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eHealth literacy and cancer screening attitudes among chronic patients

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The present study attempts to uncover eHealth literacy and cancer screening attitudes among chronic patients receiving inpatient treatment. We collected the data of this cross-sectional study from 300 chronic patients face-to-face between August 1 and November 30, 2023. Participants were administered a demographic information form, the e-Health Literacy Scale, and the Attitude Scale for Cancer Screening. We analyzed the data using independent samples t-test, one-way analysis of variance, and simple linear regression analysis. Our findings showed that only one-fifth of participants were knowledgeable about cancer screening programs. The most prevalent facilitating and hindering factors of getting screened for cancer were found to be professional healthcare guidance and lack of knowledge, respectively. Participants had a mean score of 14.17 ± 10.29 on the e-Health Literacy Scale and 89.66 ± 20.86 on the Attitude Scale for Cancer Screening. Moreover, we found that the greater the eHealth literacy, the more positive participants' attitudes toward cancer screening. Finally, 6.4% of the variance in the cancer screening attitudes was explained by eHealth literacy ($p < 0.05$). Insufficient eHealth literacy and cancer screening attitudes among chronic patients, particularly those receiving inpatient treatment, are likely to lead patients to remain incognizant of their elevated risks and unable to cooperate with their physicians. Our findings imply designing multidisciplinary initiatives to boost e-health literacy among chronic patients.

Keywords Hospitals, Chronic disease, Health literacy, Computer literacy, Early Cancer diagnosis

The Centers for Disease Control and Prevention (CDC) describes chronic diseases as "conditions that last 1 year or more and require ongoing medical attention or limit activities of daily living or both." Chronic diseases, such as cardiac disease, cancer, and diabetes, are leading causes of mortality and disability worldwide[1]. Besides, the prevalence of chronic diseases and multimorbidity is on the rise[2,3]. Behavioral and nutritional changes, including increased smoking and diets high in fat and sugar, have contributed to a global increase in the incidence of obesity, metabolic diseases, and cancer[4].

Chronic conditions continue to be a significant public health problem in Türkiye. Chronic diseases account for 68.9% of all deaths in Türkiye, with circulatory system diseases ranking first among causes of mortality at 33.4%[5]. Among individuals aged 15 years and older, the prevalence of having a single chronic condition is 22%, while the rate for those with two or more chronic diseases is 13.7%[6]. In addition, the prevalence of risk factors leading to chronic diseases remains high. In the general population, the prevalence rates are reported as 32.8% for hypertension, 30.5% for smoking, and 33.3% for obesity[7].

Cancer and other chronic diseases share common risk factors such as aging and unhealthy lifestyle habits—including smoking, poor diet, physical inactivity, obesity, and alcohol use[8,9]. Certain non-cancer chronic conditions may also predispose individuals to cancer, independent of these shared risk factors. A prospective cohort study in Taiwan with 405,878 patients followed up over an average of 8.7 years reported that chronic diseases contributed to more than one-fifth (20.5%) of cancer incidence and more than one-third (38.9%) of cancer-related deaths[9]. Diabetes is also consistently associated with a moderate increase in cancer risk[10] and recognized as a risk factor for several solid malignancies, including pancreatic, liver, colorectal, breast, and endometrial cancers[11]. Patients with cardiovascular diseases are also at higher risk for multiple cancer subtypes and cancer-related mortality[12]. A previous study demonstrated that patients with hypertension had a 1.6-fold increased risk of renal cell carcinoma[13]. It was also shown that hypertension is associated with an 11% increased risk of colorectal cancer[14] and a 7% increased risk of breast cancer[14,15]. Furthermore, a plethora of studies linked

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lung diseases (e.g., chronic obstructive pulmonary disease (COPD), chronic bronchitis, and emphysema) with an elevated risk of lung cancer[16].

Cancers represent a significant public health concern with a considerable economic burden in the 21 st century. They are responsible for nearly one in six deaths from non-communicable diseases (NCDs; 16.8%) and one in four deaths (22.8%) globally. They are also a significant contributor to premature mortality from NCDs, accounting for approximately three out of every 10 global deaths among individuals aged 30–69 (30.3% of the total) and stand among the three primary causes of death within this age group in 177 out of 183 countries[17]. In Türkiye, cancers represent the second leading cause of mortality, accounting for about one-third (29.1%) of preventable deaths[18].

The avoidance of risk factors, coupled with early diagnosis and prompt treatment, is key to the reduction of the global cancer burden[19], leading numerous countries to offer cancer screening programs for the general population[20]. The screening of the general population for solid organ cancers, including breast, colorectal, and cervical cancers, satisfies the criteria for an efficient screening program[21,22]. Nonetheless, current cancer prevention strategies predominantly focus on lifestyle-related risk factors and tend to overlook non-cancer chronic conditions as modifiable contributors to cancer risk[23,24]. In this sense, it was suggested that future cancer prevention frameworks should expand their scope to explicitly address non-cancer chronic diseases as potential targets for intervention[9]. Moreover, the extant literature does not yield a definitive answer as to whether the presence of a chronic disease constitutes an obstacle to screening. Some argue against routine screening in older adults and sick populations as the increased risk of death from other causes (e.g., cardiovascular disease and infection) may limit the benefits of screening[25,26]. On the other hand, it is argued that early detection of cancer should be regarded as a fundamental aspect of standard clinical practice, given its detrimental impact on life expectancy and the elevated prevalence of specific types of cancer among older adults and chronic patients[27,28].

A review of the literature on cancer diagnosis in patients with chronic illnesses reveals a complex interplay between the presence of a chronic disease and cancer progression. While some chronic diseases, including dementia, neurological disorders, pulmonary conditions, cardiovascular disease, and major psychiatric disorders, appear to confer an elevated risk of advanced cancer stage at diagnosis, some others (e.g., hypertension, dyslipidemia, and benign gastrointestinal and musculoskeletal disorders) are linked to a reduced likelihood of advanced stage diagnosis[29].

A growing body of evidence from research on chronic patients' participation in cancer screening programs indicates that those with multiple chronic health problems, particularly those with severe disabilities, are less likely to engage in screening for breast, cervical, and colorectal cancers[30–33]. Moreover, individuals with HIV infection[34], depression[35], obesity[36,37], and chronic renal failure[38] were reported to be less likely to participate in cancer screening. In contrast, individuals with musculoskeletal disorders[39] and chronic liver disease[40] are more likely to undergo cancer screening. Heterogeneous effects were reported among people with diabetes[41,42]. However, a lack of awareness regarding risk factors and screening procedures, apprehension about potential test results, inadequate knowledge about screening, and negative emotional responses represent the primary obstacles to screening in patients with chronic conditions[38].

Health literacy is key to managing chronic conditions and adherence to treatment regimens, as well as adherence to early detection behaviors for cancer[43,44]. Inadequate health literacy is associated with poor comprehension of medical conditions[45], reduced adherence to recommended treatments[46], elevated medical costs[47,48], and a diminished inclination to participate in preventive interventions, including cancer screening programs[49].

Encompassing the capacity to access, comprehend, evaluate, and utilize health information to make well-informed decisions, health literacy has emerged as a pivotal component of health-related intervention and strategy plans in the context of acute and chronic diseases, disadvantaged communities, and the general population[50]. However, despite a plethora of evidence that individuals with chronic conditions are among the groups that require greater access to health information[51], the majority lack the capacity to accurately define and utilize it[52]. Furthermore, the prevalence of chronic diseases increases with age[53] and is negatively associated with poor socioeconomic status[54]. Individuals with a chronic disease also demonstrate lower levels of computer and health literacy[55].

The term eHealth literacy was first proposed by Norman and Skinner in 2006. The concept refers to "the ability to search, find, understand, and evaluate health information from electronic sources and to apply the acquired knowledge to health problems"[56]. As a relatively novel concept, it has only recently begun to gain traction in academic discourse[57]. Norman and Skinner revised the definition of the concept by modifying the US Institute of Medicine (IOM) definition (2004). eHealth literacy is a multidimensional construct comprising three interrelated dimensions: the individual (the capacity to process information and manage one's own health), the system (access to functional digital services and their adaptability to individual needs), and the interaction between them (the ability to actively engage with digital services, perceive them as safe and in control, and feel motivated to engage with digital services)[58,59]. Conceptualizing eHealth literacy as an integration of multiple literacies, Norman and Skinner proposed that this construct comprises six core competencies rooted in the principles of social cognitive theory and self-efficacy theory[60]: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy[56,61]. Following the development of the concept, they operationalized eHealth literacy through the creation of the eHealth Literacy Scale (eHEALS)[56]. The scale underwent extensive validation and reliability testing across multiple languages and was widely employed in research across countries[62].

In this digital age, people are increasingly turning to the internet as a source of health information. This shift provides new avenues for managing chronic diseases and facilitates continuous, two-way communication between healthcare professionals and patients[63,64]. In Türkiye, the rate of households with internet access is high, at 95.5%[65], and internet usage for the purpose of accessing health-related information is pervasive[66]. Nevertheless,

internet usage among individuals aged 55–74 years remains relatively low in Türkiye. A slightly more than half of men (57%) and only 41% of women in this age group report internet usage. In contrast, the corresponding figures are significantly higher in several European countries: 88% of men and 84% of women in Germany; 83% of men and 85% of women in France; and an equal 96% for both men and women in Switzerland[67].

Prior research among individuals with a chronic condition demonstrated that advanced eHealth literacy is associated with enhanced access to health information, self-management of care, health-promoting behaviors, and reduced mortality[68,69]. Moreover, eHealth can assist patients in attaining their health objectives and foster a sense of personal responsibility for their well-being[70]. Individuals with superior eHealth literacy are better able to obtain accurate health information, assess the quality of that information, demonstrate enhanced self-management capacity, establish more effective connections with healthcare practitioners, and participate in treatment and nursing decision-making processes[71,72]. Community members must participate in screening programs to observe the benefits of community-based cancer screening programs, such as reducing cancer-specific mortality rate, cancer-specific fatality rate, and cancer-specific complication/sequelae rate, preventing recurrence and metastasis, and increasing patients' quality of life[73]. Studies with a foci of the general population showed that that contributing to cancer awareness and knowledge is a valuable strategy for promoting participation in cancer screening[74–76]. Moreover, it is essential to accurately measure the attitudes of individuals getting or not getting screened to reliably predict their behaviors[77].

