement and better of health related quality of life. However, no difference between intervention group and control group * association between improvement of health related quality of life and explicit use of health related quality of life data, discussion of pain and role function <u>Symptoms</u> *Positive effects on:* * decrease in symptom distress, over time * decrease in need for symptom management support, over time * patients who reported debilitating physical symptoms at visit 2 are less likely to report debilitating physical symptom visit 3.	<u>Conclusion</u> * So far, research focused on five specific patient groups, among which cancer patients. * The evidence can be structured into four health service innovation categories: consultation support, monitoring with clinician support, self-management with clinician support, and therapy. Most of the research has been conducted within four combinations, among which consultation support innovation in the cancer patient group. <u>Reflections</u> * Cancer patients who receive chemotherapy or radiation therapy (or both) for a period from 6 months to a year could theoretically benefit from both monitoring and self-management approaches. Yet, electronic symptom reporting for this group of patients has mostly been studied in the context of consultation support.
Ryhanen et al. 2010 [20] 3,5	Various: * Pre-education, post-education, post-visit * Pre-intervention, post-intervention, post-counselling tests, 6 mths follow-up * Pre-test, post-test, 9 mths follow-up * Pre-operative, pre-surgery, post-surgery * Pre-test, 2 mths, 5 mths follow-up * Pre-test, 12 wks follow-up * Pre-test, post-test 4 mths after * Pre-test and post-test measures, not specified * One measure * Duration of trials: Not specifically	All potentially relevant outcomes	<u>Knowledge and information</u> *Positive effects on:* * increase in knowledge level about breast cancer * increase in knowledge level due to interactive method * perceived information competence * information competence for those who spent more time in the interactive series <u>Support</u> *Positive effects on:* * increase in social support <u>Decision making</u> *Positive effects on:* * content of information helped patients to make decisions * useful in decision-making <u>Healthcare participation and patient involvement</u> *Positive effects on:* * healthcare participation * content of information influenced behavioral in taking care of breast health and participate in healthcare	<u>Conclusion</u> Results suggest: * Positive relationship between Internet or interactive computer-based patient education program use and knowledge levels of breast cancer patients. This also has a positive effect patient satisfaction. * Use of Internet and interactive computer programs are associated with better health information competence. However, use of Internet or interactive computer programs did not independently contribute to enhanced learning outcomes. * Education method: a) did not affect patient involvement although, b) patients tend to learn more about breast cancer treatment after using multimedia program than after reading a brochure and c) greater proportion of women in intervention group reported they had assumed a significantly more passive role than originally preferred after using interactive computer program. * Internet can be used to raise knowledge level although results do not show expected outcomes on patients' behavior. * There is a need to develop and to research Internet-based patient education. <u>Reflections</u> * No clear effect of Internet or interactive computer-based patient education on care of breast cancer patients identified, because effects differed across studies. * Most results were not statistically significant except for knowledge-related issues and some single outcomes. * Different instruments were used. Most of them were specifically designed for the study, which makes it difficult to compare outcomes.

