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Interventions to Reduce Healthcare Disparities in Cancer Screening Among Minority Adults: A Systematic Review

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Submit to: [Journal of Racial and Ethnic Health Disparities](#)

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Types of Papers: Literature reviews

Author contributions

DL SA had the idea for the article, DL HS BB and TY performed the literature search and data analysis. The first draft of the manuscript was written by DL and HS. DL BB critically revised the work. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Abstract

Background

Racial minority populations face an increased burden relative to cancer interventions. Compared to Caucasians, the cancer screening rate is substantially lower among African American, Asian American, Latinx American, and American Indian/Alaska Native populations. Barriers such as low health literacy, lack of health insurance, and miscommunication between patients and providers have been identified as important factors that result in low screening rates among minority adults. This study was to identify interventions targeting racial minority adults 40 years of age or older that were effective in increasing cancer screening uptake rates.

Methods

A systematic review of articles published in and after January 2009 was conducted using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Twenty-six published studies of cancer screening intervention tested with minority adults were identified through the searches of CINAHL, Global Health, PsycINFO, PubMed, and Scopus databases.

Results

Thirteen (50%) of the studies utilized lay community health workers to increase cancer awareness and knowledge and to encourage screening. These methods took place over the telephone, at community education sessions, or within the context of personalized patient navigation support. The intervention programs utilized culturally relevant materials as well as spoken and written information in the targeted population's native language. Various intervention designs resulted in statistically significant increases in cancer screening adherence. However, we found no intervention that consistently elevated cancer screening rates across all racial/ethnic minority adults.

Conclusions

The finding suggests that highly segmented interventions are needed in order to improve cancer screening among various racial/ethnic minority adults.

Keywords (4-6)

Preventive Health Services, Health Behavior, Population Health, Ethnology

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Introduction

A confluence of data now confirms the existence of health disparities in the prevalence, screening and diagnosis, progression, and treatment of nearly all cancers. Whether analyzing differential access to low-dose computed tomography (also called low-dose CT scan) [1], trends on the progression of prostate cancer among men in the third tertile of selenium concentrations [2], or tracking the differences in quit rates among Latino and/or African American tobacco users [3], the empirical data support an unavoidable conclusion – cancer morbidity and mortality are asymmetrically distributed by race and/or ethnicity and other variables.

Yet, despite the importance of racial minority populations undergoing screening, these populations face cancer screening disparities. The percentage of African American men and women undergoing breast, cervical, colorectal, and prostate screening is similar to or slightly less than the percentage of Caucasian men and women. However, this discrepancy occurs to a greater extent in Asian, Latinx, and AI/AN populations. For these groups, the percentage difference in the proportion of these populations undergoing screening for the aforementioned cancers is even more substantial when compared with their Caucasian counterparts [4].

Accordingly, cancer persists as a major health concern in minority populations, and these concerns exponentially increase with age. Indeed, older age is the most important risk factor for cancer. The percent of new cancer cases begins to pointedly rise between ages 45-54 leading to a median age of 66 years for the actual cancer diagnosis [5]. A number of studies indicate that old age is still associated with lack of cancer screening [6, 7]. This divergence in cancer screening coverage with age is greater in racial minorities. Therefore, it is important to screen older racial minority patients earlier given that early diagnoses lead to better prognoses [8]. Yet, care must be taken in the epistemological framework used to describe and analyze cancer disparities by race/ethnicity.

While health disparities in the American health care system offer a convenient explanation of the origins of differential cancer outcomes [9], the etiology of health disparities embraces many factors. Phenotypic variations in the liability to specific types of cancer, acculturation into morbid lifestyles, unique preference functions regarding treatment modalities, and access to primary and specialized medical care influence ethnic variance and covariance in cancer morbidity and mortality. While a multiplicity of research is required in support of a reduction in health disparities in all disease areas, a comprehensive, multi-component approach is particularly important in addressing disparities in the prevalence and progression of various malignancies. However, even more basic to the cancer-related disparities chain [10], is the need to elevate cancer screening rates across all populations while simultaneously characterizing the broadest possible range of variables that are related to differential cancer screening rates.

For example, various beliefs and ideas among different ethnic minority cultures may contribute to cancer screening disparities in adults. Educational differences may be correlated with observable population-based variance in cancer screenings. The path of causation may be relatively direct. Education in general is related to health literacy. Accordingly, those with lower levels of education may not have knowledge of the linkages between cancer and cancer screening [11-15]. As mentioned earlier, several studies have shown lack of health insurance or having public health insurance versus private as a correlate of both cancer disparities and cancer screening disparities [16, 17, 14, 7]. But even with insurance the cost sharing for screening services may also be greater [18]. Similarly, miscommunication between patient and provider due to low English proficiency, translator utilization, and language discordance is another barrier to cancer screening in racial/ethnic minorities [19-23]. Patients that are part of a racial minority population may not seek out cancer screening services due to distrust in providers and the healthcare system due to discrimination, bias, or other previous unpleasant experiences [24, 18, 25, 22]. Decreased knowledge about cancer or cancer-related programs [12, 18, 26, 27, 22, 15] as well as fear of pain related to cancer screening services [19, 12, 18, 28, 25, 22] may also contribute to cancer screening disparities in ethnic minorities. Despite having knowledge of the benefits of cancer screening, various racial/ethnic groups may experience other constraints. For example, individuals may worry about receiving their results and the ramifications that accompany a positive test [18, 25, 15].