For example, individuals with insufficient health literacy were found to demonstrate low rates of participation in various cancer screening tests, including mammography, fecal occult blood tests, colonoscopies, and Pap smears[78–83]. Yet, the existing literature lacks research that addresses eHealth literacy and cancer screening attitudes in patients with chronic conditions. It should also be noted that individuals with a chronic disease must navigate the complexities of their processes while also facing an elevated risk of developing certain types of cancer. Moreover, screening for certain cancer types may not be advised in the context of specific chronic diseases. In this complex situation, one prerequisite for chronic patients to cooperate with their physicians is to have a high level of health/eHealth literacy, even though disabilities or other handicaps can make the use of technology difficult (Watkins & Xie, 2014). Although evidence supporting the link between cancer and chronic diseases is steadily growing, there is still no standardized practice for routinely conducting cancer screenings among individuals with chronic conditions within current healthcare systems. In such cases, the decision to screen often depends on factors such as physician preference, the type and prognosis of the chronic disease, and patient preferences.

Overall, the principal aim of this study is to identify factors that may influence cancer screening behaviors among individuals with chronic diseases. The secondary aim of this study is to explore the cancer screening behaviors and eHealth literacy levels of individuals with chronic diseases from diverse backgrounds and to examine the effect of their eHealth literacy on their cancer screening attitudes.

Materials and methods

This cross-sectional study included 300 individuals receiving inpatient treatment in the internal medicine, pulmonology, cardiovascular surgery, and neurology wards in the single training and research hospital of a Central Anatolian province with a population of 350,000. Participants aged 30 years and older were diagnosed with a chronic disease at least six months ago, were conscious, had the cognitive ability to respond to survey questions, could communicate verbally, and agreed to participate in the research voluntarily.

We collected the data face-to-face using the eHealth Literacy Scale (eHEALS) and the Attitude Scale for Cancer Screening (ASCS) in the mentioned wards between August 1 and November 30, 2023. Given that the recommended age range for cancer screening programs is 30–70 years, the validity and reliability of the ASCS were tested with participants in this age group. Therefore, the ASCS was administered only to patients aged 30 to 70 years ($n = 163$). In contrast, the eHEALS was administered to all individuals who consented to participate and satisfied the inclusion criteria ($n = 300$). To facilitate data analysis using two separate scales, we set 30 years as the lower age limit for our sample. During data collection, only five patients under the age of 30 were admitted to the wards, which further supported our age restriction. We did not use a predetermined sampling method; instead, we administered the questionnaire to all eligible and voluntary patients hospitalized in the relevant wards during the data collection period. We tracked new admissions daily. In total, 320 patients were admitted to the clinic during the study period, of whom 20 were excluded for not meeting the inclusion criteria.

We performed a pilot study with the data of ten patients prior to the main study and finalized the questionnaire form. The data of these ten pilot study participants were not included in the main analyses. Besides, we calculated the statistical power of the study using the GPower-3.1.9.4 program at a 95% confidence interval (CI). The relationship between cancer screening attitudes and eHealth literacy was assumed to be 0.259. Accordingly, we calculated the power as 0.99 for a sample size of 300 and 0.95 for a sample size of 163, with an alpha level of 0.05.

Data collection tools

We collected the data using a demographic information form, designed to elicit participants' and disease-related characteristics besides their sociodemographic information, the eHEALS, and the ASCS.

Demographic information form

Based on a review of relevant literature (Aytepe & Donmez, 2022; Kurtoğlu et al., 2022), the form used in our study was developed for this study. We generated a 17-question demographic information form to elicit participants' sociodemographic characteristics (e.g., age, gender, educational attainment, employment, marital status, smoking, and internet usage), clinical features related to their chronic disease, and cancer screening practices.

eHealth literacy scale

The eHEALS was designed by Norman and Skinner (2006) and adapted into Turkish by[84]. The scale consists of 5-point Likert-type 2 items about internet usage (1 = Not useful/important at all, 5 = Very useful/important) and 8 items about internet attitudes (1 = Strongly disagree, 5 = Strongly agree). The items about internet usage are not considered in scoring, so one may get the lowest and highest total scores as 8 and 40, respectively. Higher eHEALS scores indicate greater eHealth literacy[56]. In this study, we calculated the internal consistency of the total eHEALS score to be 0.99.

Attitude scale for cancer screening

Yıldırım Oztürk et al. developed the scale to assess cancer screening attitudes of people aged 30–70 years. Age range was specified as 30–70 since the minimum age requirement for the "National Cancer Screening Program" was 30 (for cervix cancer) and the maximum age requirement was 70 (for colorectal cancer). The five-point Likert-type scale consists of 24 items (1 = Strongly disagree, 5 = Strongly agree). Six items on the scale (items 17, 18, 19, 20, 21, 22, 23, and 24) are reverse-scored. One may obtain the lowest and highest scores as 24 and 120; the higher total scores indicate a positive attitude toward cancer screening. While the authors calculated the internal consistency of the scale to be 0.95 in the original study[85], we found it to be 0.95 in this study.

Ethical considerations

The Research Ethics Committee of Nigde Omer Halisdemir University granted ethical approval to our study (No: 2023/06 dated 04/03/2023), and we obtained written informed consent from all participants. We strictly followed the ethical principles outlined in the Declaration of Helsinki in each research phase.

Data analysis

We analyzed the data using the free trial version of Statistical Package for Social Sciences (SPSS) for Windows 25.0. The data are presented as number (n), percentage (%), mean (*M*), and standard deviation (*SD*). We accepted the data to normally distribute when skewness and kurtosis values fall within ± 2[86]. While adopting parametric tests for normally distributed data, we performed non-parametric tests for the data exhibiting non-normal distribution in sub-groups of participants' sociodemographic characteristics.

While the Independent samples *t*-test and Mann-Whitney *U* test were adopted to make independent pairwise comparisons, we performed a one-way analysis of variance (ANOVA) with post-hoc (Bonferroni) and Kruskal Wallis-H test for multiple independent comparisons. For reliability concerns, we calculated the internal consistency of the participant's scores on both scales. The relationship between eHealth literacy and cancer screening attitudes was uncovered with Persons' correlation analysis, and we ran a simple linear regression analysis to determine if eHealth literacy significantly predicts cancer screening attitudes. We accepted a *p*-value of < 0.05 as statistically significant in all analyses.

Findings

We present the sociodemographic characteristics of 300 participating chronic patients in Table 1. We found the mean age to be 67.99 ± 13.09 years (30–90 years). More than half of the participants (54.3%) were aged 30–70,

Variables	*n*	%
Age (years)		
30–70	163	54.3
71+	137	45.7
Gender		
Female	143	47.7
Male	157	52.3
Educational attainment		
Illiterate	82	27.3
Literate	31	10.3
Primary school	133	44.3
Middle-high school	38	12.7
Higher education	16	5.3
Marital status		
Married	242	80.7
Single	58	19.3
Employment		
Unemployed	74	24.7
Housewife	94	31.3
Retired	92	30.7
Employed	40	13.3

Table 1. Participants' sociodemographic characteristics. *Analysis of only "yes" responses. **n< 300

52.3% were males, Of them, 44.3% had only a primary school education, and more than one in four (27.3%) were illiterate. The majority were married (80.7%), and 31.3% of female participants identified as housewives. Additionally, over half of them (56%) did not have a regular source of income (Table 1).

The majority (90%) of participants were non-smokers. Hypertension (64.0%), diabetes (58.3%), and chronic obstructive pulmonary disease (COPD) (30.0%) were the most prevalent diseases among participants. More than half of them (65.3%) reported two or more chronic conditions. We discovered that 66.3% visited their physicians on a regular basis, 34.3% adhered to a dietary regimen, and 87.7% had regular medication adherence. Only 20.0% were knowledgeable about cancer screening programs, particularly breast cancer (50.0%). A total of 36.3% of the participants had previously undergone cancer screening, with the most commonly performed screening being mammography (50.0%). The top three factors that facilitated cancer screening among participants were guidance from a healthcare worker, family encouragement, and the presence of symptoms. In contrast, the primary barriers to screening were the absence of complaints, lack of knowledge, and advanced age (Table 2).

We determined that 71.3% lacked the ability to utilize the internet. Of those having the ability to use the internet, 69.8% did so for health-related purposes. Facebook was the most frequently utilized platform for searching health-related content (45.0%). Finally, 7.9% of internet users had previously acquired some information about cancer screening programs online (Table 3).

Participants' mean scores on the scales are demonstrated in Table 4.

Our findings showed significant differences between participants' eHEALS scores and their age, educational attainment, employment, and smoking ($p < 0.05$). In other words, those aged 71 and younger, those with a higher education diploma, those employed, and smokers had significantly higher eHEALS scores. Yet, patients with COPD and hypertension scored significantly lower on the eHEALS ($p < 0.05$).

On the other hand, we administered the ASCS only to participants aged 30–70 years ($n = 163$) and found no significant difference between their sociodemographic characteristics and ASCS scores ($p > 0.05$). Nevertheless, participants knowledgeable about cancer screening programs and those getting screened for cancer before had significantly higher ASCS scores ($p < 0.05$).

The results also yielded that those with higher internet usage ability scored significantly higher on the eHEALS and ASCS ($p < 0.05$). Furthermore, participants with health-related internet usage and previous attempts to learn about cancer screening programs online had significantly higher scores on the eHEALS ($p < 0.05$; Table 5).

Participants with poor eHealth literacy ($M = 86.53$, $SD = 20.67$) had significantly lower cancer screening attitude scores than those with sufficient eHealth literacy ($M = 96.70$, $SD = 19.71$), $t_{(161)} = -2.933$ ($p < 0.05$). Besides, we found a weak positive relationship between participants' eHealth literacy and cancer screening attitudes ($r = 2.59$, $p < 0.01$).

The regression analysis showed that eHealth literacy significantly predicted cancer screening attitudes ($p < 0.05$; Table 6). In this regard, 6.4% of the change in participants' cancer screening attitude scores was explained by their eHealth literacy scores (Adjusted $R^2 = 0.064$). Therefore, it can be asserted that increased eHealth literacy has a positive effect on one's cancer screening attitudes.

Discussion

This study was designed to examine cancer screening behaviors and eHealth literacy levels among patients with a chronic disease from diverse backgrounds, with a particular focus on the influence of eHealth literacy on cancer screening attitudes. In our study, we focused on a cohort characterized by various disadvantages, including poor education, high comorbidity, the presence of chronic diseases requiring inpatient care, advanced age, and low income.