	reported.		**Depression and anxiety** *No effects on:* * depression * anxiety. Anxiety level was higher after face-to-face counselling **Social interaction** *Positive effect on:* * decrease in loneliness **Other** * The most common outcome measures were issues related to knowledge and satisfaction-related issues * Issues pertaining to decision-making and quality of life were also measured. * Some other issues like social support, coping, stress, loneliness, depression and anxiety were tested.	* Some outcome issues were measured in only one study. * Outcomes measures varied widely which makes it difficult to establish effects of patient education with Internet or interactive computer. * Internet or interactive computer-based patient educational programs for breast cancer patients care are effective in increasing patients' knowledge about breast cancer and useful in decision-making regarding participation in care * The methodological quality of the studies varied widely and in some studies was quite poor.
Salonen et al. 2014 [21] 3,5	Various: * Time diagnosis, 4 mths * Enrolment, 1-2 wks post-intervention, 3 mths later * Pre-post * In some instances, time measurement was not reported	All potentially relevant outcomes	**Knowledge and information** *Positive effects on:* * increase in ability to understand treatment options * better preparation for discussion of treatment options * promotion of knowledge gains **Support** *Positive effects on:* * improved satisfaction with cancer information for men * marginal improvement of perceived oncologist informational support for men **Decision making** *Positive effects on:* * increase in levels of decision control after treatment decision in both intervention and control group * reduction of levels of decision conflict after treatment decision in both intervention and control group * increase in patient involvement in decision making *Negative effects on:* * decrease in partner involvement in decision making **Depression and anxiety** *Positive effects on:* * reduction of depression symptoms **Psychological wellbeing** *Positive effects on:* * reduction of psychological distress for patients and partners, at 4 mths * reduction of (psychological) distress **Quality of life** *Positive effects on:* * increase in long-term quality of life related to sexual functioning and cancer worry. No difference between intervention and control group * prevention of deterioration of functional quality of life and mental quality of life **Empowerment and coping** *Positive effects on:* * patients were more empowered to discuss their disease which led to ability to control and deal with disease	Conclusion * This review supports conclusion that computer or Internet-based patient education can improve patients' knowledge, self-efficacy and provide emotional and spiritual support. This conclusion is consistent with other systematic reviews. * Social integration and knowledge sharing occurring through these new technologies possibly increase understanding of disease, treatment options and side effects. * Development on computer and Internet-based programs for prostate cancer patients is still ongoing. * The need to provide more informed and interactive information resources aimed at patients for patient education purposes has underlined benefits of using computer technology to support and improve patients' knowledge during learning process. Reflections * Difficult to compare interventions and their impact, because of dissimilarity of multimedia and single media intervention. * Therefore, no conclusions can be made or any specific advice given for future regarding technology or outcome quality. * The review limitations were based on relatively small number of included articles and included studies contained various methodological weaknesses. This urges for caution in drawing firm conclusions.

| Ventura et al., 2013 [22] 3 | All studies longitudinal: - Before-after design - Until 12 mths after inclusion | All potentially relevant outcomes | Support *Positive effects on:* * increase in social support * use of interactive services alone likely improves social support *No effects on:* * social support Decision making *Positive effects on:* * increase in decision making variables Healthcare participation and patient involvement *Positive effects on:* * increase in healthcare participation * association between Caucasian people with early -stage breast cancer and increased healthcare participation *No effects on:* * healthcare participation Quality of life *Positive effects* *No effects* Health status *Positive effects on:* * increase in general health *No effects* Health competence and health literacy *Positive effects on:* * increase in health competence * use of both information and interactive services likely leads to improvements in health competence * increase in health literacy *No effects on:* * health literacy * health competence Empowerment and coping *Positive effects on:* * increase in self-care ability * improvement in coping *No effects on:* * coping Overall satisfaction *Positive effects* *No effects* | Conclusion: * eHealth interventions that allow informational and supportive needs being satisfied are being designed and implemented and are likely to have positive effects on number of outcomes for individuals with different preferences and priorities. * Even though several communalities could be found in the reviewed interventions, methodological aspects of the design, implementation and evaluation remain unclear. Models and applied theories are needed to clarify such issues, thus enhancing the credibility and applicability of supportive eHealth interventions across target populations. Reflections * Despite similar purposes, interventions analyzed seem to lack common structure linking all aspects of a supportive eHealth program. Lacking such a structure, interventions are difficult to adapt across cultures or cancer patient groups and are barely replicable. * Internet interventions seem to produce favorable change behavior and positive outcomes, although process of achieving them remains unclear. * Overall satisfaction and quality of life are considered being multidimensional variables affected by several factors. These variables thus can hardly be seen as a direct result of supportive eHealth interventions, but more as an ultimate outcome. * Most researchers developed own measurement instruments which might lead to erroneous interpretations of results when comparing several effectiveness reports. Different instruments do not allow comparison across outcomes. * Majority of studies focus on women with breast cancer. Although some studies focus on prostate cancer, gender comparisons regarding intervention use and outcomes are not provided. |

| | | | Other
* Most commonly measured outcomes: health literacy, incl. various aspects disease, treatment, side-effects knowledge, healthcare services and/or self-care
* Selective use eHealth interventions more likely to predict benefits than total time spent using intervention | |