Racial minority patients may also feel that they are healthy, aging well, and do not need to see a doctor if they do not have symptoms [29, 16, 26]. Contrarily, these patients may have low self-efficacy and may be incapable of seeking out cancer screening services on their own [30, 23]. Cultural views can influence racial minority patients' demand for screenings. For example, having low levels of acculturation or residing in the United States for a short length of time can serve as barriers to cancer screening services [24, 20]. Family-related variables may also play a role. Specifically, cultural norms which lead patients to value their family more than themselves may lead individuals to forego cancer screening [26, 15]. The concept of fatalism has been studied in several studies and found to be complicit in the decision-making process. Findings also suggest that this philosophical perspective may both encourage and/or discourage cancer screening in minority patients [16, 26, 31, 22]. Religion may also play a complex role in cancer screening behaviors of minority adults. Some studies have found that a strong sense of religion can promote cancer screening, but others say that it does not [19, 22, 15]. Other less discussed influences that are associated with decreased cancer screening in racial minority adults include modesty [22], low cognitive status [13], lack of community participatory activities [17], time orientation [16], living outside of urban areas [11], being single, and smoking [6].

In this review, we narrowed the focus on ethnic-racial differences in cancer screening to examine interventions to promote screening. We ask, *“What types of cancer screening interventions that target racial minority adults age 40 years or older are effective in increasing cancer screening uptake rates?”*

Methods

A systematic analysis of articles published from January 2009 to June 2019 was conducted. Five electronic databases were accessed CINAHL (Cumulative Index of Nursing and Allied Health Literature), Global Health, PsycINFO, PubMed, and Scopus. The article selection process was based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [32]. Keywords that centered around three key concepts were used to narrow the search to the most relevant articles (Table 1). Articles were included if the studies covered minority populations in both the U.S.A. or in other countries and were published in English. Articles were excluded if they 1) focused Caucasian participants only; 2) contained study participants previously diagnosed with cancer; 3) examined HPV vaccination alone without reference to cervical cancer; 4) examined breast self-examination; 5) examined genetic testing; 5) were limited to broad strategies for increasing minority population recruitment and participation in research; 6) examined cancer staging/incidence/survival/mortality only; or 7) were designed to validate cancer screening questionnaires.

This process yielded 2,601 articles. Duplicates were removed, leaving 1,204 citations for review and analyses. After title and abstracts were reviewed, 64 or 2.46% of the total articles were left for review. The inclusion and exclusion criteria were applied, and 38 articles were rejected. Twenty-six, or less than 1% of the remaining articles, were included in this review. Although the search was not limited by geography, only one study was conducted outside of the United States [33]. Of the remaining 25 studies, all but two [34, 35] stated they were done in the United States.

Results

Articles covered screening for breast cancer (n=15) [36-38, 34, 39-44, 35, 45, 33, 46, 47], cervical cancer (n=4) [37, 44, 35, 45], colorectal cancer (n=9) [48-54, 35, 55, 56], and prostate cancer (n=2) [57, 58], with four articles examining more than one type of cancer screening. Lung cancer screening with low-dose CT was included in the keyword search. However, no studies pertaining to this type were identified. The studies included African-Americans (n=11) [49, 38, 57, 52, 53, 40, 43, 44, 35, 46, 58]; Asian-Americans (n=7) [38, 34, 39, 41, 42, 56, 47]; Hispanic/Latinx-Americans (n=10) [48, 36, 50, 37, 51, 38, 44, 54, 45, 33]; and American Indians/Alaska Native populations (n=1) [55]. Two articles examined more than one racial minority population [38, 44]. Although Arab populations were also included in the search, articles pertinent to Arab populations did not meet the inclusion criteria. The sample size of studies ranged from 28 to 9,575. Of the 26 studies reviewed, 17 had statistically significant increases in cancer screening uptake after intervention (Table 2), while 9 did not (Table 3). The latter studies were included for purposes of comparison.

Conceptual Framework for Behavior Change

Many of the interventions in these studies were based on the use of educational programs that targeted minority populations' knowledge, attitudes, and beliefs about cancer and cancer screening. These programs were designed within the context of one or more theoretical frameworks. One of the most popular conceptual frameworks was the Health Belief Model (n=6) [34, 39, 42, 44, 46, 47]. This model examines how behavioral change is determined by several factors, such as knowledge about cancer and cancer screening, perceived susceptibility to cancer, perceived threat of cancer to one's life, perceived positive outcomes associated with screening, barriers to screening, and self-efficacy in obtaining screening [59]. The Transtheoretical model is another commonly used conceptual framework through which cancer screening education is delivered (n=5) [34, 39, 42, 46, 56]. This model states that people move through a series of six stages when changing behavior. As one progresses through these 6 stages, he or she becomes more ready for change [60]. An alternative approach was Social Cognitive Theory (n=2) [45, 46]. The premise underlying this theory is that information is learned by observing others [61]. Finally, the PRECEDE/PROCEED Model was utilized in 2 studies [33, 46]. This model is an empirically validated public health promotion strategy that generates benefits for the individual and the community [62].