Over the past two centuries, the average life expectancy of the global population has increased exponentially, largely attributable to advancements in modern medicine and effective public health initiatives. Yet, the increase in life expectancy has also resulted in a concomitant rise in the prevalence of chronic diseases, including cancer[87]. The term chronic disease is used to describe conditions that necessitate adherence to a treatment plan for efficient control. Even though the relevant literature reports varying adherence rates among those with a chronic disease[88–92], we discovered that 62.8% of our patients had a strict adherence to treatment (i.e., dietary regimen, regular visits to a healthcare professional, and regular medication).

A substantial body of literature exists on the determinants of cancer screening behaviors[93–95]. Nevertheless, despite the rising prevalence of chronic disease, there remain gaps in our understanding of the impact these conditions have on cancer screening behaviors among patients and medical practitioners[4,29,96,97]. The prevailing approach in clinical practice guidelines, typically centered on a single chronic disease, has limitations in fully addressing the needs of patients with multimorbidity[98]. Therefore, a personalized approach that considers the specific conditions and preferences of individuals is essential for the efficient management of chronic diseases[99,100]. Designing and implementing standardized protocols for the management of chronic diseases is anticipated to be a protracted process. Consequently, there may be a degree of variability in the decision to undertake cancer screening in patients with chronic diseases, contingent on the individual physician's perspective. For this very reason, it seems critical to understand the roles of e/Health literacy and cancer screening attitudes, particularly among those with a chronic disease, in collaborating with their physician regarding cancer screening.

As part of the cancer screening program in Türkiye, individuals are recommended to participate in the following practices: annual clinical breast examination for breast cancer, biennial mammography for women aged 40–69, a quinquennial HPV-DNA test for women aged 30–65 for cervical cancer, a biennial fecal occult blood test, along with a decennial colonoscopy, for both men and women aged 50–70 for colorectal cancer[101]. Nevertheless, the general population exhibits a relatively low level of participation in cancer screening in Türkiye in comparison to other countries. In the United States, for example, the rate of mammography screening among women aged 50–74 years is 78.0%[102], the rate of Pap smear among women aged 45–64 years is 73.5%[103], and the rate of colorectal cancer screening among people aged 50–75 years is 74.0%[104]. However, the most recent

Variables	*n*	%
Smoking		
Yes	30	10.0
No	170	56.7
Quit	100	33.3
Cardiovascular diseases		
Yes	59	19.7
No	241	80.3
Heart failure		
Yes	40	13.3
No	260	86.7
Diabetes		
Yes	175	58.3
No	125	41.7
Hypertension		
Yes	192	64.0
No	108	36.0
COPD		
Yes	90	30.0
No	210	70.0
Asthma		
Yes	48	16.0
No	252	84.0
Stroke		
Yes	11	3.7
No	289	96.3
Comorbidity		
Yes	196	65.3
No	104	34.7
Regular physician visits		
Yes	199	66.3
No	60	20.0
Partly	41	13.7
Adherence to a dietary regimen		
Yes	103	34.3
No	131	43.7
Partly	66	22.0
Adherence to regular medication		
Yes	263	87.7
No	23	7.7
Partly	14	4.7
Knowledge about cancer screening programs		
Yes	60	20.0
No	240	80.0
Skin cancer*		
Yes	2	3.3
No	58	96.7
Uterine cancer*		
Yes	19	31.7
No	41	68.3
Breast cancer*		
Yes	30	50.0
No	30	50.0
Prostate cancer *		
Yes	4	6.6
No	56	93.4
Colon cancer *		
Continued		

Variables	*n*	%
Yes	15	25.0
No	45	75.0
Previous cancer screening		
Yes	109	36.3
No	191	63.7
Biopsy*		
Yes	26	23.8
No	83	76.2
Mammography*		
Yes	45	41.3
No	64	58.7
Pap smear test*		
Yes	29	26.6
No	80	90.3
Endoscopy*		
Yes	10	9.2
No	99	90.8
Colonoscopy*		
Yes	19	17.4
No	90	82.6
Facilitators of getting screened**		
Guidance from a healthcare professional	67	61.5
Family encouragement	14	12.8
Disease symptoms	14	12.8
For awareness purposes	4	3.7
Genetic factors	10	9.2
Barriers to getting screened**		
Transportation issues	11	7.5
Fear of getting cancer	17	11.6
Lack of knowledge	24	16.4
Living alone	3	2.1
Advanced age	20	13.7
Lack of time	12	8.2
No symptoms/complaints	57	39.0
Deeming results unreliable	2	1.4

Table 2. Participants' health characteristics. *Analysis of only "yes" responses. **$n < 300$

data in Türkiye demonstrates these rates to be 7.3%, 7.2%, and 2.4%, respectively[18]. From this perspective, one critical factor in increasing early detection rates and reducing mortality may be disseminating cancer-related information to the general population. Along with the trend of health-related internet usage, the Turkish Ministry of Health, as well as other non-profit organizations, engage in offering an increasing number of online cancer information resources[105,106].

In contrast to the general population, the risk of cancer is typically elevated in individuals with a chronic disease. As an illustration, the likelihood of developing cancer increases in patients with inflammatory rheumatic disorders, chronic kidney failure, Type 2 diabetes, and COPD[107,108]. Despite the elevated risk of cancer, preexisting chronic conditions may impede patients' engagement in cancer screening, prompt them to seek assistance for new and/or evolving symptoms, and influence clinicians' decisions concerning the utilization of diagnostic procedures[29]. Some chronic ailments that necessitate regular follow-ups potentially also facilitate earlier diagnostic opportunities[109]. In all cases, patients' profound awareness of their disease is pivotal in fostering a collaborative relationship with their physician.

Although we did not discover a significant difference in cancer screening attitudes between those with and without comorbidity, a previous study demonstrated that the presence of multiple chronic conditions has a deleterious impact on female patients' engagement in mammography[110]. A high comorbidity burden was linked with an increased likelihood of colorectal cancer screening but a decreased likelihood of breast and cervical cancer screening (Kurani et al., 2020). In a separate investigation of individuals with chronic kidney disease (CKD), participants identified several factors that influenced their preferences regarding cancer screening, including seeking guidance from their attending clinician or transplant team, comprehending pre-and post-test results, and being able to access information tailored to patients with CKD regarding cancer screening[108].

Variables	*n*	%
Degree of internet usage skills		
0 (Never)	214	71.3
1–5	41	13.7
6–10	45	15.0
Health-related internet usage*		
Yes	60	69.8
No	26	30.2
The most frequently accessed platform by health-related internet users**		
Facebook	27	45.0
Instagram	15	25.0
Twitter	2	3.3
YouTube	7	11.7
Blogs	2	3.3
Others	7	11.7
Previous attempts to learn about cancer screening programs online		
Yes	6	7.9
No	80	92.1

Table 3. Participants' internet usage characteristics. *Analysis of only "yes" responses. **$n < 300$

Scales	*n*	Min.	Max.	M	SD
eHEALS	300	8	40	14.17	10.29
ASCS	163	24	120	89.66	20.86

Table 4. Participants' mean scores on the scales.

Our findings indicated moderately favorable cancer screening attitudes among participants and that about one in three had undergone a cancer screening test, with nearly half of this group having received mammography. While cancer screenings are free of charge and widely accessible at the primary care level in Türkiye, participation rates in screenings remain significantly below the desired level[111]. Hence, it seems critical to understand the factors that facilitate or hinder participation in cancer screening. In this study, we identified guidance from a healthcare professional as the most significant facilitating factor in getting screened for cancer. Similarly, prior research on breast and colorectal cancer screening indicated that a physician's recommendation is robustly correlated with the decision to undergo a cancer screening[112–117]. It was postulated that physicians' familiarity with their patients' concerns and expectations would heighten their propensity to recommend screening, particularly in countries lacking standard protocols. Furthermore, a close and long-standing patient-physician relationship could facilitate a more conducive atmosphere for deliberating the merits and disadvantages of screening, consequently reducing the number of redundant tests (Bringedal et al., 2019). A previous investigation into the experiences of individuals living with chronic liver disease revealed an intriguing correlation between a sense of inclusion in the decision-making process regarding one's condition and higher rates of receiving cancer screening (Li et al., 2017). From this vantage point, it is crucial for patients to possess elevated e/Health literacy, thereby fostering heightened awareness of their concerns and expectations, which, in turn, facilitates more efficacious communication with the physician. As other factors facilitating cancer screening included family guidance and the absence of symptoms, awareness training on cancer screening could be recommended to target families. In addition, it is important to present cancer symptoms in a simple, understandable manner, particularly for older individuals. Providing services that enhance cancer screening accessibility for older adults is also essential. For instance, older adults living alone could benefit from tailored services, such as companion support, transportation assistance, and mobile cancer screening units.

In our study, one-third of participants indicated that the absence of any symptoms/complaints might hinder undergoing cancer screening. A similar study examining attitudes toward mammography revealed that 24.8% of women reported that the absence of any symptoms constituted a barrier to receiving screening[112]. In this study, the mean cancer screening attitude score was 89.66 ± 20.86. In a series of studies conducted with disparate populations, the attitude scores pertaining to cancer screening exhibited consistency[118–121], with positive correlations observed with prior cancer-related knowledge and getting screened before. Additional barriers to cancer screening included insufficient knowledge and advanced age. Therefore, it is essential to expand awareness programs starting at the primary care level and ensure that age and age-related factors are highlighted in these programs.

Our findings showed that while participants with higher levels of education exhibited more favorable attitudes toward cancer screening, their ASCS scores did not significantly differ by their sociodemographic characteristics. Prior research indicated a positive correlation between educational attainment and screening

Variables	*n*		eHEALS		t/F/χ2	*p*	ASCS		t/F/χ2	*p*
	Female	Male	M	SD			M	SD		
Age (years)										
30–70	72	91	17.56	11.90	6.676	0.000	89.65	20.86	–	
71+	71	66	10.12	5.82			–	–		
Gender										
Female	143	–	13.32	9.57	−1.367	0.173	92.00	19.91	1.278	0.203
Male	–	157	14.94	10.88			87.80	21.51		
Educational attainment										
Illiterate (1)	71	11	9.02	3.65	27.581	0.000*	89.52	22.33	3.259	0.516
Literate (2)	16	15	12.52	7.98			82.66	17.63		
Primary school (3)	42	91	13.41	9.65			89.55	18.77		
Middle/high school (4)	7	31	23.58	12.22			91.75	23.44		
Higher education (5)	7	9	27.69	12.23			92.27	26.57		
Bonferroni			1 < 3, 4, 5; 2, 3 < 4, 5							
Marital status										
Married	105	137	14.41	10.56	0.926	0.357	89.23	21.17	−0.684	0.495
Single	38	20	13.14	9.12			92.65	18.69		
Employment										
Unemployed (1)	42	32	11.03	6.56	12.516	0.000*	88.00	21.74	1.481	0.687
Housewife (2)	94	–	12.60	8.71			91.08	20.00		
Retired (3)	8	84	14.82	10.79			89.95	22.93		
Employed (4)	5	35	22.18	13.70			87.75	19.13		
Bonferroni			1, 2, 3 < 4							
Smoking										
Yes (1)	6	24	20.50	13.57	8.697	0.000*	86.17	21.56	0.332	0.847
No (2)	121	49	12.51	8.72			80.94	23.30		
Quit (3)	16	84	15.08	10.88			87.61	20.29		
Bonferroni			2, 3 < 1							
Cardiovascular disease										
Yes	32	27	13.14	9.44	−0.858	0.391	81.12	23.95	−0.986	0.325
No	111	130	14.42	10.49			84.32	21.91		
Hearth failure										
Yes	19	21	12.38	8.69	−1.360	0.179	80.92	24.03	−1.8646	0.194
No	124	136	14.44	10.51			90.47	20.44		
Diabetes										
Yes	96	79	14.47	10.47	0.601	0.549	84.61	20.62	0.843	0.400
No	47	78	13.74	10.07			82.40	24.53		
Hypertension										
Yes	114	78	13.15	9.51	−2.195	0.029*	82.70	22.96	−1.018	0.310
No	29	79	15.98	11.38			85.44	21.13		
COPD										
Yes	28	62	11.86	8.48	−2.832	0.005*	84.01	21.59	0.165	0.869
No	115	95	15.16	10.85			83.55	22.68		
Asthma										
Yes	28	20	11.90	8.28	−1.975	0.052	79.46	23.01	−1.397	0.167
No	115	137	14.60	10.59			84.49	22.14		
Stroke										
Yes	4	7	14.00	11.06	−0.055	0.956	86.00	19.65	0.350	0.727
No	139	150	14.17	10.28			83.60	22.44		
Comorbidity										
Yes	108	88	12.32	8.63	−4.391	0.000*	82.41	22.85	−1.364	0.174
No	35	69	17.64	12.16			86.16	21.18		
Regular physician visits										
Yes	100	99	13.71	9.89	1.048	0.352	84.66	22.85	1.733	0.180
No	28	32	15.88	11.61			81.07	21.14		
Partly	15	26	13.88	10.15			82.78	21.54		

Continued

Variables	*n*		eHEALS		t/F/χ2	*p*	ASCS		t/F/χ2	*p*
	Female	Male	M	SD			M	SD		
Adherence to a dietary regimen										
Yes	50	53	14.41	10.55	1.269	0.283	80.40	21.75	1.486	0.476
No	55	76	14.85	10.91			85.78	23.40		
Partly	38	28	12.42	8.40			84.67	20.68		
Adherence to regular medication										
Yes	130	133	14.05	10.24	1.096	0.336	84.38	22.52	1.992	0.369
No	5	18	16.83	10.87			79.74	21.30		
Partly	8	6	12.00	10.29			77.14	19.70		
Knowledge about cancer screening programs										
Yes	40	20	16.00	11.61	1.407	0.163	95.83	16.46	3.952	0.023*
No	103	137	13.71	9.91			87.44	21.86		
Previous cancer screening										
Yes	66	43	13.89	10.28	−0.351	0.726	98.06	17.16	5.033	0.000*
No	77	114	14.32	10.32			82.66	21.16		
Biopsy										
Yes	7	19	9.85	6.52	−3.314	0.002*	93.29	23.24	1067.500	0.346
No	136	138	14.58	10.50			89.23	20.61		
Mammography										
Yes	45	–	15.31	10.92	0.809	0.419	100.81	10.21	3.488	0.000*
No	100	155	13.96	10.19			86.93	21.89		
Pap smear test										
Yes	29	–	15.90	11.21	0.952	0.342	95.59	20.72	1209.500	0.095
No	116	155	13.98	10.19			88.73	22.35		
Endoscopy										
Yes	0	10	17.00	11.75	0.885	0.377	112.83	8.35	125.500	0.002*
No	143	147	14.07	10.25			88.77	20.69		
Colonoscopy										
Yes	4	15	13.84	10.63	−0.142	0.887	101.21	16.95	523.500	0.095*
No	139	142	14.19	10.29			82.50	22.17		
Degree of internet usage skills										
0-Never (1)	107	107	8.64	2.78	444.653	0.000*	85.82	21.50	4.129	0.018*
1–5 (2)	20	21	24.37	7.73			91.13	17.53		
6–10 (3)	16	29	31.13	9.41			96.52	20.06		
Bonferroni			1 < 2, 3; 2 < 3				1 < 3			
Health-related internet usage										
Yes	20	40	28.83	9.41	14.246	0.000*	93.09	19.21	1.445	0.150
No	123	117	10.50	6.57			88.04	21.49		
Previous attempts to learn about cancer screening programs online										
Yes	2	4	30.83	8.35	4.112	0.000*	98.80	13.44	311.000	0.419
No	141	153	13.83	10.06			81.47	22.38		

Table 5. Participants' scores by their sociodemographic Characteristics, clinical Features, and internet usage. *$p < 0.05$; *t*: independent samples *t*-test; *U*: Mann-Whitney *U* test; χ^2: Kruskal Wallis-H test; *F*: one-way ANOVA.

Dependent Variable	Independent Variable	ß	t	*p*	F	Model (*p*)	Adjusted R^2
Cancer screening attitudes	Constant	75.716	35.656	0.000*	21.504	0.000*	0.064
	eHealth literacy	0.563	4.637	0.000*			

Table 6. Impact of eHealth literacy on Cancer screening attitudes. *$p < 0.05$.

behaviors and attitudes[122,123]. Besides, a review of the literature on mammography revealed that although a lack of health education and poor educational attainment[124,125] may be risk factors for non-participation in screening programs, high educational levels and prior knowledge about cancer screening are strongly associated with higher participation in these programs[126]. The present study demonstrated that participants having received mammography adopted more favorable attitudes regarding cancer screening. As breast cancer is the most prevalent type among women, implementation of intensified awareness programs within the broader social context and across healthcare institutions may have resulted in a positive attitudinal shift among women toward mammography.

The ability to utilize the internet is key to developing eHealth literacy. It should also be noted that the utility of internet resources is contingent upon the user's possession of sufficient eHealth literacy[127]. Despite evidence that eHealth-based interventions for chronic diseases have yielded positive outcomes in Türkiye with increased access to the internet[128–131], our participants exhibited limited proficiency in internet usage skills. In fact, nearly three out of four participants had no access to the internet. This result may stem from the participants' significant exposure to disadvantaged sociodemographic characteristics (e.g., advanced age, low income, and poor education). In a previous eHealth literacy study, almost half (47.0%) of chronic disease patients reported using the internet[127]. Seven out of every 10 participants with access to the internet utilized it to acquire health-related information, which overlaps with a previous study reporting that 72% of American adult internet users searched for health information online[132]. Our analysis also yielded that participants with higher degrees of internet usage skills significantly scored higher in the eHEALS and ASCS.

The mean eHealth literacy score of our chronic patients (M = 14.17) was relatively lower than those reported in research in Türkiye[133,134] and other countries[53,127,135,136], which may be since the majority of our sample were older adults. Consistent with our findings, a previous study showed that older adults, particularly those aged 75 years and older, lag behind younger individuals in adopting digital technologies[137]. Another study found that only 17% of adults aged 60 years and older used the internet and that eHealth literacy was negatively correlated with age[138]. In our study, more than one in four participants were illiterate, which likely contributed to their limited internet usage, particularly for health purposes. Therefore, it is crucial to consider initiatives designed to enhance internet usage for health purposes, particularly for older adults with low educational levels and illiteracy. For example, activating voice command features for illiterate individuals and delivering health-related information through videos could prove valuable. Furthermore, given that individuals without traditional literacy often rely on audiovisual content and assisted methods to access digital health information, their eHealth literacy experience may differ from that of literate individuals. Moreover, given the relatively high frequency of illiterate participants in our sample, the findings for this subgroup may not be generalizable to the general population. We recommend that future studies develop and validate multimodal, supported eHealth literacy measurement tools tailored to diverse literacy levels. In this study, over half of our participants lacked a steady income, which may have adversely affected both their internet usage and eHealth literacy. It may be advisable for governments to offer subsidized or free internet access (e.g., Wi-Fi or devices), particularly for low-income older adults. In our study, individuals with two or more chronic conditions also exhibited lower eHealth literacy scores compared to those with only one chronic condition. Similarly, a study conducted on comorbidity also found that individuals with multiple chronic conditions had lower eHEALS scores compared to those without comorbidities[139].

As with previous research, we could reveal that younger age groups[140,141], those with higher educational attainment[127,142], and employed participants[127,141] had higher eHEALS scores. However, Xie (2011) recruited a sample of older adults for group sessions to improve their eHealth literacy levels. The intervention led to a significant improvement in their eHealth literacy levels of older participants. Therefore, intervention programs designed to enhance eHealth literacy should be considered for older patients.

Contrary to expectations, smokers had higher eHEALS scores, implying that individuals may sometimes remain unable to transform health-related knowledge about addiction into attitudes and behaviors. Nevertheless, our analysis yielded that participants with greater eHealth literacy had more favorable attitudes toward cancer screening. Similarly, prior research demonstrated that individuals with higher eHealth literacy adopt more desirable knowledge, attitudes, and behaviors with regard to cancer screening[144,145]. Furthermore, eHealth literacy accounted for 6.4% of the variance in cancer screening attitudes.

The novel contribution of our study may be the investigation of eHealth literacy and cancer screening attitudes among a hospitalized chronic patient sample. It must be acknowledged, however, that we carried out the study on patients suffering from specific chronic diseases and hospitalized in specific wards of a single hospital, thereby limiting the generalizability of the data set to all chronic patients. Moreover, as our findings relied on data from hospitalized patients, the results might differ for patients with better disease management and prognosis or those who are treated on an outpatient basis. Therefore, future research should focus on chronic patients of varying prognoses (e.g., those followed up at primary care centers and outpatient clinics). In addition, lower eHealth literacy levels in this study compared to the general population with chronic diseases may be attributed to the rate of relatively older patients in our cohort (45.7% aged 70 years and above). Therefore, future studies should consider sociodemographic factors when designing data collection. A further limitation of this study may be the cross-sectional design of this study, which precludes the drawing of causal inferences regarding the relationships between the study variables. It is recommended that future intervention studies focus on improving eHealth literacy and promoting cancer screening behaviors among individuals with chronic conditions.

Although screening protocols have not yet been fully integrated into healthcare systems and debates around their applicability continue, current evidence highlights an elevated cancer risk among chronic patients. This underscores the need to prioritize this population in cancer screening efforts. In the absence of standardized procedures, however, raising awareness among such patients becomes critical. We carried out this study on a specific cohort of chronic patients, with a particular focus on those receiving inpatient treatment. Despite

their heightened cancer risk, our findings indicated that they exhibited low levels of eHealth literacy and moderate attitudes toward cancer screening. Thus, we hypothesize that poor e-health literacy adversely affects the prognosis of the disease and the length of hospital stay, as it impairs the ability to effectively manage chronic diseases. Particularly in light of the inherent risks associated with chronic conditions, it is imperative to possess a high degree of eHealth literacy to facilitate collaboration with medical professionals.

Despite the pervasiveness of e-Health applications, a significant proportion of participants - approximately 75% - reported lacking the requisite digital skills to utilize these technologies. Fortunately, seven out of ten internet users reported using the internet to access health-related content. Therefore, awareness-raising initiatives for cancer screening programs should target the chronically ill to manage their diseases and associated risks. Hospitalization may be an excellent opportunity to raise awareness and implement a strategy for cancer screening at the earliest clinically possible time among those with chronic diseases. Moreover, chronic patients without internet skills should be recruited for relevant web-oriented training and activities, as increased internet literacy contributes to eHealth literacy.

Overall, the general population in Türkiye seems not to have the desired level of cancer screening attitudes and health literacy, which is more visible among disadvantaged groups, especially chronic patients. By identifying behaviors and attitudes toward cancer screening in a distinct population of chronic patients, the study offers some insights into the facilitators and barriers affecting attitudes and behaviors related to cancer screening. These findings could help to inform the development and implementation of targeted interventions at local, regional, and national levels to improve cancer screening uptake in at risk populations. Healthcare authorities should organize awareness-raising activities to enhance e/Health literacy and positive cancer screening attitudes, particularly among chronic patients, which will also pave the way for chronic patients to cooperate with their own physicians. Considering both facilitators and barriers to cancer among individuals with chronic conditions is likely to enhance the effectiveness of interventions.

Data availability

"The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request".

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References

1. Centers for Disease Control and Prevention. Chronic Diseases. Accessed: Apr. 15, 2025. [Online]. Available: https://www.cdc.gov/chronic-disease/about/index.html
2. Booth, F. W., Chakravarthy, M. V., Gordon, S. E. & Spangenburg, E. E. Waging war on physical inactivity: using modern molecular ammunition against an ancient enemy. *J. Appl. Physiol.* **93** (1), 3–30. https://doi.org/10.1152/JAPPLPHYSIOL.00073.2002 (2002).
3. Fortin, M., Hudon, C., Haggerty, J., Van Den Akker, M. & Almirall, J. Prevalence estimates of multimorbidity: A comparative study of two sources. *BMC Health Serv. Res.* https://doi.org/10.1186/1472-6963-10-111 (2010).
4. Wong, G., Howard, K., Tong, A. & Craig, J. C. Cancer screening in people who have chronic disease: The example of kidney disease. *Semin. Dial.* **24**(1), 72–78. https://doi.org/10.1111/j.1525-139X.2010.00804.x (2011).
5. Institute, T. S. Death and Cause of Death Statistics, 2023. Accessed: Apr. 15, 2025. [Online]. Available: https://data.tuik.gov.tr/Bulten/Index?p=Olum-ve-Olum-Nedeni-Istatistikleri-2023-53709
6. Ünal, B. & Ergör, G. Türkiye non-communicable diseases and risk factors cohort study, Accessed: Apr. 15, 2025. [Online]. (2021). Available: https://www.google.com/search?q=TÜRKİYE+BULAŞICI+OLMAYAN+HASTALIKLAR+VE+RİSK+FAKTÖRLERİ+KOHORT+ÇALIŞMASI&rlz=1C1GCEA_enTR1137TR1137&oq=TÜRKİYE+BULAŞICI+OLMAYAN+HASTALIKLAR+VE+RİSK+FAKTÖRLERİ+KOHORT+ÇALIŞMASI&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIGCAEQRRg80gEKMTQ
7. Organization, W. H. Country Profiles, Turkey. Accessed: Apr. 15, 2025. [Online]. Available: https://data.who.int/countries/792
8. Wilcox, N. S. et al. Cardiovascular disease and cancer: shared risk factors and mechanisms, *Nature Reviews Cardiology*, vol. 21, no. 9. Nature Publishing Group, pp. 617–631, Apr. 10, (2024). https://doi.org/10.1038/s41569-024-01017-x
9. Tu, H. *et al.* Cancer risk associated with chronic diseases and disease markers: Prospective cohort study. *BMJ* **360**, 134 (2018). https://doi.org/10.1136/bmj.k134
10. Schinner, S. Diabetes mellitus, fasting glucose, and risk of cause-specific death. *Yearb. Med.* (2011). https://doi.org/10.1016/s0084-3873(11)00370-1
11. Bjornsdottir, H. H. et al. A national observation study of cancer incidence and mortality risks in type 2 diabetes compared to the background population over time. *Sci. Rep.* https://doi.org/10.1038/S41598-020-73668-Y (2020).
12. Bell, C. F. et al. Risk of cancer after diagnosis of cardiovascular disease. *JACC CardioOncol* **5**(4), 431–440. https://doi.org/10.1016/j.jaccao.2023.01.010 (2023).
13. Corrao, G., Scotti, L., Bagnardi, V. & Sega, R. Hypertension, antihypertensive therapy and Renal-Cell cancer: A Meta-Analysis. *Curr. Drug Saf.* **2** (2), 125–133. https://doi.org/10.2174/157488607780598296 (2008).
14. Seretis, A. et al. Association between blood pressure and risk of cancer development: a systematic review and meta-analysis of observational studies. *Sci. Rep.* https://doi.org/10.1038/s41598-019-45014-4 (2019).
15. Han, H. et al. Hypertension and breast cancer risk: A systematic review and meta-analysis. *Sci. Rep.* https://doi.org/10.1038/srep44877 (2017).
16. Brenner, D. R., McLaughlin, J. R. & Hung, R. J. Previous lung diseases and lung cancer risk: A systematic review and meta-analysis. *PLoS One* https://doi.org/10.1371/journal.pone.0017479 (2011).
17. Bray, F., Laversanne, M., Weiderpass, E. & Soerjomataram, I. The ever-increasing importance of cancer as a leading cause of premature death worldwide, *Cancer*, vol. 127, no. 16, pp. 3029–3030, Aug. (2021). https://doi.org/10.1002/cncr.33587
18. The Ministry of Health of Türkiye. 2022. Accessed: Jun. 09, 2024. [Online]. Health Statistics Yearbook (2022). Available: https://www.saglik.gov.tr/TR-103184/saglik-istatistikleri-yilligi-2022-yayinlanmistir.html
19. Organization, W. H. Cancer, Cancer. Accessed: Jun. 09, 2024. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/cancer
20. Sankaranarayanan, R. Screening for cancer in low- and middle-income countries, *Annals of Global Health*, vol. 80, no. 5. No longer published by Elsevier, pp. 412–417, Sep. 01, (2014). https://doi.org/10.1016/j.aogh.2014.09.014
21. Barratt, A. et al. Users' guides to the medical literature: XVII. How to use guidelines and recommendations about screening. *JAMA* **281**, 2029–2034. https://doi.org/10.1001/jama.281.21.2029 (1999).

22. Andermann, A., Blancquaert, I., Beauchamp, S. & Déry, V. Revisiting Wilson and Jungner in the genomic age: A review of screening criteria over the past 40 years. *Bull. World Health Organ.* **86**, 317–319. https://doi.org/10.2471/BLT.07.050112 (2008).
23. Commission, E. Cancer prevention | Knowledge for policy. Accessed: Apr. 15, 2025. [Online]. Available: https://knowledge4policy.ec.europa.eu/cancer/cancer-prevention-2024_en
24. World Health Organization. Preventing cancer. (2024). https://doi.org/10.1038/442720a
25. Kajbaf, S., Nichol, G. & Zimmerman, D. Cancer screening and life expectancy of Canadian patients with kidney failure. *Nephrol. Dial Transpl.* **17** (10), 1786–1789. https://doi.org/10.1093/ndt/17.10.1786 (2002).
26. Satariano, W. A. & Ragland, D. R. The effect of comorbidity on 3-year survival of women with primary breast cancer. *Ann. Intern. Med.* **120**(2), 104–110. https://doi.org/10.7326/0003-4819-120-2-199401150-00002 (1994).
27. EBPG Expert Group on Renal Transplantation European best practice guidelines for renal transplantation. Section IV: Long-term management of the transplant recipient. IV.7.1 late infections. Pneumocystis carinii pneumonia. *Nephrol. Dial Transpl.* **17 Suppl 4**, 29 (2002). https://pubmed.ncbi.nlm.nih.gov/12091642/ Accessed: Jun. 10, 2024. [Online]. Available: .
28. Boer, R., de Koning, H. J., van Oortmarssen, G. J. & van der Maas, P. J. In search of the best upper age limit for breast cancer screening. *Eur. J. Cancer*. **31** (12), 2040–2043. https://doi.org/10.1016/0959-8049(95)00457-2 (1995).
29. Renzi, C. et al. Comorbid chronic diseases and cancer diagnosis: disease-specific effects and underlying mechanisms, *Nature Reviews Clinical Oncology*, vol. 16, no. 12. Nature Publishing Group, pp. 746–761, Jul. 26, (2019). https://doi.org/10.1038/s41571-019-0249-6
30. Lofters, A. et al. Screening for cervical cancer in women with disability and Multimorbidity: a retrospective cohort study in Ontario, Canada. *C Open.* **2** (4), E240–E247. https://doi.org/10.9778/cmajo.20140003 (2014).
31. McCann, D. G. C. A review of hurricane disaster planning for the elderly. *World Med. Health Policy*. (2011) https://doi.org/10.2202/1948-4682.1144
32. Klabunde, C. N. et al. Influence of age and comorbidity on colorectal Cancer screening in the elderly. *Am. J. Prev. Med.* **51** (3), e67–e75. https://doi.org/10.1016/j.amepre.2016.04.018 (2016).
33. Guilcher, S. J. T. et al. Level of disability, multi-morbidity and breast cancer screening: Does severity matter?. *Prev. Med.* **67**, 193–198. https://doi.org/10.1016/j.ypmed.2014.07.025 (2014).
34. Kendall, C. E. et al. A cross-sectional population-based study of breast cancer screening among women with HIV in Ontario, Canada. *C Open.* **5** (3), E673–E681. https://doi.org/10.9778/cmajo.20170038 (2017).
35. Vigod, S. N., Kurdyak, P. A., Stewart, D. E., Gnam, W. H. & Goering, P. N. Depressive symptoms as a determinant of breast and cervical cancer screening in women: A population-based study in Ontario, Canada. *Arch. Womens. Ment. Health* **14**(2), 159–168. https://doi.org/10.1007/s00737-011-0210-x (2011).
36. Constantinou, P., Dray-Spira, R. & Menvielle, G. Cervical and breast cancer screening participation for women with chronic conditions in France: Results from a national health survey. *BMC Cancer* https://doi.org/10.1186/s12885-016-2295-0 (2016).
37. Martinez-Huedo, M. A. et al. Adherence to breast and cervical cancer screening in Spanish women with diabetes: Associated factors and trend between 2006 and 2010. *Diabetes Metab.* **38**(2), 142–148 (2012). https://doi.org/10.1016/j.diabet.2011.09.007
38. James, L. J. et al. Beliefs and attitudes to bowel cancer screening in patients with CKD: A semistructured interview study. *Clin. J. Am. Soc. Nephrol.* **12** (4), 568–576. (2017).
39. Martín-López, R. et al. Inequalities in uptake of breast cancer screening in Spain: analysis of a cross-sectional National survey. *Public. Health*. **127** (9), 822–827. https://doi.org/10.1016/j.puhe.2013.03.006 (2013).
40. Li, D. J. et al. Physician-Patient communication is associated with hepatocellular carcinoma screening in chronic liver disease patients. *J. Clin. Gastroenterol.* **51** (5), 454–460. https://doi.org/10.1097/MCG.0000000000000747 (2017).
41. McBean, A. M. & Yu, X. The underuse of screening services among elderly women with diabetes. *Diabetes Care*. **30** (6), 1466–1472. https://doi.org/10.2337/dc06-2233 (2007).
42. Zhao, G., Ford, E. S., Ahluwalia, I. B., Li, C. & Mokdad, A. H. Prevalence and trends of receipt of cancer screenings among us women with diagnosed diabetes. *J. Gen. Intern. Med.* **24**(2), 270–275. https://doi.org/10.1007/s11606-008-0858-8 (2009).
43. Song, I. Relationship between health literacy and health-related quality of life in Korean adults with chronic diseases. *PLoS One* 19(4):e0301894 (2024). https://doi.org/10.1371/journal.pone.0301894
44. Baccolini, V. et al. The association between adherence to cancer screening programs and health literacy: A systematic review and meta-analysis, *Preventive Medicine*, vol. 155. Academic Press, p. 106927, Feb. 01, (2022). https://doi.org/10.1016/j.ypmed.2021.106927
45. Gazmararian, J. A., Williams, M. V., Peel, J. & Baker, D. W. Health literacy and knowledge of chronic disease. *Patient Educ. Couns.* **51** (3), 267–275. https://doi.org/10.1016/S0738-3991(02)00239-2 (2003).
46. Scott, T. L., Gazmararian, J. A., Williams, M. V. & Baker, D. W. Health literacy and preventive health care use among medicare enrollees in a managed care organization. *Med. Care*. **40** (5), 395–404. https://doi.org/10.1097/00005650-200205000-00005 (2002).
47. Howard, D. H., Gazmararian, J. & Parker, R. M. The impact of low health literacy on the medical costs of medicare managed care enrollees. *Am. J. Med.* **118** (4), 371–377. https://doi.org/10.1016/j.amjmed.2005.01.010 (2005).
48. Eichler, K., Wieser, S. & Brügger, U. The costs of limited health literacy: A systematic review, *International Journal of Public Health*, vol. 54, no. 5. Birkhauser Verlag AG, pp. 313–324, (2009). https://doi.org/10.1007/s00038-009-0058-2
49. Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J. & Crotty, K. Low health literacy and health outcomes: an updated systematic review. *Ann. Intern. Med.* **155** (2), 97–107. https://doi.org/10.7326/0003-4819-155-2-201107190-00005 (2011).
50. World Health Organization. Improving health literacy. Accessed: Jun. 12, 2024. [Online]. Available: https://www.who.int/activities/improving-health-literacy
51. Lee, K., Hoti, K., Hughes, J. D. & Emmerton, L. M. Consumer use of 'Dr Google': A survey on health information-seeking behaviors and navigational needs. *J. Med. Internet Res.* https://doi.org/10.2196/jmir.4345 (2015).
52. McCray, A. T. Promoting health literacy. *J. Am. Med. Inf. Assoc.* **12** (2), 152–163. https://doi.org/10.1197/jamia.M1687 (2005).
53. Paige, S. R., Krieger, J. L., Stellefson, M. & Alber, J. M. eHealth literacy in chronic disease patients: an item response theory analysis of the eHealth literacy scale (eHEALS). *Patient Educ. Couns.* **100** (2), 320–326. https://doi.org/10.1016/j.pec.2016.09.008 (2017).
54. Mielck, A., Vogelmann, M. & Leidl, R. Health-related quality of life and socioeconomic status: Inequalities among adults with a chronic disease. *Health Qual. Life Outcomes* https://doi.org/10.1186/1477-7525-12-58 (2014).
55. Egbert, N. & Nanna, K. M. Health Literacy: Challenges and Strategies, *Online J. Issues Nurs.*, vol. 14, no. 3, pp. 1–11, Accessed: Jul. 31, 2024. [Online]. (2009). Available: https://search.proquest.com/openview/bf355cd3a6d89e05dacd42fc4b75f592/1?pq-origsite=gscholar&cbl=43860
56. Norman, C. D. & Skinner, H. A. eHEALS: The eHealth literacy scale. *J. Med. Internet Res.* https://doi.org/10.2196/jmir.8.4.e27 (2006).
57. Karnoe, A. & Kayser, L. How is eHealth literacy measured and what do the measurements tell Us?? A systematic review. *Knowl. Manage. E-Learning*. **7**, 576–600. https://doi.org/10.34105/j.kmel.2015.07.038 (2015). no. 4.
58. Norgaard, O. et al. The e-health literacy framework: A conceptual framework for characterizing e-health users and their interaction with e-health systems. *Knowl. Manag E-Learning*. **7** (4), 522–540. https://doi.org/10.34105/j.kmel.2015.07.035 (2015).
59. Tamminen, A. et al. Perceptions of Finns with chronic diseases about factors affecting their eHealth literacy: A qualitative interview study. *Digit. Heal* https://doi.org/10.1177/20552076231216395 (2023).
60. Bandura, A., Freeman, W. H. & Lightsey, R. Self-Efficacy: the exercise of control. *J. Cogn. Psychother.* **13** (2), 158–166. https://doi.org/10.1891/0889-8391.13.2.158 (1999).

61. Norman, C. D. & Skinner, H. A. eHealth literacy: Essential skills for consumer health in a networked world. *J. Med. Internet. Res.* https://doi.org/10.2196/jmir.8.2.e9 (2006).
62. Diviani, N., Dima, A. L. & Schulz, P. J. A psychometric analysis of the Italian version of the ehealth literacy scale using item response and classical test theory methods. *J. Med. Internet Res.* **19**(4), e6749. https://doi.org/10.2196/jmir.6749 (2017).
63. Graffigna, G., Barello, S., Bonanomi, A. & Riva, G. Factors affecting patients' online health information-seeking behaviours: The role of the Patient Health Engagement (PHE) Model. *Patient Educ. Couns* **100**(10), 1918–1927. https://doi.org/10.1016/j.pec.2017.05.033 (2017).
64. Fox, S. & Online, H. I. *PEW Internet Am. Life Proj.*, pp. 1–17, Accessed: Jun. 12, 2024. [Online]. (2005). Available: https://policycommons.net/artifacts/620412/health-information-online/1601626/
65. TÜİK Hanehalkı Bilişim Teknolojileri (BT) Kullanım Araştırması, 2023, Türkiye İstatistik Kurumu. Accessed: Jul. 17, 2024. [Online]. Available: https://data.tuik.gov.tr/Bulten/Index?p=Hanehalki-Bilisim-Teknolojileri-(BT)-Kullanim-Arastirmasi-2023-49407
66. Touch, S. Türkiye'de İnternetin Sağlık Bilgi ve Hizmetlerine Ulaşma Amaçlı Kullanım Alışkanlıkları. Accessed: Jul. 17, 2024. [Online]. Available: https://www.socialtouch.com.tr/trend-bulteni/turkiyede_internetin_saglik_amacli_kullanimi_eylul2013/index.html
67. United/Nations Country Profiles _ Data Portal, UN Data Portal Population Division. Accessed: Apr. 21, 2025. [Online]. Available: https://w3.unece.org/PXWeb/en/PDFCountryProfiles
68. Neter, E. & Brainin, E. Association between Health Literacy, eHealth Literacy, and Health Outcomes among Patients with Long-Term Conditions: A Systematic Review, *European Psychologist*, vol. 24, no. 1. Hogrefe Publishing, pp. 68–81, Feb. 11, (2019). https://doi.org/10.1027/1016-9040/a000350
69. Stellefson, M. et al. Web 2.0 chronic disease self-management for older adults: A systematic review. *J. Med. Internet Res.* **15**(2), e2439. https://doi.org/10.2196/jmir.2439 (2013).
70. Slev, V. N. et al. Self-management support and eHealth for patients and informal caregivers confronted with advanced cancer: An online focus group study among nurses. *BMC Palliat. Care* **16**(1), 1–12. https://doi.org/10.1186/s12904-017-0238-4 (2017).
71. Zrubka, Z. et al. Exploring eHealth literacy and patient-reported experiences with outpatient care in the Hungarian general adult population: Cross-sectional study. *J. Med. Internet Res.* https://doi.org/10.2196/19013 (2020).
72. Nejati, B. et al. Determinants of satisfactory patient communication and shared decision making in patients with multiple myeloma. *Psychooncology.* **28**(7), 1490–1497. https://doi.org/10.1002/pon.5105 (2019).
73. Güven, S. & Tezcan *Temel Epidemiyoloji*. Accessed: Apr. 17, 2025. [Online]. (2017). Available: https://scholar.google.com/scholar?hl=tr&as_sdt=0%2C5&q=Tezcan+SG.+Temel+Epidemiyoloji.+Ankara%2C+Türkiye%3A+Hipokrat+Kitapevi%3B+2017.+&btnG=.
74. Kim, K. & Han, H. R. Potential links between health literacy and cervical cancer screening behaviors: A systematic review, *Psycho-Oncology*, vol. 25, no. 2. John Wiley and Sons Ltd, pp. 122–130, Feb. 01, 2016. https://doi.org/10.1002/pon.3883
75. Jung, S. M., Jo, H. S. & Oh, H. W. Internal motivation, perceived health competency, and health literacy in primary and secondary Cancer prevention. *Asian Pac. J. Cancer Prev.* **17** (12), 5127–5132. https://doi.org/10.22034/APJCP.2016.17.12.5127 (2016).
76. Dolan, N. C. et al. Colorectal cancer screening knowledge, attitudes, and beliefs among veterans: does literacy make a difference? *J. Clin. Oncol.* **22** (13), 2617–2622. https://doi.org/10.1200/JCO.2004.10.149 (2004).
77. Ezel & Tavşancıl *Tutumların Ölçülmesi ve SPSS ile Veri Analizi - Nobel Akademik Yayıncılık*. Accessed: Apr. 17, 2025. [Online]. (2019). Available: https://books.google.com/books?hl=tr&lr=&id=Vx1HEQAAQBAJ&oi=fnd&pg=PA1&dq=+Tavşancıl+E.+Tutumların+Ölçülmesi+ve+SPSS+ile+Veri+Analizi.+Ankara,+Türkiye:+Nobel+Yayınları%3B+2019&ots=iPF7yVlSOw&sig=83iLzq2okJnFHPBTu87icfEUvSY
78. Guerra, C. E., Dominguez, F. & Shea, J. A. Literacy and knowledge, attitudes, and behavior about colorectal cancer screening. *J. Health Commun.* **10**(7), 651–663. https://doi.org/10.1080/10810730500267720 (2005).
79. Smith, S. K. et al. Informed choice in bowel cancer screening: A qualitative study to explore how adults with lower education use decision aids. *Heal Expect.* **17**(4), 511–522. https://doi.org/10.1111/j.1369-7625.2012.00780.x (2014).
80. Heberer, M. A. et al. Factors associated with cervical cancer screening in a safety net population. *World J. Clin. Oncol.* **7** (5), 406–413. https://doi.org/10.5306/wjco.v7.i5.406 (2016).
81. Fernandez, D. M., Larson, J. L. & Zikmund-Fisher, B. J. Associations between health literacy and preventive health behaviors among older adults: Findings from the health and retirement study. *BMC Public. Health* https://doi.org/10.1186/s12889-016-3267-7 (2016).
82. Komenaka, I. K. et al. Association of health literacy with adherence to screening mammography guidelines. *Obstetr. Gynecol.* https://doi.org/10.1097/AOG.0000000000000708 (2015).
83. Huang, C. M., Chan, E. & Hyder, A. A. Web 2.0 and internet social networking: A new tool for disaster management? - Lessons from Taiwan. *BMC Med. Inf. Decis. Mak.* https://doi.org/10.1186/1472-6947-10-57 (2010).
84. Gencer, Z. T. Norman ve Skinner'in e-sağlık okuryazarlığı ölçeğinin kültürel uyarlaması için geçerlilik ve güvenilirlik çalışması. *Istanbul Univ. Fac. Commun. J.*, vol. 52, pp. 131–145, (2017). https://doi.org/10.17064/iuifd.333165
85. Yildirim Öztürk, E. N., Uyar, M. & Şahin, T. K. Development of an attitude scale for cancer screening. *Turk. Onkol Derg.* **35** (4), 394–404. https://doi.org/10.5505/tjo.2020.2341 (2020).
86. George, D. SPSS for windows step by step: A simple study guide and reference, 17.0 update, 10/e., in *Pearson Education India.*, Boston, (2011). https://doi.org/10.2307/1318629
87. S. James, D. Abate, K. Abate, S. Abay, C. A.-T. Lancet, and U. 2018, National Incidence,Prevalence, and Years Lived With Disability for 354 Diseases and Injuries for 195 Countries and Territories, 1990–2017: a Systematic Analysis … *Lancet*, vol. 392, no. 10159, pp. 1789–1858, 2018, Accessed: Jul. 03, 2024. [Online]. Available:https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)322797/fulltext.
88. Bissonnette, J. M. Adherence: A concept analysis. *J. Adv. Nurs.* **63**(6), 634–643. https://doi.org/10.1111/j.1365-2648.2008.04745.x (2008).
89. Andal, E. Compliance: Helping patients help themselves, *Clin. Rev.*, vol. 116, no. 3, pp. 23–25, Accessed: Jul. 01, 2024. [Online]. (2006). Available: https://scholar.google.com/scholar?hl=tr&as_sdt=0%2C5&q=Andal+E%2C+Compliance%3A+Helping+patients+help+themselves.+Clin+Rev+2006%3B116%3A23–5.&btnG=.
90. Nieuwlaat, R. et al. Interventions for enhancing medication adherence, *Cochrane Database of Systematic Reviews*, vol. no. 11. John Wiley and Sons Ltd, Nov. 20, 2014. (2014). https://doi.org/10.1002/14651858.CD000011.pub4
91. Kärner, A., Göransson, A. & counseling B. B.-P. education and and undefined Conceptions on treatment and lifestyle in patients with coronary heart disease—a phenomenographic analysis, *ElsevierA Kärner, A Göransson, B BergdahlPatient Educ. Couns. 2002•Elsevier*, Accessed: Jul. 01, 2024. [Online]. (2002). Available: https://www.sciencedirect.com/science/article/pii/S0738399101001859
92. De Geest, S. & Sabaté, E. Adherence to long-term therapies: evidence for action. *Eur. J. Cardiovasc. Nurs.* **2**, 323. https://doi.org/10.1016/S1474-5151(03)00091-4 (2003).
93. qiang Ma, Z. & Richardson, L. C. Cancer screening prevalence and associated factors among US adults. *Prev. Chronic Dis.* **19**, 1–5. https://doi.org/10.5888/pcd19.220063 (2022).
94. Mosquera, I. et al. Inequalities in participation in colorectal cancer screening programmes: A systematic review. *Eur. J. Public. Health.* **30** (3), 416–425. https://doi.org/10.1093/eurpub/ckz236 (2020).

95. Fallahian, F., Nelson, H. & Pories, S. The Role of Social Determinants of Health on Cancer Screening, *American College of Surgeons*, p. 32, Accessed: Jul. 03, 2024. [Online]. (2022). Available: https://www.facs.org/media/klfjxvxt/22junbull-low-res.pdf#page=34
96. Kurani, S. S. et al. Association of neighborhood measures of social determinants of health with breast, cervical, and colorectal cancer screening rates in the US midwest. *JAMA Netw. Open* **3**(3), e200618. https://doi.org/10.1001/jamanetworkopen.2020.0618 (2020).
97. Kiefe, C. I., Funkhouser, E., Fouad, M. N. & May, D. S. Chronic disease as a barrier to breast and cervical cancer screening. *J. Gen. Intern. Med.* **13**(6), 357–365. https://doi.org/10.1046/j.1525-1497.1998.00115.x (1998).
98. Boyd, C. M. et al. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. *JAMA* **294**, 716–724. https://doi.org/10.1001/jama.294.6.716 (2005).
99. Ashley, E. A. The precision medicine initiative: A new national effort. *JAMA* **313**, 2119–2120. https://doi.org/10.1001/jama.2015.3595 (2015).
100. Hajjar, A. & Alagoz, O. Personalized disease screening decisions considering a chronic condition. *Manage. Sci.* **69**(1), 260–282. https://doi.org/10.1287/mnsc.2022.4336 (2023).
101. The Ministry of Health of Türkiye. Cancer screenings. Accessed: Apr. 22, 2025. [Online]. Available: https://hsgm.saglik.gov.tr/tr/kanser-taramalari
102. American Cancer Society. Accessed: Jul. 25, 2024. [Online]. Key statistics for breast cancer, (2022). Available: https://www.cancer.org/cancer/breast-cancer/about/how-common-is-breast-cancer.html
103. Gorina, Y. & Elgaddal, N. Patterns of mammography, pap smear, and colorectal cancer screening services among women aged 45 and over. *Natl Health Stat Rep* **157**, 1–17. https://doi.org/10.15620/CDC:105533 (2021).
104. Miller, K. D. et al. Cancer treatment and survivorship statistics. *CA. Cancer J. Clin.* **72**(5), 409–436. https://doi.org/10.3322/caac.21731 (2022).
105. Türk, T. O. & Derneği Toplum Bilgilendirme Sitesi. Accessed: Jul. 31, 2024. [Online]. Available: https://www.kanser.org/saglik/toplum/sik-rastlanan-kanserler/list
106. T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, Kanserler afişler/broşürler. Accessed: Jul. 31, 2024. [Online]. Available: https://hsgm.saglik.gov.tr/tr/dokumanlar-kanserdb/afisler-brosurler.html
107. Kedra, J. & Seror, R. Cancer screening in chronic inflammatory rheumatic diseases, *Joint Bone Spine*, vol. 90, no. 4. Elsevier Masson, p. 105557, Jul. 01, (2023). https://doi.org/10.1016/j.jbspin.2023.105557
108. James, L. J. et al. Patient preferences for cancer screening in chronic kidney disease: a best–worst scaling survey. *Nephrol. Dial. Transplant.* **37**(12), 2449–2456. https://doi.org/10.1093/NDT/GFAB360 (2022).
109. Salika, T., Lyratzopoulos, G., Whitaker, K. L., Waller, J. & Renzi, C. Do comorbidities influence help-seeking for cancer alarm symptoms? A population-based survey in England. *J. Public. Heal (United Kingdom)*. **40** (2), 340–349. https://doi.org/10.1093/pubmed/fdx072 (2018).
110. Jensen, L. F., Pedersen, A. F., Andersen, B., Vestergaard, M. & Vedsted, P. Non-participation in breast cancer screening for women with chronic diseases and multimorbidity: A population-based cohort study. *BMC Cancer* **15**, 1–10. https://doi.org/10.1186/s12885-015-1829-1 (2015).
111. Babaoğlu, A., Büyüközmen, E. & Can, F. Awareness of Cancer screening tests in the community in Izmir and factors affecting the participation of individuals in Cancer screening tests. *Med. J. West. Black Sea.* **5**(2), 173–181. (2021) doi: 10.29058/mjwbs.853692.
112. Maxwell, A. E., Bastani, R. & Warda, U. S. Breast cancer screening and related attitudes among Filipino-American women, *Cancer Epidemiol. Biomarkers Prev.*, vol. 6, no. 9, pp. 719–726, Accessed: Jul. 29, 2024. [Online]. (1997). Available: https://aacrjournals.org/cebp/article-abstract/6/9/719/154263
113. Maxwell, A. E., Bastani, R., Crespi, C. M., Danao, L. L. & Cayetano, R. T. Behavioral mediators of colorectal cancer screening in a randomized controlled intervention trial. *Prev. Med.* **52**(2), 167–173. https://doi.org/10.1016/j.ypmed.2010.11.007 (2011).
114. Taylor, V. et al. Colorectal cancer screening among African Americans: The importance of physician recommendation, *J. Natl. Med. Assoc.*, vol. 95, no. 9, pp. 806–812, Accessed: Jul. 29, 2024. [Online]. (2003). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2594456/
115. Klabunde, C. N., Schenck, A. P. & Davis, W. W. Barriers to colorectal cancer screening among medicare consumers. *Am. J. Prev. Med.* **30** (4), 313–319. https://doi.org/10.1016/j.amepre.2005.11.006 (2006).
116. Gilbert, A. & Kanarek, N. Colorectal cancer screening: Physician recommendation is influential advice to Marylanders. *Prev. Med.* **41**(2), 367–379. https://doi.org/10.1016/j.ypmed.2005.01.008 (2005).
117. Beydoun, H. A. & Beydoun, M. A. Predictors of colorectal cancer screening behaviors among average-risk older adults in the United States, *Cancer Causes and Control*, vol. 19, no. 4. Springer, pp. 339–359, May 18, 2008. https://doi.org/10.1007/s10552-007-9100-y
118. Topal Hancer, A. & Yılmaz, P. The relationship between cancer informatıon overload and attitudes for cancer screening in geriatric patients who have had surgical. *Sağlık Bilim. Derg.* **32**, 191–198. https://doi.org/10.34108/eujhs.1177490 (2023).
119. Çinar, D. et al. Women's attitudes towards healthy life awareness and breast cancer screening during the coronavirus disease 2019 pandemic: A cross-sectional descriptive study. *Eur. J. Cancer Prev.* **31** (4), 346–353. https://doi.org/10.1097/CEJ.0000000000000756 (2022).
120. Özdemir, A. & Şahinöz, T. Toplumda Afet Farkındalığı Oluşturmaya Yönelik Kullanılan Araçlar: Nitel Bir Çalışma. *Afet Ve Risk Derg.* **5** (1), 78–93. https://doi.org/10.35341/afet.975612 (2022).
121. Özdemir, Ü., Kartın, P. T. & Kalyoncuo, S. Factors affecting attitudes towards cancer, cancer prevention, and early diagnosis behaviors among cancer patient relatives. *J. Prev.* **44**(5), 639–662. https://doi.org/10.1007/s10935-023-00750-2 (2023).
122. Erkal, E. Determining individuals' attitudes toward cancer screening and their influential factors. *Makara J. Heal Res.* **26**(2), 6. https://doi.org/10.7454/msk.v26i2.1336 (2022).
123. Karadeniz, H. & Çetinkaya, F. Early cancer detection/screening behaviors of individuals aged 40 years and over in trabzon and the influencing factors. *Turk. Onkol Derg.* **34** (3), 153–161. https://doi.org/10.5505/tjo.2019.1885 (2019).
124. Chan, T. K. C., Tan, L. W. L., van Dam, R. M. & Seow, W. J. Cancer screening knowledge and behavior in a multi-ethnic Asian population: The Singapore community health study. *Front. Oncol.* **11**, 684917. https://doi.org/10.3389/fonc.2021.684917 (2021).
125. Haas, J. S. et al. Disparities in the use of screening magnetic resonance imaging of the breast in community practice by race, ethnicity, and socioeconomic status. *Cancer* **122**(4), 611–617. https://doi.org/10.1002/cncr.29805 (2016).
126. Lee, Y. S. et al. Andersen's Behavioral Model to Identify Correlates of Breast Cancer Screening Behaviors among Indigenous Women, *J. Evidence-Based Soc. Work (United States)*, vol. 17, no. 1, pp. 117–135, Jan. (2020). https://doi.org/10.1080/26408066.2019.1650316
127. Shiferaw, K. B., Tilahun, B. C., Endehabtu, B. F., Gullslett, M. K. & Mengiste, S. A. E-health literacy and associated factors among chronic patients in a low-income country: A cross-sectional survey, *BMC Medical Informatics and Decision Making*, vol. 20, no. 1. BioMed Central Ltd, pp. 1–9, Aug. 06, (2020). https://doi.org/10.1186/s12911-020-01202-1
128. Seiler, A., Klaas, V., Tröster, G. & Fagundes, C. P. eHealth and mHealth interventions in the treatment of fatigued cancer survivors: A systematic review and meta-analysis, *Psycho-Oncology*, vol. 26, no. 9. John Wiley and Sons Ltd, pp. 1239–1253, Sep. 01, (2017). https://doi.org/10.1002/pon.4489
129. Palacios, J. et al. Internet-delivered self-management support for improving coronary heart disease and self-managementyrelated outcomes a systematic review, *Journal of Cardiovascular Nursing*, vol. 32, no. 4. Lippincott Williams and Wilkins, pp. E9–E23, (2017). https://doi.org/10.1097/JCN.0000000000000392

130. Jackson, B. D., Gray, K., Knowlesd, S. R. & De Cruz, P. EHealth technologies in inflammatory bowel disease: A systematic review, *Journal of Crohn's and Colitis*, vol. 10, no. 9. Oxford Academic, pp. 1103–1121, Sep. 01, 2016. https://doi.org/10.1093/ecco-jcc/jjw059
131. Shen, H., Van Der Kleij, R. M. J. J., Van Der Boog, P. J. M., Chang, X. & Chavannes, N. H. Electronic health self-management interventions for patients with chronic kidney disease: Systematic review of quantitative and qualitative evidence. *J. Med. Internet. Res.* https://doi.org/10.2196/12384 (2019).
132. Fox, S. & Duggan, M. Health Online Pew Research Center, *National survey by the Pew Research Center's Internet and American Life Project*. p. 55, 2013. Accessed: Jul. 30, 2024. [Online]. (2013). Available: https://www.pewresearch.org/internet/2013/01/15/health-online-2013/
133. Kurtoğlu, İ, Necla, Y. & Taş, M. A. Kronik hastaların e-sağlık okuryazarlık düzeyleri üzerine bir araştırma. *Mehmet Akif Ersoy Üniversitesi Sos Bilim Enstitüsü Derg* **35**, 126–136. https://doi.org/10.20875/makusobed.1009918 (2022).
134. Zaimoğlu, B. N. & Özer, Z. Investigation of E-health literacy and patient activation levels in individuals with chronic disease. *Turk Nefroloji, Diyal. ve Transplant. Hemsireleri Dern.* **18**, 12–21. https://doi.org/10.47565/ndthdt.2023.63 (2023).
135. Milne, R. A. et al. Predictors of high ehealth literacy in primary lung cancer survivors. *J. Cancer Educ.* **30**, 685–692. https://doi.org/10.1007/s13187-014-0744-5 (2015).
136. Martinez, C. H. et al. Internet access and use by COPD patients in the National Emphysema/COPD Association Survey. *BMC Pulm Med.* **14**(1), 166. https://doi.org/10.1186/1471-2466-14-66 (2014).
137. Masterson Creber, R. M., Hickey, K. T. & Maurer, M. S. Gerontechnologies for Older Patients with Heart Failure: What is the Role of Smartphones, Tablets, and Remote Monitoring Devices in Improving Symptom Monitoring and Self-Care Management? *Current Cardiovascular Risk Reports*, vol. 10, no. 10. Current Medicine Group LLC 1, Oct. 01, (2016). https://doi.org/10.1007/s12170-016-0511-8
138. Choi, N. G. & Dinitto, D. M. The digital divide among low-income homebound older adults: Internet use patterns, ehealth literacy, and attitudes toward computer/internet use. *J. Med. Internet Res.* **15**, 5. https://doi.org/10.2196/jmir.2645 (2013).
139. Mangin, D. et al. Multimorbidity, eHealth and implications for equity: a cross-sectional survey of patient perspectives on eHealth. *BMJ Open.* **9**(2), e023731. https://doi.org/10.1136/bmjopen-2018-023731 (2019).
140. Efthymiou, A., Middleton, N., Charalambous, A. & Papastavrou, E. The association of health literacy and electronic health literacy with self-efficacy, coping, and caregiving perceptions among carers of people with dementia: Research protocol for a descriptive correlational study. *JMIR Res. Protoc.* **6**, 11. https://doi.org/10.2196/resprot.8080 (2017).
141. Zibrik, L. et al. Patient and community centered eHealth: Exploring eHealth barriers and facilitators for chronic disease self-management within British Columbia's immigrant Chinese and Punjabi seniors. *Heal. