Technology support for cancer management of culturally and linguistically diverse communities: A systematic review

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Abstract

Current research on technology-supported health promotion in culturally and linguistically diverse (CALD) communities cancer support is in its infancy. This paper aims to identify the technology-related studies that facilitate the cancer management of CALD consumers. A literature search was conducted in Scopus, Web of Science, PubMed, Google Scholar, CINAHL Plus, Medline, and EBSCO. The new revised PRISMA framework is employed in the selection process of the studied papers. In addition, the revised Cochrane Collaboration approach was used to assess the risk of bias. The review included 12 empirical studies in technology-mediated CALD cancer support. Functionalities such as Pain management, cancer-related information support, psychological and physiological support, social and spiritual support, self-efficacy and support care needs, and health-related quality of life support are presented in these studies. The results indicate the functionalities that will need to be included for Technology support of cancer consumers from diverse backgrounds.

Keywords: Cancer, online support, technology support, social support, CALD community

Introduction

The cancer mortality rate accounted for close to 10 million people in 2020, and breast cancer is the leading morbidity (2.26 million cases), followed by lung cancer (WHO, 2022). Many ongoing efforts on cancer management improvement have been studied. Regardless of the treatment outcome, the side effects of surgery, radiation therapy and chemotherapy could affect the overall health-related quality of life (HRQoL) (Klein et al., 2014). Moreover, cancer treatment-related adverse effects may persist for long term, requiring continuous support (Lovelace et al., 2019). Furthermore, cancer survivors with cultural and language limitations, usually classified as the minority group, require additional efforts to meet optimal cancer management. Cultures, languages, beliefs, and norms are integral to establishing good communication. Communication between healthcare professionals and patients is one of the primary and vital aspects of accomplishing cancer management programs. A study reports that language and belief hinder communication factors between health practitioners and patients who suffer from cancer diseases (Hyatt

et al., 2017). The existence of health disparities between majority and minority groups in cancer management can have a significant impact on the health and well-being of individuals and communities.

Previous studies have confirmed that technologies such as telehealth shows a significant outcome in cancer management (Chávarri-Guerra et al., 2021; Cox et al., 2017). Online self-management interventions have been found to be accessible, portable and encouraging for patient engagement leading to significant improvements in patients' fatigue, depression, anxiety and quality of life(Adeola et al., 2022).Vlahu-Gjorgievska et al. 2021 reviewed mobile health application for childhood cancer support (Vlahu-Gjorgievska et al., 2021), however, few studies have been conducted on technology utilisation to facilitate cancer management for cancer survivors who experienced language and cultural constraints (Buscemi et al., 2019; Napoles et al., 2019). In addition, due to highly diverse cultural backgrounds, patients may have different preferences for adopting technology or coping mechanisms for communication. For example, the Aboriginal community requires a flexible system and cancer information support for coordinating cancer care (Reilly et al., 2018). Thus, it might require developing such technologies to include functionalities that could facilitate a wide range of diverse user backgrounds, explicitly considering the language and cultural aspects. Moreover, with the recent COVID-19 pandemic, the need for virtual care is in demand. Hispanic and non-Hispanic Black cancer survivors claimed that interaction through telehealth was better than personal sessions during the COVID-19 pandemic (Tashkandi et al., 2020). This could infer that virtual care has more opportunities for other underserved patients. Besides, it has also been found that cancer patients among migrants usually have higher unsatisfied needs and worse psychosocial outcomes compared to the Australian-born cancer patients (Shaw et al., 2016).

There is a role of information systems in providing support for cancer consumers. However, technology solutions are often provided without due consideration for all facets of the healthcare management process and consumer engagement perspectives. The application provided to cancer consumers need to provide the relevant information and skills for user confidence and motivation to enhance consumer engagement and self-management. Therefore, any system developed needs to provide the system context and primary task support. Moreover, the Representation theory (Burton-Jones & Grange, 2013) indicated effective use of the systems involves the motivation and competency of the users, the purpose and nature of the system and the task. Thus, to provide technology support of the CALD cancer consumers, the support that we will need to provide to the users and characteristics of the system. In addition, despite the significant growth in the support of digital health innovation, the number of studies and applications on self-management and engagement of the culturally and linguistically diverse community for cancer consumers is limited. Current research on technology-supported health promotion in CALD communities' cancer support is in its infancy. This research will address an issue that is of very high importance to advancing the research.

Studies indicated that CALD communities face unmet needs in health literacy, lifestyle behaviour and interaction with others (McCarthy et al., 2018). As a result of these unmet needs, they experience distress, highlighting a need for providing consumer-centred care. Thus, assisting and understanding cancer consumers' needs and helping to overcome some of the obstacles will enhance health communication and interaction with CALD populations (Deen et al., 2011; Hibbard, 2017). Thus, understanding the technology perspectives of cancer support for the CALD community or minority would be beneficial for information systems design and development.

Although the medical technologies of cancer treatment have improved a lot in the past half a century, the health disparities or inequality among the minority group and majority groups such as African Americans and White Americans have been more significant than before (Naylor et al., 2012). Another interesting study indicates that the racial/ ethnic minority groups are more likely to extend life at the cost of their all-personal property compared to the majority group (LoPresti et al., 2016). Although there were previous review studies on the health of minority groups in USA (LoPresti et al., 2016; Naylor et al., 2012; Salman et al., 2016; Willard, 2021), South Africa (Brown et al. 2016) and in Australia (Hyatt et al., 2017), these studies focus on the existence of health disparities between the majority group and minority groups and highlighted the importance of addressing the problem. (Brown et al. 2016; Naylor et al. 2012; Wang et al. 2020; Willard 2021) examined the Interventions to address the issues, while (Hyatt et al. 2017; LoPresti et al. 2016; Salman et al. 2016) explored the reasons for the problems. Of the reviews that examined the interventions, three studied the interventions designed for patients and one studied the interventions for clinical trials. Additionally, these interventions were limited to providing education and emotional support to patients, and not on technology-based intervention for cancer support for the CALD

community. Thus, there is a need to conduct a systematic literature review on the technology intervention, study characteristics and task support of CALD community cancer consumers.