Other conceptual frameworks were also used in the interventions. Motivational interviewing was the basis of the intervention for one study [36]. This approach utilizes a personal technique to motivate change by exploring areas of uncertainty and using the person's own beliefs to fuel change [63]. Another study utilized a mapping framework to develop an intervention [51]. Intervention mapping uses 6 steps to promote health behaviors [64]. Another study [18] used the Theory of Planned Behavior, which states that one's intended behavior is influenced by subjective norms, perceived behavioral control, and attitudes towards the existing behavior [65]. The Elaboration Likelihood Model was used to shape the intervention in still another study [35]. This model states that attitude change is influenced by analyzing arguments for one side or the other [66]. Another utilized the Extended Parallel Process model to motivate change in screening behaviors [46]. This approach motivates behavior change by emphasizing fear [67]. Lastly, one study used the PEN-3 cultural model to ensure sociocultural appropriate program development [46]. This approach utilizes three primary domains including: 1) the individual's cultural identity as an intervention point of entry; 2) the recognition that relationships and expectations support health seeking practices; and 3) the idea that cultural empowerment can generate both beneficial and harmful health practices [68].

Intervention Methodologies

The studies included tailored their interventions to impact the target population's cancer screening beliefs and behaviors through a multiplicity of approaches. One standardized approach involved reaching the target audience by utilizing culturally relevant content and graphics that were sensitive to cultural issues. Ten or 38.5% of the studies analyzed tailored their educational materials toward the target population's culture (n=10) [34, 36, 39, 41, 42, 46, 47, 55, 57, 58]. An even greater number of studies ensured that intervention materials were provided in the target population's native language (n=12 or 46.15%) [37, 39, 41, 42, 44, 45, 47, 48, 50, 51, 54, 56]. Nine or 34.6% used education sessions for small groups held at a specified location within the community (n=9 or 34.61%) [34, 35, 39, 41, 42, 44, 52, 56, 58]. Another study [38] also examined how regular contact with a primary care physician affected cancer screening rates. Regular contact was defined as visiting the primary care physician, as indicated in the electronic medical record, for at least three visits per year. Learning about cancer screening with others in the same ethnic minority population was another intervention strategy utilized. One method involved hosting home health parties where a group of family and friends gathered in one's home to learn about cancer and cancer screening (n=2) [48, 54]. Similarly, some studies utilized family or close friends to promote cancer screening in minority adults (n=3) [35, 41, 44].

Lastly, some studies used peer testimony from someone of the same ethnic minority population who was previously diagnosed with cancer or who had undergone cancer screening [40]. This information was relayed via two primary approaches. The most frequently used intervention was utilizing lay community health workers to relay information to racial minority adults (n=12 or 46.2%) about the importance of screening [34, 36, 37, 45, 46, 48, 49, 51, 52, 54, 56, 58]. These individuals were members of the community and of the targeted minority population and had undergone training to deliver cancer and cancer screening information to others in the community. In Latinx American populations, a lay health community worker is often called a *promotor(a)* (n=4) [36, 45, 48, 54]. Other

studies used lay community health workers and/or patient navigators (n=5) [34, 43, 49, 50, 53]. This concept is similar to lay community health workers. However, patient navigators are trained to provide both patient education and coordinate longitudinal cancer care through individualized support. Other studies made cancer screening information more accessible for minority adults by providing or mailing participants printed materials to take home (n=10) [33, 35, 37, 43, 44, 46, 50, 52, 53, 56]. The intervention was relayed either in conjunction with lay community health workers or patient navigators or solely by telephone (n=9) [33, 34, 36, 37, 43, 46, 49, 50, 56], home visits (n=6) [34, 36, 37, 43, 45, 51], video (n=4) [40, 47, 51, 57], tablet or computer (n=2) [46, 51], and/or text messages (n=1) [55].

Outcome Measures and Intervention Effects by Race/Ethnicity

Disparity research has fully documented intersectoralities. Smith and Weinstock [69] highlight the complexity of disparities by emphasizing the use of an expansive intersectoral perspective. Such an argument suggests that the use of an intervention fidelity approach may foreclose the use of intervention modifications that generate greater congruence between need and intervention. The integrated discussions of past successful interventions for increasing cancer screenings are designed to stimulate intervention component deletion, merger, and other alterations based upon the most accurate characterization of each targeted individual's needs. In each study selected, screening uptake was measured after the intervention. Indeed, 20 of the 26 studies or 76.9% of the studies used self-reported data to measure cancer screening uptake, while the rest verified cancer screening via electronic medical records (EMR) (n=3) [38, 48, 55], or by utilizing both approaches (n=3) [33, 36, 46]. Although not the focus of this review, many of the selected articles contribute to intervention redesign by describing how these interventions changed the knowledge, attitude, and beliefs of selected segments of the various minority populations that were targeted by the various interventions.

African Americans. As discussed earlier, one model of behavioral health change emphasizes the importance of knowledge about the benefits of cancer screenings. Similarly, an abundance of research has revealed the efficacy of using community health workers. In the first study by Cole et al. [49], there were 3 treatment groups based upon: 1) two or more educational telephone sessions with a community health worker utilizing patient navigation; 2) motivational interviewing to influence blood pressure control (control condition); and 3) both #1 and #2. Participants in the #1 and #3 interventions were significantly more likely to complete colorectal screening within 6 months after the intervention (AOR [adjusted odds ratio] = 2.28; 95% CI [confidence interval]: 1.28-4.06 and AOR = 2.44; 95% CI: 1.38-4.34 respectively). Indeed, screenings increased from 8.4% in the control group to 17.5% in the #1 intervention group and 17.8% in the #3 intervention. This represented a 108% and 111.9% improvement in cancer screening rates relative to the central group.

African American males have demonstrated higher levels of mistrust in the American health care system than is the case with African American women [70]. Moreover, this mistrust is more dominant at the level of the health care provider rather than the health care institution. In addition, PSA (i.e., prostate specific antigen) tests for prostate cancer may further augment this mistrust since their acuity is higher with Caucasian males than with African American males [71]. In this regard, African American males may be more receptive to cancer screening interventions delivered within a trusted environment.

One study identified an increase in cancer knowledge and intention to screen after the intervention [57], while another study [52] addressed a continuing theme in health disparity research, identified a faith-based organization as an important distribution site for health information. Rather than affirming this often-held belief, the later study used qualitative methodologies to identify barriers that may hamper the efficacy of these institutions as intervention sites. Holt et al. [52] found a statistically significant increase ($P < .05$) in FOBT (i.e., fecal occult blood test) in a non-spiritual control group vs. a non-spiritual colorectal cancer education intervention. Cancer screenings grew by 9%. Interestingly, when a spiritual intervention was implemented, the cancer screenings actually decreased by 1%. There was also a statistically insignificant increase in barium enema within 5 years in the spiritually-based group and 1.5% decrease in the nonspiritual-based intervention group. However, the study also found that both interventions increased screening awareness, an important pre-requisite to behavioral change.

Patient Navigation

Five studies examined patient navigation [34, 43, 49, 50, 53]. The concept of patient navigation of the health care system references the fact that curvilinear and multidirectional processes are needed to obtain health care in health care systems worldwide. As a result, access can be confusing and daunting to those with inconsistent knowledge of its structure. Freeman and Rodriguez [72] have applied the nomenclature “patient navigation” to these processes. Accordingly, patient navigation interventions are designed to serve as a metaphorical roadmap that diminishes errors, omissions, and other barriers that result in the underrepresentation of selected individuals and groups in health care preventive and curative systems. Myers et al. [73], for example, tested the efficacy of patient navigation interventions among Latinx Americans and identified this approach as a successful strategy with this unique population. Horne et al. [53] assessed a patient navigation intervention that was aimed to identify and overcome barriers to colorectal cancer screening with African Americans. The results indicated that this intervention was associated with a significant increase in overall screening (OR [odds ratio] = 1.56; 95% CI: 1.08-2.25). When these researchers further analyzed screening methods and demographics, they found that the intervention caused a statistically significant increase in colonoscopy or sigmoidoscopy screening but not FOBT. They also discovered that people aged 70-74 years were even less likely to report being screened by colonoscopy or sigmoidoscopy.

Media and Related Interventions

Imran et al. [74], utilizing data from the Jackson Heart Study, confirmed that television watching is associated with a higher rate of mortality for those who have higher levels of viewing time. Cohen [75] conducted research which revealed that African Americans watch TV 10 hours more per week than the total population in the United States. While adverse health outcomes have also been associated with these patterns, the data also suggest that television and other media may be positioned to serve as a tool for cancer screening interventions.

A study by Kreuter et al. [40] tested the efficacy of two interventions: 1) a narrative video with breast cancer survivor stories entitled, “*Living Proof*”, and 2) an informational video about breast cancer using an expository and didactic approach entitled, “*Facts for Life*” as the control variable. However, no statistically significant increase in mammogram rates occurred by the 3 or 6-month follow-up. Nevertheless, an increase in breast cancer screening did occur. A 49% increase in breast cancer screening rates occurred for those who viewed the narrative video and a 40% increase took place in those who viewed the informational video. Overall, however, these increases in mammography rates were not significant. However, the findings were, nevertheless, informative. Specifically, intervention #1 had a stronger effect at 6-month follow-up in women with less than a high school education, those who had no close friends or family with breast cancer, and in those who were less trusting of traditional cancer information sources.

