

Harnessing Digital Videos to Promote Cancer Prevention and Education: a Systematic Review of the Literature from 2013–2018

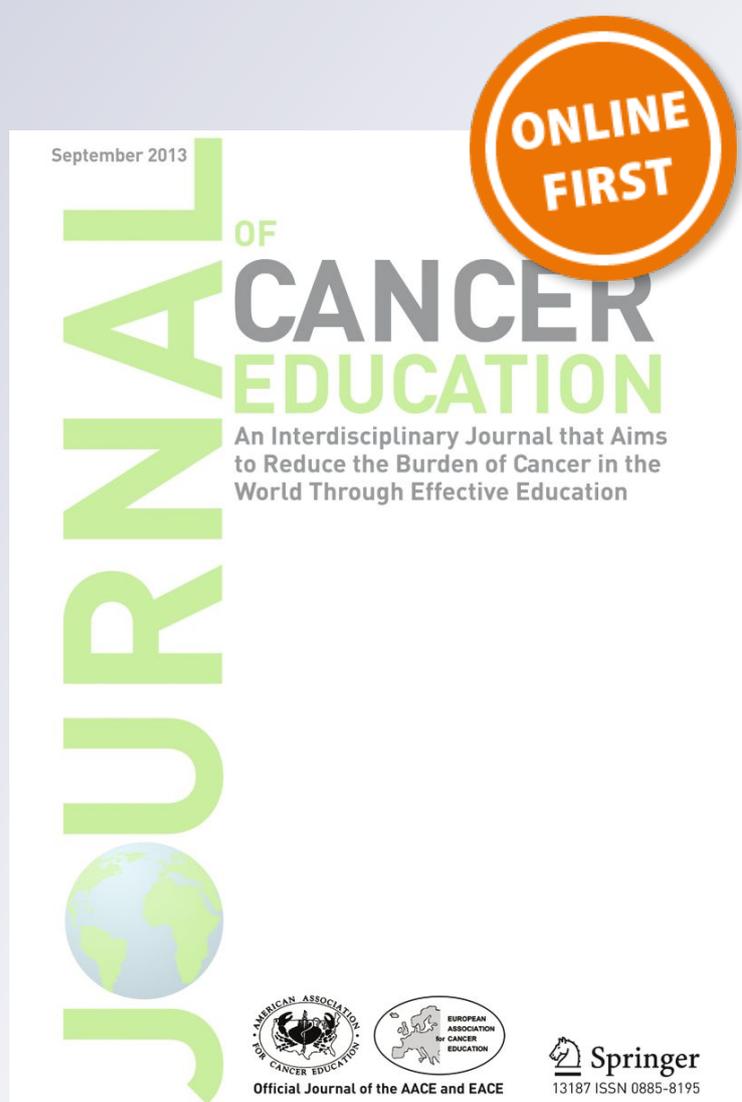
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Harnessing Digital Videos to Promote Cancer Prevention and Education: a Systematic Review of the Literature from 2013–2018

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Abstract

Social media has transformed the way cancer patients search for information about their chronic health problems. The purpose of this systematic review is to identify the use of online digital videos to increase cancer knowledge and to understand information preference, behavioral changes, and attitudes towards online cancer education videos. The databases used for this review included MedLine, PsychINFO, and PubMed. These medical databases were used to locate peer-reviewed academic journals from 2013–2018 using the following MeSH terms: “cancer education videos,” “cancer prevention videos,” and “cancer education digital videos.” A total of 4996 articles were retrieved from the initial search, and 33 articles were reviewed. Articles were excluded if videos did not (1) focus on cancer education and prevention; (2) posted on an online platform; and (3) assessed participants’ knowledge, attitude, or beliefs about cancer. Eleven articles were found to meet inclusion criteria for final review. All of the studies focused on increasing education on preventive health behaviors (i.e., sunscreen use, smoking, and diet) and/or early detection strategies (i.e., screening testing and/or self-skin exams). While online digital health videos have the potential to improve health outcomes, issues related to technology access and health literacy must be considered when developing online health education videos.

Keywords Cancer · Oncology · Cancer education · Digital videos · Digital education

Introduction

In recent years, there has been an increasing demand for health education materials in the form of digital videos available on the Internet [1]. Digital videos are defined as multimedia visuals created and used to share information on online platforms and social media such as YouTube or Vimeo [2,3]. With this in mind, in 2007, the Centers of Disease Control and Prevention

(CDC) released a “Social Media Toolkit and Guide to Writing for Social Media” to encourage health educators to effectively use social media to develop and share health information with diverse populations using different forms of online platforms [3]. In the last decade, social networking use among individuals in the USA began and continues to increase steadily [4]. For example, in 2005, only 5% of the US population reported using at least one social media platform and since 2011, the proportion of individuals has increased to 69% of the population [5]. In the USA, 62% of all internet users reported online media as a source to seek health information—this amounts to about 6 million people who use the Internet daily to find health information [2].

In 2013, 35% of US adults used the Internet to aid in self-diagnosing a condition they believed they or someone had, and 41% of them confirmed their initial diagnosis with their clinician [6]. This suggests that for a large portion of adult internet users, the process of seeking health-related information begins online. Given the large number of people using the Internet daily, it is essential to highlight the use of health education materials on the Internet and how online use plays a significant role in seeking health-related information [7].

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Because social media provides access to immediate and timely information, removing geographic barriers and increasing knowledge by incorporating online health information can be useful in improving health outcomes. [8] Cancer is one disease where people locate information and find solutions online. Since the burden of cancer is often higher for marginalized populations, the poor, the uninsured, and racial/ethnic minorities [9,10], online platforms are tools that have the potential to address the drivers of health inequities by tailoring online health information to diverse populations. Issues of health literacy must also be considered when using online videos to educate patients as being health literate means one can find information (i.e., videos), communicate their needs and preferences, process meanings, and make informed health choices [11]. Although, the disparity of health equity still persists and issues of limited access to the Internet or social media must be considered when developing online, digital health interventions [8].

Research has demonstrated that Internet-based interventions are practical tools for improving psychological and behavioral cancer health outcomes [12,13]. Using digital video-based interventions for promoting cancer health may offer several advantages to using other forms of information. First, digital videos are an inexpensive method used to deliver educational content that can reach an audience at a higher magnitude than conventional methods [14]. For example, Sweat et al.'s study [15] on the cost-effectiveness of brief video-based interventions not only showed the effectiveness of single-session video-based interventions by reducing sexually transmitted infections but also reported a significant savings in averted medical costs. Second, digital videos allow information to be delivered in a standardized manner while removing inconsistencies among delivery of health information. Additionally, viewers have increased autonomy in the way in which they learn—they have the opportunity to revisit material and follow at a comfortable pace, with the option to pause, fast-forward, or rewind scenes [16]. Third, digital videos can be made accessible in different formats, including through websites, digital video/versatile disc (DVD), and/or downloadable files. This versatility increases accessibility across various platforms [17]. Finally, digital videos are receptive to patients with low health literacy rates showing increased rates of retention from the content and adherence to prescribed medications [18,19,]. However, more research is necessary to evaluate the effectiveness of videos on changing health behaviors among those at risk for cancer. In this systematic review, we aim to: (1) identify the use of online digital videos to promote cancer health activities and (2) identify information preference, changes in behavior, and knowledge of various cancer topics as it pertains to digital videos. This field is emerging and rapidly changing, and the need to determine the effectiveness and best practices for patient care are critical for advancing cancer health.

Methods

The databases used for the systematic review literature search included the following: PubMed, MEDLINE, and PsychINFO. The initial search process began in November 2018, and final searches were concluded in January 2019. Articles included for review were limited to those published in English and considered peer-reviewed from 2013 to 2018. Articles published during these years were concurrent to the spike in social media and Internet use among people living in the USA [5]. Broad search strategies used across all databases were used to ensure the search captured all relevant articles. The following MeSH terms: “cancer education videos,” “cancer prevention videos,” and “cancer education digital videos were included in the search.

The inclusion criteria were [] the use of videos to promote cancer education and prevention []; digital studies about cancer conducted in in English and published between January 2013 and January 2019; [3] videos using an online platform such as Vimeo or YouTube; and [4] studies that assessed participants change in knowledge or behaviors after digital video exposure. The primary focus of the search was to identify studies assessing the ability of online digital videos to increase cancer knowledge through education and promote prevention strategies such as cancer screenings and self-exams. Studies that included other cancer education and prevention strategies (i.e., written or verbal information) in combination with or in comparison with videos were also considered. Studies evaluating the efficiency of instructional video-assisted technologies on cancer treatments for clinicians and studies of content analyses of cancer education videos and social media posts were excluded. Content analysis articles for digital videos, such as publications focusing on the frequency in which health care professionals developed videos or accuracy of information presented, were excluded from this review as these articles did not assess how digital videos impacted participants' attitudes, behaviors, and intentions pertaining to cancer education. Additionally, instructional video-assisted technology publications on cancer treatment were excluded because they focused on health care professionals' attitudes on the use of surgical equipment instead of cancer patients.

Two reviewers trained in public health initially conducted the searches among the three databases independently. IV reviewed two databases, PubMed and Medline, and NA reviewed, PsychInfo. Another reviewer (PV) trained in systematic reviews reviewed the search process by establishing inclusion and exclusion criteria and addressed discrepancies between the two reviewers. All of the three authors (IV, NA, PV) met after the initial search to review abstracts collectively with the consideration of inclusion and exclusion criteria.

Literature Search

Among the three databases and with the use of three different key phrases, 11,240 abstracts were yielded for review. The majority of excluded articles were those published before 2013 ($n = 6244$). With the exclusion criteria considered, 596 studies were excluded for not having an online video intervention. Other exclusions included studies that only contained analyzing the content of the video ($n = 110$), and studies using videos not related to cancer education and prevention ($n = 4236$). Thirty-three articles were kept for full review and it was found that 17 of those articles did not have an online video component. The final review consisted of 11 articles, while 5 of those were duplicates from searches across the 3 databases (Fig. 1).

Results

Study Design Characteristics

The articles included in this review were methodologically rigorous in design, four studies included randomized controlled trials, [21–24] one study used a between-subject experimental design, [25] two studies had a quasi-experimental design, [26,27] one study had a block 2:1 randomized block pre-post study design, [28] another study included non-randomized uncontrolled before and after study, [29] and one included retrospective cohort study design [30]. Participants in these studies were required to watch an online video or were included in a control group to understand the differences in cancer education, retention, behaviors, intentions, and attitudes among different groups with various interventions. Specific types of cancer in the online video interventions of these studies included lung cancer [21,29], skin cancer [23,26,31], colon cancer [22,30], breast cancer [24], and cervical cancer (Table 1) [27].

Of all the studies reviewed, only Bol et al. [21] enrolled participants that were placed in one of three conditions: (arm 1) text-only display webpage; (arm 2) text webpage with non-personalized videos; and (arm 3) text webpage with personalized messages. After viewing and interacting with the website, participants were directed to complete questions regarding how well they were able to recall the information and answered satisfaction questions [21]. Investigators from this study found that the participants in groups that included videos, regardless of personalization, were able to recall more information than those in the text-only group [21].

Study Outcomes

This systematic review looked at three primary study outcomes that were demonstrated in the selected publications—

information preference, knowledge, and behavioral modification/intentions. Information preference was defined by the authors as the participant preference in receiving information, such as a health care professional, brochure, social media platform, or digital video uploaded on the Internet. Knowledge was defined as how participants performed or remembered information after viewing digital videos on the Internet. Finally, behavioral modification/intentions were defined as [1] whether participants changed their lifestyle, based on the information from the digital video, to reduce their risk of cancer, or [2] if they had increased the likelihood of undergoing preventive screening for cancer.

Information Preference

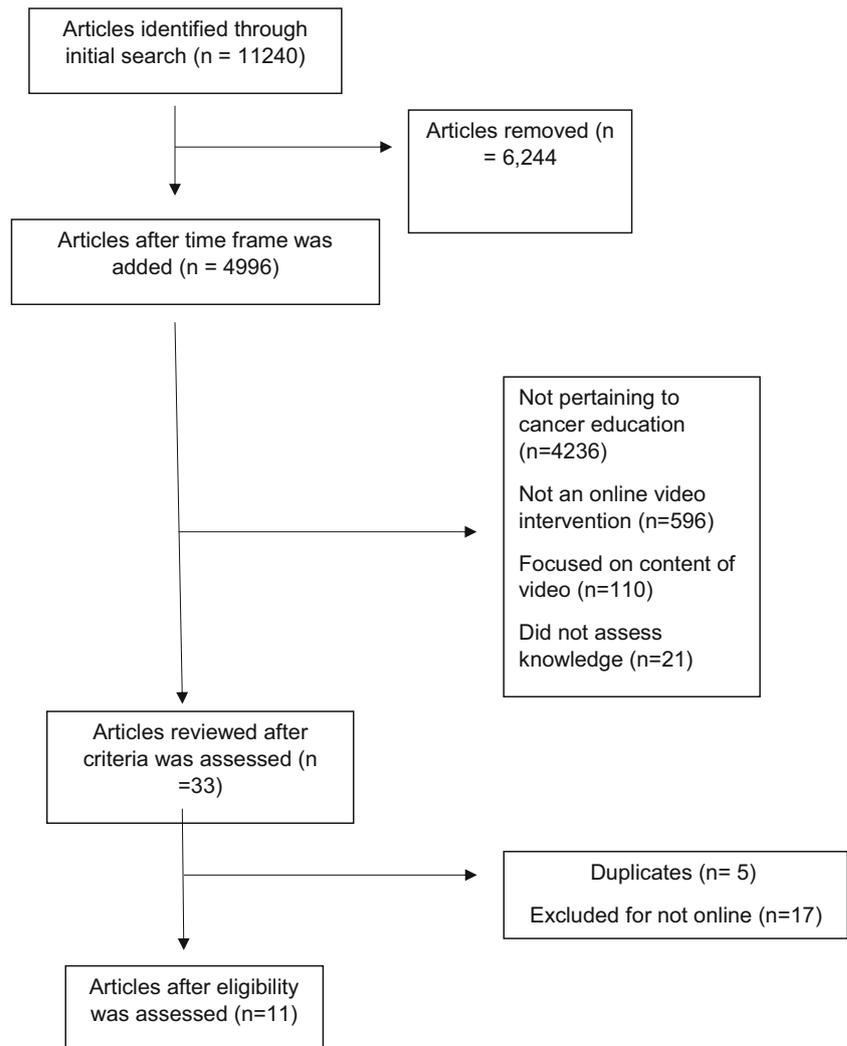
Among all studies included in this review, videos were assessed in their ability to improve cancer knowledge through education or inhibit prevention strategies among those with cancer or those at risk of developing cancer. The study conducted by Lauckner and Whitten [25] compared Twitter, YouTube, and Facebook as sources of information on cancer risk reduction messages. The investigators found that watching videos on YouTube ($M = 3.67$, $SD = 1.38$) lead to higher comprehension when compared with Twitter ($M = 3.11$, $SD = 1.49$). Additionally, videos on YouTube ($M = 5.93$, $SD = 0.98$) led to stronger attitudes towards taking steps to reduce their cancer risk when compared with Facebook ($M = 5.65$, $SD = 0.89$) [25]. Another study that focused on YouTube videos instead found that videos on self-inspection of skin for melanoma patients were preferred as a supplement to receiving information from a physician and/or from written information [31]. Over 62% of participants in this study reported that educational videos on YouTube should be implemented in their treatment plan as another means of obtaining information [31]. Additionally, a majority of participants reported improved self-efficacy in performing self-skin inspections after watching the educational YouTube video (79%) [31].

Knowledge

Knowledge was assessed in more than half of the studies ($n = 9$) via administration of a pre- and post-test when watching an online video. In Volk et al.'s study, [29] participants had an increase in lung cancer knowledge from their overall pre-test score 25.5% ($SD = 20.7$) to their overall post-test score 74.8% ($SD = 20.2$) after viewing the online decisional aid. Moreover, knowledge on risks and benefits from low-dose computed tomography (LDCT) after completing the online video decision aid increased from 18.2% ($SD = 9.1$) to 72.7% ($SD = 28.4$) [29]. Lee et al.'s study [27] revealed that in North Korean women, who were enrolled in the mobile video intervention, knowledge of vaginitis (pre $M = 0.29$, $SD = 0.44$ vs. post $M = 0.68$, $SD = 0.45$) and cervical cancer (pre $M = 0.42$, $SD = 0.40$ vs. $M = 0.76$, $SD = 0.40$) significantly increased

Table 1 Summary of study characteristics (*n* = 11)

Study	Country	Recruitment setting	Participant demographics	Type of cancer	Study design	Intervention/digital video	Study outcome
Bol et al. [21]	The Netherlands	Hospital	Lung cancer patients	Lung cancer	Single-center randomized controlled trial	(Arm 1) Webpage only displays text (Arm 2) Webpage contains text with non-personalized videos (Arm 3) Webpage containing text with personalized videos	Knowledge
Damude et al. [31]	The Netherlands	Melanoma center	Melanoma patients	Skin cancer	Single group non-randomized trial	Online instructional videos uploaded to YouTube on self-inspection of skin and lymph nodes	Information
Hayat et al. [30]	USA	Hospital	Patients about to undergo a colonoscopy over 40 years old	Colon cancer	Retrospective cohort	30-min video on bowel cleansing	Knowledge
Lauckner & Whitten [25]	USA	Midwestern university	College students	General cancer risk	Between-subjects experiment with 2 × 4 factorial design	General script on cancer risk reduction messages modified for either Facebook, Twitter, or YouTube	Information
Lee & Shin [27]	South Korea	Seoul and surrounding area	North Korean female migrants	Cervical cancer	Quasi-experimental	4-h video divided into 8 sections	Knowledge
Palmer et al. [28]	USA	Deaf clubs, community events, and from previous study	Deaf American sign language users	General cancer risk	2:1 randomized controlled study design	Six online digital modules	Knowledge
Perrault & Silk [24]	USA	Online Facebook pages, Craigslist, online community newsletter	Mothers of young daughters	Breast cancer	Randomized controlled trial	Videos on concerns with PFOA, where PFOA found, and how PFOA impact young girl's development of breast cancer	Knowledge and behavioral modification/intentions
Prakash et al. [22]	USA	Hospital	Patients about to undergo a colonoscopy over 18 years old	Colon cancer	Single-blinded, randomized, multicenter prospective trial	5-min bowel preparation video	Knowledge
Roman et al. [26]	USA	Social networking sites, radio stations, fliers, and social networking sites	Hispanic adults over the age of 18	Skin cancer	Quasi-experimental	5-min video on melanoma	Knowledge and behavioral modification/intentions
Tsai et al. [23]	USA	Outpatient dermatology clinic	African American adults	Skin cancer	Randomized controlled trial	20-min video on melanoma risk factors	Knowledge
Volk et al. [29]	USA	Tobacco treatment program	Adult smokers	Lung cancer	Uncontrolled, before-after design	6-min video on lung cancer screening	Knowledge and behavioral modification/intentions

Fig. 1 Flow diagram of article selection process

after the intervention. Not only did knowledge increase but also did self-efficacy in the management of both vaginitis and cervical cancer from 2.55 (SD = 0.41) to 3.85 (SD = 0.45) [27]. Of those participating in the study conducted by Prakash et al. [22], the video group of preparing for a colonoscopy had 64% of participants learning additional information where the outcome of the study looked at patient satisfaction, and 75% reported satisfaction of 5 on 5-point Likert scale. In Hayat et al.'s study [30], investigators used multivariate analysis and reported higher excellent/good score for those in the educational video group (92.3%, 95% CI (84.8, 96.3)) than those in the control group (87.4%, 95% CI (76.4, 93.7)). In Bol et al., [21] investigators focused on website satisfaction and recall of cancer related in older lung cancer patients. This study concluded that individuals randomized to the video arm on a website led to a significantly higher recall score in non-personalized video ($M = 10.11$, 95% CI (8.87, 11.36)) and personalized video ($M = 10.96$, 95% CI (9.70, 12.23)) when compared with those with text-only information ($M = 7.38$, 95% CI (6.12, 8.65)) [21]. Roman et al. [26] revealed there

was an increase in the proportion of correct responses 70% vs. 90% after administration of online educational video. This study showed that the online digital video increased participant's knowledge of melanoma risk factors and prevention techniques [26]. In Perrault and Silk et al.'s study [24], knowledge was assessed by asking participants to answer true and false questions regarding content from the videos located on a website (intervention arm) and those with just text website (control arm). The study concluded that there were no significant differences in scores for perfluorooctanoic acid (PFOA) knowledge (3.37 vs. 3.11, $p = 0.211$), products (9.77 vs. 9.63, $p = 0.620$), and actions to take (11.75 vs. 11.47, $p = 0.390$) among those that viewed the video and those that did not view the video on the website when asked 2 weeks after visiting the website [24]. Moreover, Tsai et al.'s study [23] found no difference in increased knowledge among African Americans and self-efficacy of skin cancer and protective behaviors when comparing a video group and a brochure group ($p = 0.527$). However, within the intervention group, participants showed a significant increase in knowledge when comparing pre- and

post-survey assessing sun-protective behaviors (1.78 vs 2.08, $p = 0.001$), perceived risk of possible development of melanoma (1.69 vs. 2.00, $p = 0.04$), higher confidence on how to conduct self-skin examinations (0.22 vs 1.13, $p < 0.001$), differentiating moles and melanoma (1.37 vs. 2.98, $p < 0.001$), and being able to distinguish asymmetry in moles (1.22 vs. 3.22, $p < 0.001$) [23]. Additionally, in Palmer et al., [28] participants in both arms demonstrated an increase in cancer genetic knowledge after watching the online videos. Scores from the pre-test were 73.9% and 72.2% between the two groups, but once completing the videos, both groups increased knowledge to 82.2% and 81.6%, respectively [28].

Behavioral Modifications and Intentions

Three studies specifically assessed differences in behaviors and prevention strategies, including reports on increase of self-skin exams [26], intention to complete cancer screenings [29], and performance of protective behaviors [24]. Roman et al. [26] reported that during the 1-month follow-up, 75% of participants indicated a self-skin examination, which was an increase from only 9.49% of participants reporting self-skin examinations at baseline. In Perrault and Silk's study [24], investigators reported high self-efficacy among participants that viewed videos on a website when asked about being more conscious of a carcinogenic chemical (PFOA). Those in the video intervention self-reported higher actions taken (2.98 vs. 2.04, $p = 0.004$) after the study was completed [24]. Actions taken were measured from reduction techniques that were explained on the website, which included but not limited to checking labels of products for that chemical or avoiding the use of certain items [24]. Volk et al.'s study [29] looked at the feasibility of an online video decision aid among current and former smokers. Approximately 78.8% of the participants indicated a stronger interest in screening for lung cancer after the completion of the decision aid, as a result of understanding the benefits on LDCT.

Summary

Overall, a majority of the studies ($n = 8$) that had a study outcome of knowledge demonstrated that among participants who viewed online digital videos, there was an increase in awareness and understanding of the risk factors and screening procedures related to cancer [22,23,25–30]. However, Perrault and Silk's study [22] of mothers of young daughters did not show a statistical difference among mothers who were in the video intervention and mothers who were not in the video intervention. The same was seen when the participants were followed up after 2 weeks. This study measured knowledge as knowing what products could contain PFOA's and behaviors to reduce PFOA exposure, and they were not directly asked

about the exposure as a cancer risk factor. Additionally, in regards to information preference, results from the selected articles reported that digital videos should be incorporated in cancer treatment and that YouTube was the social media outlet preferred over Twitter and Facebook to disseminate information on cancer risks [25,31]. Finally, behavioral modifications such as self-skin inspections [26], identifying products containing PFOAs [24], and increased likelihood for obtaining lung cancer screening [29] increased after viewing online digital videos.

Discussion

This review assessed the feasibility of digital videos on promoting cancer prevention and increasing general knowledge of cancer. As more and more people are accessing the Internet as a medium to gather information on a wide variety of different health topics [7], digital videos present an opportunity to disseminate and gain knowledge of general health information. Furthermore, with 87% of adult online users reporting the use of cellular phones to seek information as a preferred choice [32], short digital videos could be used to provide quick, timely, and tailored health information on specific topics. Even though the majority of the studies included in this review did not use social media sites to publish their cancer education videos, it is essential to disseminate critical cancer health digital videos using website pages to reach populations that are more diverse. Future research should focus on the development of online educational videos using popular social media sites such as YouTube, Twitter, and Facebook in order to educate and reach diverse populations.

Only three articles focused on vulnerable populations [23,26,27]. While all of the three articles demonstrated an increase in knowledge from the online digital videos in a post-test compared with a pre-test, only one study [27], by Lee, focused on the use of mobile interventions. The implementation of digital videos in mobile interventions can play a vital role in reaching disadvantaged populations. From 2013 to 2017, the use of smartphones in households earning less than \$30,000 increased by 12% [33]. Additional studies showed that enrolled participants from hard-to-reach populations and low income had access to smartphones ranging from 34 to 68% [34,35]. Ergo, the use of smartphones is increasing among them and providing a linkage between mobile phone and online digital videos can further increase health literacy and possible long-term health outcomes.

Limitations

There are several limitations presented in this systematic review. Limitations included using keywords that may not have

been inclusive to all possible outcomes, as well as only searching three major medical and public health databases. Studies were only considered if digital videos were posted online and in English, which may have limited our review. The search also only included articles published from 2013–2018 and this time period was selected because this is where we have seen a spike of increasing Internet use among the general population [4].

Another limitation includes how the sample was recruited. Several studies included convenience sampling [25,29] and snowball sampling [27] or had a large sample of participants that identified as non-Hispanic Caucasian/White [24,30]. By targeting only a convenience sample who are majority non-Hispanic White, the findings may not be generalizable to all populations. This may occur because of sampling bias, which introduces bias related to sampling participants with similar traits. This can then lead to an insufficient power and failure to detect differences among sociodemographic groups [36]. Only two studies included minority populations as their sample, which demonstrates the need for future studies to consider diverse populations as these two studies reported promising results. [23,26] Thompson et al. [37] found that research on new media interventions on cancer prevention including underserved racial and ethnic groups is lacking, and more research is needed to determine how to deliver these interventions to underserved populations effectively. With consideration to health equity, diverse populations must be considered in the development of digital interventions related to cancer prevention.

Another limitation to this review is the use of studies that evaluated videos that were only posted on online platforms such as YouTube or Vimeo. Many of the studies we excluded after we reviewed abstracts ($n = 17$) were excluded because they were not available on an online platform. This was considered an exclusion criterion to better assess the effectiveness of videos that are currently posted online and available to a larger, general audience. Since digital videos are a form of media that is increasing in the field of health education, future reviews should include all studies that assess cancer education videos, regardless of whether they are available online.

Clinical Implications

Online digital videos are a unique way to provide health education and offer alternatives mean to deliver information to reach the public. Therefore, digital videos have the potential to promote and change behaviors among those at risk by reducing unhealthy behaviors and increasing knowledge and screening. However, more research is needed to ensure that these digital videos translate to meaningful change, such as getting a cancer screening. An increase in screening improves early detection of cancer, allowing for better cancer health

outcomes among diverse populations, and overall reducing health disparities [38,39].

Future Considerations

While Internet use poses a great opportunity to disseminate health information, the digital divide among certain groups should also be of consideration when developing online health education tools, to reduce the perpetuation of health disparities [40]. The digital divide can be defined as the pattern of unequal access to technology based on factors such as race, ethnicity, gender, age, socioeconomic status, and geographic location [41]. This lack of access to the Internet or technology, in general, can influence employment and education opportunities among disadvantaged populations, further contributing to health disparities [42]. Individuals who lack access to the Internet resources also face barriers related to content including lack of local information, language barriers, literacy barriers, and lack of cultural diversity [42].

Conclusion

This review focused on evaluating cancer knowledge from online digital videos and understanding how users are influenced by the videos to take action and retain cancer-related information. Digital videos demonstrate to be useful and innovative tools in promoting health education, including diverse and hard-to-reach populations in these study is essential to determine feasibility, acceptability, and effectiveness of online videos in improving health outcomes.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

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