Thus, the literature review is conducted to answer the research question, "How teleconsultation and technology-based support can assist cancer management of culturally and linguistically diverse cancer survivors"?

Method

The new revised PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analyses) framework is employed to assist reviewers with the collection and selection process of the studied papers (Page et al., 2021). A library search was conducted in January 2022. Several most used online library databases namely Scopus, Web of Science, PubMed, Google Scholar and CINAHL Plus and Medline via EBSCO were used for searching studies. The four keywords alongside each word's synonym were constructed to query papers. A Boolean operator (AND & OR), type of study design, language and full-text accessibility were applied to refine search strategies.

Keywords for library database search

telehealth or telemedicine or telenursing or technology or "Information Technology" or "Information Communication Technology" or "Internet of Things" or IoT or smartphone or apps or "mobile apps" or software

"cancer patients" or "oncology patients" or "patients with cancer" or "neoplasms" or "malignant"

treatment or intervention or therapy or management or rehabilitation or efficacy or effect or effectiveness or outcome

"language barrier" or "communication barrier" or "non-english speaking" or "cultur*" or "culturally minority" or "cultural background" or "cultural differen*" or marginali* or "ethnic*" or "minor*".

Quality Assessment

The revised Cochrane Collaboration tool was employed to assess the risk of bias (RoB) in identified randomised control trial (RCT) studies (Sterne et al., 2019). A total of ten RCT studies were assessed for their risk of bias as presented in figure 1.

Study Analysis

The analysis for this review is adopting a conceptual model for ehealth developed by (Shaw et al., 2017). This model consists of three main fields such as (1) health in our hands, (2) interaction for health and (3) empowering health by data through collecting, organising, and using health information. Based on our review objectives, the collected studies for this review are adhered to the first and second domain of the conceptual model. The first domain refers to the use of digital technologies to follow up, monitor and disseminate health-related information. The second domain emphasises the use of digital technologies to facilitate communication between health practitioners and health consumers.

Inclusion criteria

Academic journal articles: Accessible peer-reviewed papers with full text in the English language

Study design: Studied papers must be from the empirical type of studies (e.g., randomised control trial (RCT or pre and post-test on focus group).

Participants: Eligible participants who were diagnosed with any type of cancer. Participants with a specific type of culture or language background that considered a minority among the surrounded communities. This includes immigrants and natives (e.g., English and non-English speaking or Hispanic or Asian).

Technology: Technology is used to facilitate cancer management (e.g., mobile apps or web technology to bridge the interaction of health professionals and cancer-diagnosed patients). Technology is used for teaching or educating cancer patients.

Intervention: Participants who received cancer management for health-related quality of life (HRQoL) improvement, physical and psychological support, social and spiritual support, self-efficiency and

knowledge about cancer via technology interference such as mobile apps, web-based, or computer-based systems.

Exclusion criteria

Retrospective surveys and review types of studies; Cancer participants who are not limited by any culture and language barriers; Screening and diagnostic studies are excluded.
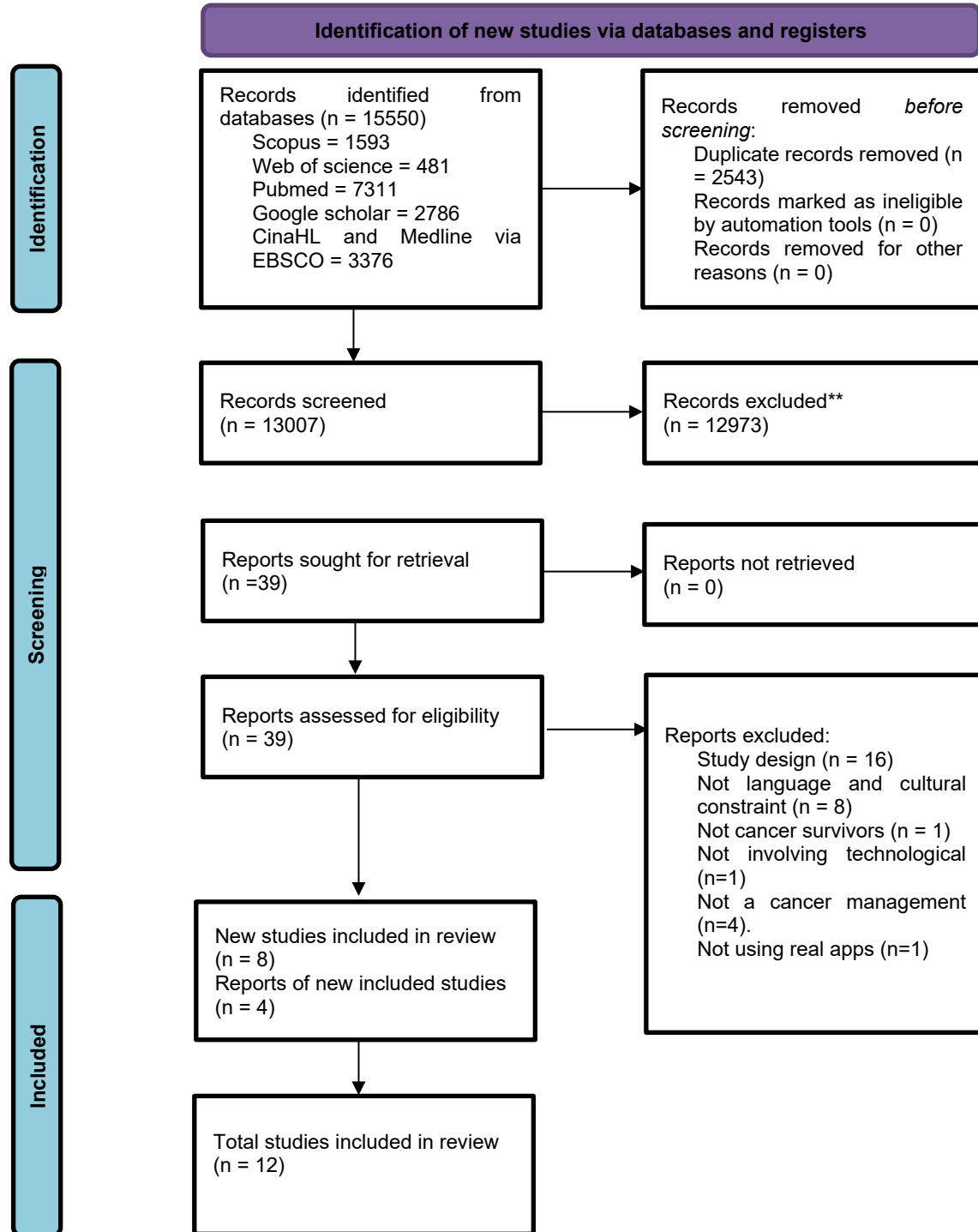

Figure 1: PRISMA flow chart

Selection of studies

A combined set of keywords was used for searching reviewed papers. As a result, a total of 15550 articles were derived from the designated online libraries. The duplication check was performed to exclude duplicated papers which results in 13007 papers considered for the title and abstract screening. After conducting title and abstract checks, a total of 39 articles were retained for full-text review. Following the inclusion and exclusion criteria protocol, 8 papers were eligible for the review and the other 29 studies were excluded due to not review protocols such as not meeting the required study design (n=16), not including one of the three study domains (n=10), not for cancer management (n=4), and not using a real application (n=1). Additionally, 4 studies were identified from a reference check and therefore the total number of papers for this review is 12 studies. The detail of the article selection is elaborated in the PRISMA flowchart and can be found in figure 1.

Data Extraction

Different database search was performed and all the search results are imported into an EndNote file and filtered duplicated studies. Title and abstract screening are conducted by at least 3 authors. Any discrepancies were discussed among members to get the consensus. The process of data extraction and analysis was conducted using the online Covidence platform (Bray et al., 2018). Moreover, the EndNote application was used for managing references (The EndNote Team, 2013).

Results

Study design and population

Of the total of 12 studies, 10 papers were using randomised control trial (RCT) study design (Anderson et al. 2015; Ashing & Rosales 2014; Badger et al. 2013; Chee et al. 2017; Chee et al. 2020; Im et al. 2019; Im et al. 2020; Im et al. 2021; Yanez et al. 2015; Yanez et al. 2020), one article was using focus group with pre and post-test study design (Buscemi et al. 2019) and the other study was using mix method (Napoles et al. 2019). The Cochrane guideline was used to assess the Risk of Bias (RoB) for the 10 RCT studies. The number of study participants in each study ranges from 23 cancer survivors as the smallest cohort (Napoles et al. 2019) and 221 as the largest group (Ashing & Rosales 2014). 11 out of 12 studies were focused on the breast cancer survivors and only 1 study used prostate cancer (Yanez et al. 2015). This also means that cancer survivors who accounted for 11 studies were women and only one study was conducted on the male cohort. In addition, all studies were conducted in America with race and cultural backgrounds varying from Asia such as China, Japan and Korea, Hispanic-Latina, and African American. For the cultural background differences, five studies were conducted on Asian populations such as China, Japan and Korea who lived in America. The other five studies were performed on the American Hispanic-Latina and the rest of the 2 studies were mixed from, Latina, African American and white people.

Quality Appraisal

The reviewed papers were assessed for quality using the revised Cochrane Collaboration tool. The assessment was applied for the risk of bias (RoB) in identified randomised control trial (RCT). A total of 10 papers were assessed. Bias arising from the randomisation process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of outcome and bias in selection of the reported results were assessed. Bias tool https://www.riskofbias.info was utilisied for the assessment.

Overall, all three rating categories were found in each study with *a low risk of bias* and *some concerns* as major themes. Figure 1 displays the risk of bias in ten identified RCT studies. A total of 12 papers are reviewed however only 10 studies are eligible for the quality assessment as these papers used randomised control trial (RCT) study design. Most of the studies were rated as *low risk* of bias with five papers. In addition, four papers are categorised into *uncertain* and one study is identified as *high* risk (figure 2 & 3).

	randomisation process	deviations from intended interventions	missing outcome data	measurement outcome	selection of the reported result	Overall Response
(Anderson, Palos et al. 2015)	low	uncertain	uncertain	low	low	low
(Ashing & Rosales 2014)	uncertain	low	high	high	low	high
(Badger et al. 2013)	low	low	high	low	low	low
(Chee et al. 2017)	low	uncertain	low	low	low	low
(Chee, Lee et al. 2020)	high	high	low	low	low	uncertain
(Im, EO et al. 2019)	low	uncertain	high	low	low	uncertain
(Im et al. 2020)	low	uncertain	low	high	low	uncertain
(Im et al. 2021)	low	uncertain	high	low	low	uncertain
(Yanez et al. 2015)	low	uncertain	uncertain	low	low	low
(Yanez et al. 2020)	low	uncertain	low	low	low	low

Low risk of bias   uncertain risk of bias   high risk of bias

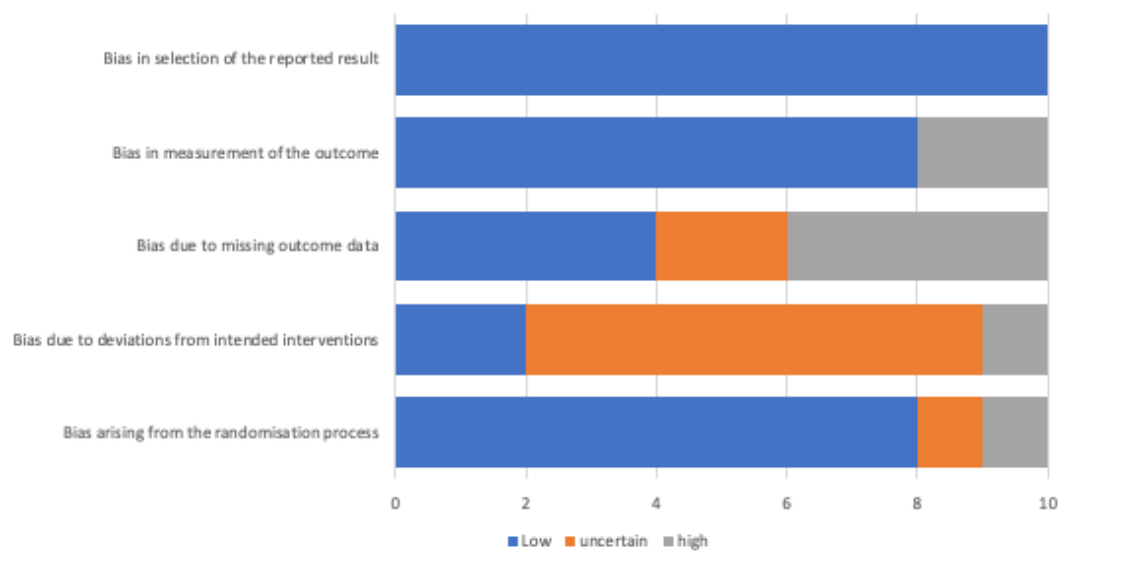Figure 2: Quality Appraisal Results

Figure 3: Risk of Bias assessment

Type of Features used in delivering interventions

The interventions were delivered via various types of methods namely teleconsultation (3/12), websites (6/12), and smartphone applications (3/12). Anderson, Palos et al. (2015), Ashing & Rosales (2014) and Badger et al. (2013) have all been interested in whether can telephone technology has a positive impact on English and Spanish language speaking patients. The intervention group received eight biweekly psychoeducational teleconsultation sessions lasting 40–50 minutes each (Ashing & Rosales 2014). Buscemi et al. (2019) and Nápoles et al. (2019) used only one mobile phone software to intervene with patients on Health-Related Quality of Life (HRQoL) questions. Buscemi et al. (2019) created My Guide, a Smartphone application intended at increasing HRQoL among Hispanic BCS. The trackC smartphone app (in Spanish) was created to store women's breast cancer diagnostic and treatment histories, as well as information on probable side effects, healthy lifestyles, and survivorship options (Nápoles et al. 2019). Yanez et al. (2020) used two applications, both apps are culturally sensitive and provide evidence-based information for

lowering symptom burden and enhancing the health-related quality of life (My Guide) or promoting a healthy lifestyle (My Health). The content of the My Guide and My Health smartphone apps was created in partnership with a community partner (Latina Breast Cancer Association) and is based on Latina cultural values and beliefs (eg, external locus of control, familism, fatalism, and Machismo/Marianismo) (Yanez et al. 2020). The other six studies were all delivering interventions through websites. Chee et al. (2017) were providing content from the Internet Cancer Support Group for Asian Americans (ICSG-AA) for the patients. In their next study Chee et al. (2020), they had provided two different websites of Cancer Pain Management Support Program for Asian American (CAPAA) and the American Cancer Society (ACS). There were three that studies provided Theory culturally tailored intervention and coaching on computer/mobile devices (Im, EO et al. 2019; Im et al. 2020; Im et al. 2021). Three components of the technology-based program (social networking sites, instructional modules, and online resources) were available in five languages: English, simplified and traditional Chinese, Korean, and Japanese. These elements were used for both group coaching and support as well as individual coaching and support (Im, EO et al. 2019; Im et al. 2020; Im et al. 2021). And Yanez et al. (2015) were helping patients by Web Internet technology that integrated Assessment Center, online data management and assessment platform via CAT.

	Culture or race or language	Study design	Support type
(Anderson et al., 2015)	African and Latina (English & Spanish)	RCT., T1 (4-6 weeks after enrolment) T2(8-10 weeks), (n=60)(C=29)(I=31）	Teleconsultation
(Ashing & Rosales, 2014)	Latina (English and Spanish speaking)	RCT, 4-6 months follow up assessment after baseline; 3-4 months post intervention, (n=221) (C= 110),(I = 111)	Teleconsultation
(Badger et al., 2013)	Latina (Hispanic)	RCT, T1 (Baseline assessment); T2 post 8 weeks; T3 post 8 weeks. Total 16 weeks, (n=90)	Teleconsultation
(Buscemi et al., 2019)	Latina (Hispanic)	• Focus group T1 and T2 assessment. • 4 weeks trial and +3 hours/week, (n=25)	Smartphone app
(Chee et al., 2017)	Asian (Chinese, Korean, or Japanese)	RCT, Repeated measures pre and post-test control group design, 22 Months, (n=65) (C = 30), (I = 35)	Internet Cancer Support Group for Asian American
(Chee et al., 2020)	Asian(Chinese, Korean,or Japanese)	RCT, Repeated measures pre and post-test control group design, 23 months, (n=94)(C = 30)(I = 64)	Website
(Im et al., 2019)	Asian(Chinese, Korean,or Japanese)	RCT. Repeated measures pre and post-test control group design; Post-test was after 1 month and 3 months., (n=91) (C = 49), (I = 42)	American Cancer Society (ACS) Website
(Im et al., 2020)	Asian (Chinese, Korean, or Japanese)	RCT. Repeated measures pre and post-test control group design.;Post-test was after 1 month and 3 months. (n=115) (C=49) (I = 66)	computer/mobile devices.
(Im et al., 2021)	Asian (Chinese, Korean, or Japanese)	RCT, Repeated measures pre and post-test control group design,Post-test after 1 month and 3 months., (n=67) (C= 33)(I = 34)	Social media, and online resources
(Nápoles et al. 2019)	Latina (Hispanic)	Two months intervention, Mix methods such as debriefing interviews, baseline assessment and structured surveys, (n=23)	App and Telephone coaching
(Yanez et al., 2015)	Black and Non-Hispanic White	RCT.10-week,group-based psychosocial intervention, Assessed at baseline weekly and 6 months after baseline, (n=74)(C= 37)(I=37)	Web-based platform

| (Yanez et al., 2020) | Latina (Hispanic) | RCT. Participants were assigned to use either the My Guide or My Health smartphone apps. Baseline (T1), After the 6-week intervention (T2), 2-week post-T2 assessments was conducted (T3)(n = 80) (C = 40) (I = 40) | Smartphone applications (My guide and my health) |

Table 1: Characteristics of the studies

Type of instruments used to assess outcomes

Most of the studied papers aimed to improve the quality of life (QoL) of cancer survivors. Six studies used the Functional Assessment of Cancer Therapy (FACT) to measure physical and social well-being as well as functional and emotional aspects which all belong to HRQOL class, most of which are customised based on the study population characteristics and objective (Ashing & Rosales 2014; Buscemi et al. 2019; Chee et al. 2017; Nápoles et al. 2019; Yanez et al. 2015; Yanez et al. 2020). In addition, the Brief Pain Inventory (BPI) instrument was used in two studies to assess the pain level of patients that suffer from Breast Cancer (Chee et al. 2017; Chee et al. 2020; Im et al. 2020). Two other studies use a different scale for pain assessment such as the pain management index (PMI) and Memorial Symptoms Assessment Scale-Short Form (MSAA-SF) respectively (Anderson et al. 2015; Im, EO et al. 2019). Two studies used the Patient Reported Outcomes Measurement Information System (PROMIS) method for reporting the intervention outcomes. Nápoles et al. (2019) employed PROMIS to assess cancer-related fatigue and health distress and Yanez et al. (2015) measured depressive symptoms with PROMIS and Computerised Adaptive Testing (CAT). Additionally, the Centre for Epidemiology Studies Depression Scale (CES-D) was employed in two studies to assess the depression variable (Ashing & Rosales 2014; Badger et al. 2013).

Cancer Behavioural Inventory (CBI) was mostly used scale for assessing the self-efficacy of respondents (Chee et al. 2017; Chee et al. 2020; Im et al. 2019; Im et al. 2020; Im et al. 2021). Perceived isolation and perceived, social influences interaction were measured by utilising the Perceived Isolation Scale (PIS) (Chee et al. 2017; Chee et al. 2020; Im et al. 2020; Im et al. 2021). Support Care Needs Survey (SCNS) was used in three studies to assess the support care needs of studied participants (Chee et al. 2017; Chee et al. 2020; Im et al. 2021).

Feasibility and acceptability

Five papers present the feasibility and acceptance and usability of using assistive technology for cancer management in cancer survivors (Buscemi et al. 2019; Chee et al. 2017; Napoles et al. 2019; Yanez et al. 2015; Yanez et al. 2020). Noticing that all five papers' target groups are the minority group but only three papers have explained how they take into consideration the characteristic such as language and living habits of the target minority group and design the specification intervention for them (Buscemi et al. 2019; Chee et al. 2017; Nápoles et al. 2019). Feasibility outcome was assessed towards enrolment rate of a participant in the study, participant use of application and retention rate throughout the intervention process. The acceptance rate was measured utilising user satisfaction and usability in using the apps or service tools. To be specific, three of the five papers check the feasibility and acceptability of designed mobile applications, two of them list their outcome of retention rate as 91.7% and more than 90% while the other paper says the majority (n=17;81%) rated the overall quality "very good" or "excellent" (Buscemi et al. 2019; Nápoles et al. 2019; Yanez et al. 2020). The rest two papers are web-based intervention studies, and one paper says its retention rate reaches 85.7% while another paper says that all invited users and experts positively evaluated the intervention (Chee et al. 2017; Yanez et al. 2015). Three papers give the exact number of acceptability satisfaction as 65.91(value range 42-70), 3.6 out of 4 and 90% (Buscemi et al. 2019; Yanez et al. 2015; Yanez et al. 2020). The other two paper describe their performance of acceptability as good.

Pain management

Four studies were assessed for pain outcomes related to breast cancer. Three of them focus on the group of Asian people and show their consideration of the particularity of Asian people as Asian people are usually more likely to endure pain and use their own herbal medicine (Chee et al. 2017; Chee et al. 2020; Im et al. 2020). In the evaluation process, three studies show a detailed design of quantification of pain (Anderson

et al. 2015; Chee et al. 2020; Im et al. 2020). One study admits its weakness as that pain intensity could not be measured and the pain was measured by using a single item related to physical and psychological symptom distress (Im et al. 2020). Three studies showed positive outcomes using telephone and website as assistive technologies in delivering the intervention (Anderson et al. 2015; Chee et al. 2017; Im et al. 2020). Moreover, one study reported that there was no significant difference in pain change for both intervention and control groups (Chee et al. 2020).

Knowledge of cancer management

Three studies aimed to improve the knowledge of cancer survivors regarding breast cancer management using telephone and smartphone applications. Badger et al. (2013) recruited 90 Latinas with their supportive partners (SPs). They were randomly and equally divided into 2 groups. 45 dyads were assigned to the Telephone Health Education (THE) group with the aim of improving knowledge about cancer and 25 dyads were allocated to the telephone interpersonal counselling (TIP-C) group whose objective is to increase the perception of social support. The whole duration of the study was 16 weeks and post knowledge assessments were conducted after eight weeks. Participants' knowledge regarding cancer was assessed by a 20-item cancer knowledge measure. The result of the study shows a significant improvement in cancer knowledge over time in THE group compared to the TIP-C group. In addition, Buscemi et al. (2013) report their study using a smartphone application called my Guide to deliver their intervention to 25 cancer survivors. The intervention was delivered for four weeks and the knowledge regarding cancer was evaluated with 16 questions. The focus of knowledge is a general understanding of breast cancer and endocrine therapy. Overall, the study findings demonstrate a significant improvement in breast cancer knowledge in post-assessment compared to baseline assessment. Similarly, Napoles et al. (2019) conducted a study using telephone coaching for 23 Latino American women who were diagnosed with breast cancer for 2 months. The outcome of the study shows a greater improvement in cancer knowledge compared to baseline assessment. All these three studies showed positive outcomes of knowledge about cancer (Badger et al. 2013; Buscemi et al. 2019; Napoles et al. 2019).

Psychological support

For the psychological domain outcome, various aspects were assessed under this domain. These aspects are sadness, emotional distress, depression, stress, anxiety, and emotional well-being. Nine studies included at least one or more of the aspects as the targeted outcome in the intervention (Anderson et al. 2015; Ashing & Rosales 2014; Badger et al. 2013; Chee et al. 2017; Im et al. 2019; Im et al. 2020; Napoles et al. 2019; Yanez et al. 2015; Yanez et al. 2020).

Three studies used telephonic-based intervention to improve the psychological support of the patients. Anderson et al. (2015) was able to decrease their pain level from the baseline of 86% to 43%; P = 0.004 for the intervention group in the intervention group and in the control group, from a baseline of 80% to 56%; P = 0.07. Ashing & Rosales (2014) were able to decrease the depressive symptoms from baseline M=25.4, SD= 10.2 to M=17.2, SD= 10.5 (p<0.001) for the intervention group and for the control group symptoms remained unchanged. Badger et al. (2013) reported a noticeable difference in multivariate main effect for time Wilks's Λ=0.60, F (2, 66) =22.19, p<0.001 but not in treatment group time or dyad role time.

According to Chee et al. (2017) RCT trials report, by controlling for background and disease factors the treatment group was able to improve the physical and psychological factors F = 3.16, p < 0.10. Similarly, Im et al., (2019 and Im et al., (2020) studies showed a notable decreased change in psychological symptoms β = −0.13, p = 0.05 and βGxT1 = −0.22, p = 0.0062 respectively.

Based on the Napoles et al. (2019) finding report, the health distress level was reduced by conducting a two-month intervention, their results B=−.36; P=.01; Cohen d=0.3 was the intervention. Moreover, Yanez et al. (2015) and Yanez et al. (2020), a decline in depressive symptoms was stated with (P<.05) and (F 2,142 = 0.61, P = .546 emotional well-being, F 2,143 = 1.76, P = .175 well-being and F 2,143 = 1.20, P = .305 functional well-being) respectively. Therefore, the outcome for the psychological domain was all positive in all nine studies.

Physical well-being support

Six studies have paid attention to the physical well-being support function of their intervention and showed that their intervention can provide a certain degree of help in improving physical well-being related to

patient's physical symptoms (Badger et al. 2013; Chee et al. 2017; Im et al. 2019; Im et al. 2020; Nápoles et al. 2019; Yanez et al. 2020).

(Badger et al. 2013) the telephonic intervention was able to minimise the physical symptoms of the patients, their results produced for multivariate main effect for time Wilks's $\Lambda= 0.61$, F (2, 66) =21.16, p<0.001 but not in treatment group time or dyad role time. (Chee et al. 2017) was also able to improve the physical symptoms in the intervention group. In (Im et al. 2019) and (Im et al. 2020) we able to demonstrate a huge difference in physical symptoms for the intervention group (β = −0.07, p = 0.08) and (βGxT1 = −0.22, p = 0.0062) respectively. (Nápoles et al. 2019) the two monthly interventions were lower the fatigue of the patients in comparison with the baseline (B=−.26; P=.02; Cohen d=0.4) and (Yanez et al. 2020) using the smartphone applications was able to reduce the physical burden of the breast cancer symptoms (F 2,143 = 0.96, P = .387). All six studies had a positive outcome for the physical domain.

Perceived isolation and social and spiritual support

Two studies reported perceived social isolation outcomes (Chee et al. 2020; Im et al. 2021). Both studies employed the same instrument, the Perceived Isolation Scale (PIS), to assess social isolation. Significant changes in perceived isolation were reported in the intervention group (Chee et al. 2020). Similarly, a favourable outcome was also found in the intervention group compared to the control group (Im et al. 2021).

Three studies referenced the social well-being outcomes of the studied cancer survivors. Badger et al. (2013) utilised the telephone as a medium to deliver the intervention and the result showed a significant increase in social well-being was reported in the TIP-C group. Not dissimilar, Im et al. (2021) stated the intervention group has greater improvement in social support compared to the control group. However, Yanez et al. (2020) employed a smartphone application named my guide and my health to disseminate breast cancer related information to 80 Latinas, and their preliminary result indicated no interaction of time and condition for social well-being in their intervention. Badger et al. (2013) reported there was progress in improving spiritual well-being in the TIP-C group.

Self-efficacy and support care needs

Five studies reported the self-efficacy outcomes of cancer survivors in their literature (Chee et al. 2017; Chee et al. 2020; Im et al. 2021; Nápoles et al. 2019; Yanez et al. 2015). Moreover, the support care needs outcome was reported in three studies (Chee et al. 2017; Chee et al. 2020; Im et al. 2021).

Four papers reported positive outcomes of self-efficacy in their intervention. Chee et al. (2017) recruited 65 Asian American breast cancer survivors. The self-efficacy of the intervention group who accessed the Cancer Support Group for Asian Americans (ICSG-AA) demonstrates a better outcome than the control group. Similarly, Chee et al. (2020) utilised two websites namely Cancer Pain Management Support Program for Asian American (CAPAA) and American Cancer Society (ACS) to conduct a study. A total of 94 participants who were diagnosed with breast cancer with Asian backgrounds originated from China, Japan and Korea. Participants were randomly allocated to two groups. The control group was only assigned to the ACS website and the intervention group had access to both ACS and CAPAA websites. The outcome of the result was reported with a substantial change in self-efficacy attribute in the intervention group. A similar positive outcome of self-efficacy was also observed in the technology-based program support to Asian Americans who had breast cancer (Im et al. 2021). Moreover, Yanez et al. (2015) also reported the same outcome of improvement in self-efficacy from their study of the web-based platform which was delivered to 74 respondents who were diagnosed with advanced prostate cancer. Additionally, all three reviewed papers reported a positive result of the support care needs variable.

On the other hand, one paper reported opposite outcomes on the self-efficacy variable in the study. Telephone coaching was delivered to 23 Latino breast cancer survivors for two months. The outcome of the self-efficacy of respondents to manage cancer was observed with no change in post-assessment compared to baseline data (Nápoles et al. 2019).

Health-related quality of Life (HRQoL) support

Health-related quality of life (HRQoL) was found in three studies (Buscemi et al. 2019; Chee et al. 2017; Yanez et al. 2015). The authors used FACT-G to assess the HRQOL of cancer survivors. (Buscemi et al. 2019) using the smartphone application for intervention was able to increase the HRQoL of the patients in 4

weeks. The outcome (F = 3.31, p < 0.10) shows greater improvement in the intervention group compared to the control group (Chee et al. 2017). (Yanez et al. 2015) conducted a technology-assisted psychosocial intervention of 10 weeks and was able to improve the relaxation self-efficacy (P<.05).

Discussion

All the studies aimed to deliver healthcare services that can assist cancer survivors in managing cancer. Each study has at least one or more of the following interventions: pain management, cancer-related information support to improve knowledge of cancer, psychological and physiological support, social and spiritual support, self-efficacy and support care needs and health-related quality of life supports.

Beliefs and norms about cancer and its causes affect culturally and linguistically diverse communities, such as Latino-Hispanic, Asian (Japanese, Korean and Chinese) and African American communities, in different forms. For instance, stress is one of the more common beliefs about the cause of breast cancer among these communities (Gonzalez et al., 2015). This can lead to misinformed cancer patients who rely on themselves to survive rather than health professionals. This situation only becomes more severe when the underserved population are added to the equation since they are more likely to give in to false beliefs and self-medicate.

Based on the evidence related to the consideration of cultural and linguistic concerns in the reviewed studies, it can be found that all studies have indicated they have made some effort to overcome the problem, but most of those interventions have been limited to overcoming language barriers. Patients from various cultural backgrounds have limited access to evidence-based and culturally relevant services. If they support patients through a telephone-based operation, this strategy focuses more on overcoming language obstacles and sometimes ignores their cultural background. Some of them have mentioned considering of cultural habits of the minority groups. However, these studies emphasised more on the effectiveness of the system and support provided. For example, Im et al. (2020) have paid more attention to the effectiveness of a technology-based information support program in boosting Asian American breast cancer survivors' self-efficacy while considering very little about their cultural beliefs and attitude. Others discovered that technology-delivered emotional and information support therapies that are relatively brief, culturally acceptable, and highly accessible could result in significant benefits. One of the studies Badger et al. (2013) indicated that core cultural values are considered in the intervention. This overall result indicates and highlighted that needs of a deeper understanding of the difference between cultural and linguistic factors in the studies of minority groups.

Feasibility and acceptability were reported in five studies. A detailed description of the evaluation process of checking feasibility and acceptability and the outcome was provided. According to five studies, the overall feasibility and acceptability of their studies could be very good. However, noticing that the five studies mainly rely on patient feedback to generate conclusions about feasibility and acceptability can lead to some bias. From the review it can be seen that not many studies were designed for the minority group and effectiveness studies have been available. It could be possible that the feedback from patients is far better than average numbers because they have never received these excellent or specialised services before, which also indicates the unequal treatment status of the minority group in the current environment.

Cancer pain has been classified as a significant problem that causes increasing concern for the whole population and negative impacts on the quality of life (Koh et al., 2018). But pain management is tended to be ignored compared to the other obvious or significant symptoms in cancer treatment, as the result showed that only 4 of 12 studies have evaluated pain. The possible explanation of this problem could be the complexity of the evaluation and quantification of pain as the evaluation process is usually conducted by patent's rating or inadequate self-assessment of the pain (Paice, 2018; Smith & Saiki, 2015). Especially for the minority group, which usually has a very different cultural background and living habits. Of those four studies that have evaluated the performance in pain management, three of them have found positive outcomes showing the need to relieve pain for minority groups and the accessibility of their interventions in pain management. Besides, the primary intervention of the 4 studies on improving pain management for cancer patients is education. It has been proved that cancer patients require time and repeated information through the education process to get over the resistance to their dysfunctional beliefs and fear (Ekstedt & Rustøen, 2019). However, those studies mainly focus on the language barriers in delivering education and do not mention any specific consideration of the cultural difference in the education process.

The importance of adequate knowledge about cancer can assist in the self-management of cancer patients (Carpenter & Colwell, 1995; Nápoles-Springer et al., 2009). Family plays a vital role in supporting cancer survivors' efforts to manage their life, and with adequate knowledge about cancer, families can effectively assist patients' efforts to overcome the consequence that might occur as a result of lacking cancer knowledge. Families can be reliable sources of information for children with cancer who have insufficient access to information (Wang et al., 2016).

This review presented the technology-based health services including education features to assist in disseminating cancer related information. Previous studies confirmed the finding in this review regarding the use of technology to improve cancer patients' knowledge about cancer (Moradian et al., 2018; Wang et al., 2020). It seems evident that teleconsultation and the use of mobile applications can be effective instruments to serve as information banks which can facilitate the improvement of cancer knowledge.

Cancer and its management have an enormous effect on patient and their families. It is also followed by substantial alterations in life such as psychological, emotional, spiritual, and social for the cancer patient. These alterations in life can lead to many mental illnesses such as anxiety, depression, post-traumatic stress disorders, etc. Due to this, it is of utmost importance for cancer care experts to provide the best possible support or sources of support for the patients. Cancer patients have to go through various kinds of psychological, emotional and pragmatic demands in their regular life along with the physical brunt of this disorder and its treatment. But this battle is not only for the patients, it is even a battle for the member of the patient's family. Although it has been found that the Health-Related Quality of Life (HRQoL) of children of cancer patients was better in comparison with the norm, however for children with special needs, it was worse (Bultmann et al., 2014). Some of the factors that impacted a child's HRQoL are older age, having a parent with cancer, a parent not living together and a parent's bad mental and physical health.

Even the size of the social group has an impact on a patient's health. The larger a woman's social network and the more integrated she is within it, the more emotional support and instrumental support available to her (Bloom et al., 2001). Also, if a women's emotional support is favourable her mental health is improved. For men, the practical and problem-related informational support is of more interest than emotional support, or men, other than women, have more difficulties dealing with the emotional side of cancer (Mehnert et al., 2010). The authors reported that 16% of psychological distress was found in all patients with prostate cancer. Various technologies and telephonic based have been dedicated to providing psychological support for culturally and linguistically diverse cancer survivors. All 9 studies showed a positive outcome in improving psychological support.

In six articles, the authors have described the physical well-being support function to their patients and helped them understand the benefits physical activity can provide in their recovery. Less than 20% of cancer patients meet the recommended physical activity (PA) guidelines, partially due to poor knowledge and enforcement/encouragement amongst healthcare professionals (Roscoe et al., 2022). Patients have made assumptions regarding physical activity; some believe fatigue after exercise creates a negative environment in which they are bound to fail. Delivering the right information about the benefits of physical well-being is very important in managing a patient's cancer. Physical activity also likely contributes to a lower risk of prostate and lung cancer (Zyzniewska-Banaszak et al., 2021). Activities that are recommended are as followed walking, dancing, recreational cycling, yoga, and jogging. It has been noted that practising physical activity also relates to having a better Quality of life for cancer patients. Physically active patients reported a better QoL than their less-active peers, specifically in their physical and functional well-being (Tristao Parra et al., 2020).

Self-efficacy and support care needs are two domains identified in this review. These two domains positively correlate with the management of cancer through technology-related intervention. Despite one study in this review having a contrasting outcome of the self-efficacy variable, most studies reported complying with the previous review study, which stated that adequate self-efficacy support through digital-based intervention could improve the quality of life of cancer survivors(Escriva Boulley et al., 2018; Khoo et al., 2021; Xu et al., 2019). Additionally, the support care needs outcome described in this review corresponds to the finding stated in the review study on the use of e-health can effectively enable the support care needs of patients (Marthick et al., 2021; Ownsworth et al., 2021). Providing the right access to technological support could benefit cancer patients who are constrained by culture and language barriers. In this review, web-based interventions show positive outcomes compared to telephonic based support in reinforcing the self-efficacy of Latino breast cancer survivors. This could imply that web technologies have better user experiences, and

patients could be provided with various support rather than teleconsultation, which merely focuses on the cancer program.

Social support is considered one of the essential aspects that need to be considered in improving the quality of life (QoL) of cancer survivors. Providing optimal social support to cancer survivors allows them to be present in the social functions and improve their relationships with their families and communities (Hofman et al., 2021; Rivera Rivera & Burris, 2020). Digital health could be a novel method to support the social well-being of cancer patients. In addition, spiritual support is identified as part of the deliverance of cancer management through phone-based intervention for cancer patients (Flanigan et al., 2019; Hindmarch et al., 2022). The positive outcome of spiritual well-being was also reported in this review, and it is consistent with the previous review studies (Marthick et al., 2021). Evidence from earlier studies pointed out that spiritual support has an association with the pain management of cancer survivors. This evidence corresponds to pain management which is also reported in this review.

Quality of life is a concept that explains patients' physical, psychological, and emotional well-being which has been affected by medical care. This review contains three articles that report on the HRQoL support in a cancer patient's life, and all three articles helped participants improve their HRQoL. A lack of social support lowers patients' quality of life to such an extent that the loss or absence of support networks from family or friends can lead to an increase in the mortality risk after the cancer diagnosis (Ruiz-Rodríguez et al., 2022). Depression is more prevalent among hospitalised patients, especially when the end-of-life approaches and the association of symptoms such as fatigue, depression and sleep disorders cause a significant impact on HRQoL of people living with cancer (Freire et al., 2014). Hence, for a patient to have a better HRQoL, a patient needs to have good physical and emotional support and convenient access to instrumental sources. In addition, the patient needs to be educated about the importance of the HRQoL in their recovery. Good social support at the time of detection leads to having a better HRQoL at later stages of recovery. Findings show that certain aspects of social support, such as emotional, affectionate, and informational support, were more influential on HRQOL than the provision of instrumental support (Leung et al., 2014).

It can be seen that there is a paucity of technology mediated cancer support for CALD communities worldwide. There is a need for effective communication, positive patient-provider relationships, and receiving treatment with respect were overall associated with better reports of cancer care experiences among CALD communities. Health related quality of life support and outcome measures were presented in these studies. HRQoL support is needed for cancer survivors, and also the HRQoL measures provide cancer consumer (patient) reported outcome measures which are valuable information for cancer care.

Health literacy has been an important factor in the cancer care outcome, and there is a need to provide support and educational material to diverse communities. While the different technology support to cope with the cancer journey, studies emphasised the importance of knowledge, pain management, physical well being support, psychological support, social and spiritual report. Moreover, there is a need for support care measures and HRQoL measures to indicate patient reported outcome measures. Although the reviewed articles included those utilising the traditional teleconsultation methods to web-based and smart phone applications, the review provided the functionalities that could be included in the technology intervention for cancer care support. The reviewed article also indicated that the cancer stress affects not only the patients but also the family members and the carers. Thus, future studies need to provide support for them as well.

Although the effectiveness of the technology mediated support for cancer consumers was conducted, meta-analysis is not conducted in this study as the outcome measures are different.

Implications of the study

Results from this systematic literature review would be beneficial for the creation of technology-mediated support for the CALD cancer consumers as this study systematically reviewed articles presenting the results of clinical trials and empirical studies that provided outcome measures based on the technology mediated support. Thus, the results indicate the functionalities that will need to be included for the cancer consumers from the diverse backgrounds. As information systems are to address real-world problems and phenomena, understanding the system characteristics and task support needed for the cancer consumers will provide valuable information for the system designers and researchers. Thus, this study will support the implementation and translational research in cancer care. Having the necessary technology support for

cancer consumers of CALD communities will provide inclusivity to minority or disadvantaged communities, promoting their healthcare, improving health literacy, reducing the health disparity and promote consumer centric care, thus, there is a practical application for cancer care and impact to healthcare. Moreover, the results will have the practical implications for the healthcare policy for the support of culturally diverse cancer consumers.

Conclusion

Teleconsultation and technology-based interventions such as websites and mobile apps have enormous advantages in improving cancer management. The finding in this review has shown significant achievement in culturally and linguistically diverse cancer patients with such intervention. Pain management, knowledge of cancer, psychological and physical wellbeing, social and spiritual support, health-related quality of life (HRQoL), self-efficacy, and supportive care needs are the intervention features delivered to the referred underserved cancer survivors. The evidence showed that telephone, websites, and mobile applications can greatly improve cancer management of culturally and linguistically diverse cancer survivors. Based on the results, we proposed to healthcare authorities to consider the advantages of telephone ad technology- based intervention when developing policies and guidelines. This will enable many the potential that can connect the disparity gap in cancer management among underserved communities. Future studies might consider other underserved cancer survivors with different forms of difficulties such as disabled communities, remote communities, and geriatric cohorts in the study, as the solution of the technology-oriented intervention has many benefits. The future studies could also include cost and time analysis derived from the assistive technologies used.

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