However, patient navigation interventions were effective. Marshall et al. [43] found a statistically significant increase in mammogram adherence within 2 years after utilization of patient navigation services that were designed to help overcome barriers to breast cancer screening (93.3% compared to 87.5% in the control; $p < 0.001$) (OR = 2.26; 95% CI: 1.59-3.22). This effect was stronger among women who weren't up to date at enrollment. Mosavel & Genderson [35] used a 60-minute interactive workshop for youth 12-17 years of age to prepare a factual and emotional appeal about breast, cervical, and colorectal cancer to an adult relative. They found no statistically significant increase in mammogram rates 100% (n=5) compared to 67% (n=2) to the control group. Pap smear rates increased by 50% (n=1) compared to 0% in the control group. Colonoscopy rates increased by 33% (n=2) compared to 0% in the control group. This study also found that youth (Chi-sq= 21.31; $p < 0.001$) and adults (chi-sq= 14.77; $p < 0.01$) found the intervention more likely to explain why screening and follow-up is important. Yet, a study carried out by Russell et al. [46] found that a significantly higher proportion of women received mammogram 50.6% (n=45) compared to 17.8% (n=16) in the control after a combined interactive breast cancer educational computer program *and* a 4 day health advisor counseling sessions were provided (RR [relative risk]= 2.8; 95% CI: 1.7-4.6) (OR = 4.7; 95% CI: 2.4-9.4; $p < 0.0001$). They also found forward stage movement in screening adoption after intervention. Lastly, in a study completed by Ukoli et al. [58], there was not a statistically significant increase in PSA testing 22.1% (n=119) to 62.8% (n=246), DRE (digital rectal exam) 21.5% (n=116) to 14.0% (n=55), PSA with DRE 7.8% (n=42) to 46.9% (n=90), and PSA without DRE 14.3% (n=77) to 78.0% (n=156) after a 15 minutes culturally appropriate prostate cancer education intervention. Along with increased rates of screening, they also identified increased knowledge about prostate cancer and cancer screening after the intervention.

Knowledge and Education Interventions

Asian Americans. Various combinations of interventions have been tested among Asian Americans in order to determine whether these efforts resulted in statistically significant ($P < .05$) increases in cancer screening. In the subsections that follow, findings regarding the efficacy of selected interventions that were tested in Asian American communities are described. Such findings are important given that the need for cancer screening among Asian Americans is extreme. Such a conclusion is further supported by the fact that while White Americans', African Americans', and Latinx Americans' first cause of death is heart disease, this is not the case among Asian Americans. Rather, cancer was and continues to rank as the first cause of death in these communities. Lee et al. [76] highlight the fact that cancer ranks as the number one cause of death among Asian Americans. As was true with the African American population, access to health care via health insurance and health care prevention by way of a medical home were identified as two of the causal variables.

However, Wu and Raghunathan [77] analyzed the use of preventative services among Asian Americans living in the State of Michigan before and after the passage of the Affordable Care Act. They discovered that even with greater access to health care and to preventive services, there is an urgent need for access to "...culturally-sensitive education about the importance and availability of preventive services, which could improve adherence to preventive health services, thereby reducing health disparities (pg. 201)." In this regard, it is less than surprising that one successful cancer screening intervention implemented for Asian Americans involved not only education, but other services as well. For example, Han et al. [34] experienced a 31.9% ($P < .001$) increase in the receipt of mammograms after providing in-class breast cancer education, follow-up counseling, and navigation assistance with lay community health workers.

It appears that all educational interventions are not equally effective. Kim et al. [39] found *no* statistically significant increase in mammography after a culturally competent interactive education session about breast cancer. This intervention was entitled, "*GO EARLY, Save Your Life.*" Interestingly, a statistically significant increase in mammography did occur from 16 to 24 weeks after the initial intervention. Specifically, mammography screenings increased from 7% ($n=7$; $p < .05$) to 15% ($n=14$; $p < .01$). This study not only identified an increase in cancer and early screening knowledge, but it was also effective in modifying beliefs. A study by Lee et al. [41] also found a statistically significant increase in mammogram uptake at 6 months based on a unique intervention called KIM-CHI (Korean Immigrants Mammography). This culture-specific health intervention provided a breast cancer education program for couples. Within 6 months after the intervention, breast cancer screening rates grew from 20% ($n=41$) to 35% ($n=71$; $p=0.0005$). Within 15 months after intervention, the screening rates increased from 42% ($n=83$) to 56% ($n=109$; $p=0.004$).

Lee-Lin et al. [42] designed a culturally appropriate breast health education program on breast cancer and screening. The intervention involved group teaching, targeted messages, and individual counseling. They found that 50% ($n=21$) of the women completed a mammogram by week 12 post-intervention. They also discovered linkages between length of residency in the United States and responsiveness to the cancer screening intervention. Patients were more likely to obtain a mammogram if they had resided in the United States between 3 and 15 years. They also found that the intervention increased Asian Americans' beliefs regarding cancer susceptibility.

Nguyen et al. [56] reported on a health education intervention that compared two delivery methods. Two treatment groups were used. Lay health workers provided education in 2 small group sessions utilizing a flipchart about colorectal cancer and cancer screening and a guide showing where to obtain screening. Overall colorectal cancer screening rates grew from 72.3% to 79.5% ($p=0.0003$) (OR= 1.56; 95% CI: 1.19-2.03). The increase in colorectal cancer screening was significantly greater in intervention #1 than in #2 (OR= 1.94; 95% CI: 1.34-2.79). Lastly, this study found that an increase occurred in intention-to-screen, awareness of colorectal cancer and screening practices, amount of people who were up-to-date on screening, screening frequency, and age at first time screening. Education using media was also used.

Latinx Americans. A study completed by Nuño et al. [45] found that participants were significantly more likely to report having mammography (OR=2.0; 95% CI: 1.3-3.1), but not significantly more likely to report having a Pap smear screenings (OR=1.5; 95% CI: 0.9-2.6) within 1 year of a *promotora*-administered education intervention to

promote breast and cervical cancer screening and prevention as well as referral information. At 2 years post-intervention, both mammography (OR=2.8; 95% CI: 1.6-5.0) and Pap smear rates (OR=2.9; 95% CI: 1.3-6.1) were significantly higher after the intervention. Interestingly, these results had a stronger effect on those who had not experienced previous screenings. They also found that people who attended 2 classes instead of one were more likely to have had a mammogram or Pap smear within the last year.

Lastly, the study completed by Püschel et al. [33] involved 3 treatment groups: 1) mail contact was made via a letter from a primary care physician; a breast cancer informational booklet, and a mammogram order was written with optional dates for getting tested; 2) #1 strategies were combined with a lay health educator home visit or telephone call for those who had not made an appointment after 6 weeks of receiving #1; and 3) opportunistic advice was given when patients contacted a primary care provider at a clinic as a control condition. A statistically significant increase in mammography occurred within 6 months of both #1 and #2 interventions. After intervention #1, screening rates increased by 51.6% (n=79) compared to 7.7% (n=12) in the control group according to *self-reported data*. Cancer screening rates increased by 51.8% (n=86) compared to 6% (n=10) in the control group according to *electronic medical record data*. After intervention #2, screening rates increased by 67.3% (n=103) compared to 7.7% (n=12) in the control group according to self-reported data. Screening increased to 70.1% (n=86) compared to 6% (n=10) in the control group according to the electronic medical record data.

Media Strategies

Chinese-American. Wang et al. [47] conducted an intervention that included 3 treatment groups. The first treatment group viewed a culturally targeted soap opera style video with a female physician making recommendations. The evaluation addressed susceptibility beliefs, severity information, benefits of screening, and barriers to breast cancer screening. Information about screening programs was also provided. The second intervention featured a video that was designed to match video #1 but without cultural beliefs. The third intervention involved a mailed Chinese breast cancer fact sheet. No statistically significant increase in mammography occurred after intervention #1 (the intention-to-treat model OR = 1.37; 95% CI: 0.92-2.04) nor #2 (the intention-to-treat model OR = 1.30; 95% CI: 0.87-1.96) based on 6-month follow-up survey (OR= 1.49; 95% CI: 0.97-2.28 for #1). According to the 6-month follow-up survey (OR= 1.37; 95% CI: 0.89-2.11), for intervention #2 the change was also insignificant. Yet, there was a statistically significant increase in mammography among low-acculturated women with intervention #1.

Latinx Americans. The vast majority of studies used involved knowledge change while a minority utilized media-based delivery methods. However, the range of interventions that have been used to target Latinx Americans is much broader. Elder [78] reports on an effort to increase cervical and colorectal cancer screenings among Latinx Americans who were involved in the church. Designed to elevate cancer knowledge, reduce barriers to screening, increase self-reported breast cancer screening, increase breast exams by physicians, and other outcomes, successes occurred in some areas but not in others. However, this section provides the results of the integrative literature review for this population.

Home Health Parties

Latinx Americans. Findings did reveal a statistically significant increase in knowledge, self-efficacy, subjective norms, and perceived benefits from screenings based upon the use of home health parties. Moralez et al. [54] found a statistically significant increase in FOBT from 31% to 41% (p=0.014) and in sigmoidoscopy or colonoscopy from 30% to 40% (p=0.014) at 6-month follow up after *promotor(a)*-led educational home-health parties were used to teach participants about colorectal screening and prevention. *Promotor(a)s* also assisted in scheduling appointments. This study revealed an increase in awareness and knowledge after their intervention. Briant et al. [48] found a statistically significant increase in colorectal cancer screening with fecal occult blood testing (FOBT). The screening rate increased from 57.1% to 82.5% in women, and 40% to 72% in men after their exposure to *promotor(a)*-led home health parties. A statistically significant increase also took place in levels of awareness and knowledge. However, a statistically insignificant decrease took place in behavioral intention to obtain further screenings. Another study completed by Coronado et al. [36] did not find a statistically significant increase in mammography participation one year after the intervention. EMR data show an increase from 11.0% to 18.6% (P<0.01), and self-reported data show an increase from 20.5% to 37.5% (P<0.01). Enard et al. [50] found a statistically significant

increase in colonoscopy or flexible sigmoidoscopy adherence after tailored patient navigation towards colorectal cancer screening. The rate of screenings grew from 23.8% before intervention to 35.6% after intervention ($p=0.03$) (AOR = 1.82; $p=0.02$). There was also an increase in fecal occult blood test adherence, but this was not statistically significant. One study completed by Fernández et al. [37] found no statistically significant differences in mammography or Pap smear completion due to lay health worker education about breast and cervical cancer. However, overall mammography completions increased from 29.9% to 40.8% ($p<0.05$) and Pap smear completions increased from 23.6% to 39.5% ($p<0.05$) after the intervention.

Media-Based Interventions

Latinx Americans. A study by Fernández et al. [51] utilized 2 different colorectal cancer educational interventions that were introduced via lay health workers. The first used a flipchart and video while the second used a tailored interactive media tablet. There was not a statistically significant difference in screenings relative to both intent-to-treat analysis (control 10.8%, $n=22$; flipchart and video 13.6%, $n=32$; and media 10.2%, $n=22$) nor for protocol analysis (control 13.3%, $n=22$; flipchart and video 18.9%, $n=27$; and media 11.9%, $n=13$) for any of these interventions.

AI/AN. The preliminary literature review revealed a paucity of studies on interventions that targeted American Indian/Alaskan Natives (AI/AN). Nevertheless, some articles were found regarding interventions to increase cancer screenings among these populations. For example, Burhansstipanov et al. [79] reported on a 2013-2014 intervention called Native Cancer 101 Module 10. "Prevention and Early Cancer Detection". Implemented by a community-based organization, educational workshops and cancer screenings were held in order to ultimately increase cancer screenings. Approximately 144 participants had never experienced a cancer screening. In addition to seeking to increase knowledge regarding cancer screenings, the workshops were also used to recruit participants for phase 2 of the intervention - the services of patient navigators to address any barriers to the receipt of a cancer screening that may have arisen. While 144 persons had participated in the workshop and 136 or 94.4% had agreed to being contacted by the patient navigators, only 86 or 63.2% of those who had agreed were reached during follow-up. But, with the health care system navigation services, 63 or 73.25% of the 86 persons contacted reported that they had already received at least one cancer screening test for which they qualified. However, this study was excluded from those included in the study because one or more exclusion criteria was not met.

Research has been conducted which suggests an extremely unusual theory regarding the epidemiologic variables underlying cancer prevalence rates among *AI/AN*. Voskarides [80], theorizing from Inuit and Alaska Indians (groups who inhabit land regions with extremely low temperatures), argues that there may be a relationship between exposure to very cold weather and cancer rates. Although this hypothesis has not yet been empirically confirmed, this study suggests that there is an even greater need for cancer screening interventions among Native Americans who inhabit very cold climates. Information such as this demonstrates that the hypothesis of intervention fidelity may fail to generate the most effective disparities decreases without modifications and adaptation. Thus, far more research is needed on cancer screening interventions among Native Americans.

As mentioned, the literature review, after the application of the exclusion criteria, revealed only one article on *AI/AN* [55]. A statistically significant increase in screening from 11.9% ($n=142$) to 15.2% ($n=181$) ($P<.05$) was found after up to 3 text messages, submitted 1 month apart, were sent. These e-mails presented information about colorectal cancer and guidelines for screening. As this data indicates, a 27.46% improvement occurred. However, while this change was clinically significant, it was not statistically significant ($P>.05$). They also found that the intervention had a stronger effect on women.

Multiple Minority Populations Interventions. In the design and implementation of public health interventions, research and theories from managerial marketing are applied. However, as is often the case with multi-disciplinary approaches, a time lag occurs sometimes rendering the "borrowed" methods and approaches "dated". For example, while public health professionals, driven by the goal of greater health equity have been increasing the use of market segmentation in seeking to implement interventions to increase cancer screenings, managerial marketers have been exploring ways to successfully *retreat* from subcultural marketing segmentation in order to reduce costs through the use of transcultural methods to impact behaviors. This is not to say that public health professionals have not also

tested the efficacy of interventions that can simultaneously generate statistically significant change across population groups. For example, the well-known VERB campaign was designed and implemented to increase physical activity across four ethnicities - Latinx Americans, Asian Americans, African Americans and, critically, American Indians. However, market segmentation was used. Yet, approximately 17 years later, Licsandru et al. [81], reports on the use of “*multi-ethnic embedded marketing communications...for the ethnically diverse millennial consumers....*” (pg. 261). Accordingly, this integrated and systematic literature review also sought research which simultaneously targeted multi-ethnic groups.

An article selected by Flores et al. [38] studied regular contact with a primary care physician and found that this increased longitudinal adherence to recommended screening mammography in all 3 minority populations (African American: OR= 1.93; 95% CI: 1.31-2.86; p=0.001) (Hispanic: OR= 1.92; 95% CI: 1.27-2.87; p=0.002) (Asian: OR= 1.55; 95% CI: 1.01-2.39; p=0.045). Moreover, the change in cancer screening was statistically significant across populations. A study by McGraw & Bullock [44] also found a statistically significant increase in Pap smear rates from 56% to 69% but no difference in mammogram rate (71%) before and after discussions with woman of various races/ethnicities, aged 30-45 years about screening. For all groups, the services provided also included identifying barriers, and making appointments. The study found that older women were more likely to get a mammogram if nominated by daughters or “educated” by highly educated younger women. It also found that Hispanic women were most likely to obtain a mammogram across the two minority populations. Additionally, this study discovered that women with a history of a Pap smear in the previous 2 years were more likely to get a Pap smear. When measuring intent, the authors found that older women had lower intentions of getting screened, and Hispanic older women had higher levels of intention compared to older African-American women.

Discussion

This systematic review of 26 studies was designed to identify effective interventions that increased cancer screening uptake in racial minority populations. As Table 2 reveals, the integrated literature review found no intervention component that consistently produced successful results in cancer screening uptake among all minority adults. The two intervention designs that produced consistently significant results were hosting a home health party (n=2) [48, 54] or having regular contact with a primary care physician (n=1) [38]. However, due to the low number of studies overall that had this design, it is difficult to know if this is an effective strategy.

Utilizing a minority population’s native language was a successful intervention strategy in several studies (n=8) [39, 41, 44, 45, 48, 50, 54, 56]. Yet, this thesis was contradicted in others (n=4) [37, 42, 47, 51]. As Table 2 reveals, some of these interventions were successful [34, 39, 41, 46, 55] but others were not (n=5) [36, 42, 47, 57, 58]. The remaining intervention approaches were also mixed in results, such as discussing cancer screening with family members and/or close friends (n=2 [41, 44]; n=1 [35]), educational group learning sessions (n=5 [34, 39, 41, 44, 56]; n=4 [35, 42, 52, 58]), and peer testimony (n=0, n=1 [40]). Educational group learning sessions were held in areas in the community including minority community health centers [34, 42, 56], general community centers [35], minority population churches [35, 39, 52], and lay community health workers’ homes or participants’ homes [56].

When examining methods of delivering messages promoting cancer screening used in the interventions, patient navigation was successful in all of the studies that adopted it (n=5) [34, 43, 49, 50, 53]. Having a patient navigator to help minority adults with the cancer screening process consistently produced an increase in cancer screening uptake when utilized. Lay community health worker assistance was also successful in increasing screening rates in all racial minority adults (n=8) [33, 34, 45, 46, 48, 49, 54, 56], five studies did not show an effect [36, 37, 51, 52, 58].

Presenting cancer screening education on printed materials that were given or mailed to participants (n=7) [33, 43, 44, 46, 50, 53, 56] and contacting participants through the telephone were more successful than not (n=7) [33, 34, 43, 46, 49, 50, 56]. However, these findings were contradicted by three [35, 37, 52] and two studies [36, 37], respectively. Home visits (n=3 [34, 43, 45]; n=3 [36, 37, 51]) and tablet or computer methods (n=1 [46]; n=1 [51]) were equally successful and unsuccessful, while presenting information in a video (n=4) [40, 47, 51, 57] did not produce any significant increases in cancer screening uptake. Text messaging was successfully utilized in one

study [55], but it is hard to definitively say this could be an appropriate health education delivery method for all ethnic minority adults.

Because many of the studies analyzed incorporated multiple concepts in their intervention strategies, it is hard to point to one or two methods that will consistently work across racial minority populations. For example, certain studies specifically mentioned adding culturally-relevant materials to their intervention [34, 36, 39, 41, 42, 46, 47, 55, 57, 58]. However, this did not directly overlap with the studies that used a lay community health worker or patient navigator. These two intervention strategies are designed to culturally connect with all racial minority populations. Although the study did not specifically mention cultural components, they were incorporated with the lay community health workers or patient navigators.

It should be noted that the one type of intervention that elicited consistently significant increases in cancer screening rates, *patient navigation*, was utilized in three different minority populations: African American [43, 49, 53], Asian American [34], and Latinx American [50]. We believe that this intervention was effective in various populations due to its longitudinal design. It ensures that minority adults are supported throughout the knowledge acquisition, cancer screening, and follow-up processes. Similarly, the one article [38] focusing on regular contact with a primary care physician studied these three racial minority populations as well. Due to continuous support from primary care physicians, racial minority adults were better able to assess their barriers and undergo cancer screening.

Home health parties, where two studies had significant increases in screening rates [54, 48], were used solely with Hispanic populations. This strategy did not focus on building longitudinal support like the aforementioned studies, but we believe its success was due to the community involvement with friends and family. It allowed minority adults to initiate conversations with loved ones and better understand how cancer screening fits into their values.

Text messaging to relay cancer screening information was only used in one article [55]. These text messages served as a continual reminder to minority adults about the importance of cancer screening and prevention. Because this was the only article that targeted interventions toward the AI/AN population, this promising strategy should be studied further in other populations. Promising interventions studied in African American, Asian, and Latino populations should also be studied in AI/AN populations in the future.

Conclusion

The need for cancer prevention strategies that can successfully increase cancer screenings is an urgent one. Increases in the use of successful interventions will not only reduce cancer prevalence rates but can also decrease disparities in cancer outcomes. The purpose of this study is that of simplifying findings so that they can be more easily duplicated. For example, patient navigation elicited consistently significant increases in cancer screening rates in three different minority populations. However, additional studies are needed that investigate the efficacy of patient navigation as well as other methods such as home health parties, frequent contact with primary care, and text messaging. These interventions should focus on longitudinally supporting racial minority adults in seeking cancer and cancer screening information and in distributing findings to individuals. Nevertheless, these findings can serve as an important guide that, when accessed by community health professionals, can actively diffuse effective cancer screening interventions into all racial/ethnic communities thereby achieving the quality of this study.

Compliance with Ethical Standards

- * Disclosure of potential conflicts of interest

None of the authors declares that he/she has conflict of interest.

- * Research involving human participants and/or animals

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

- * Informed consent

N/A

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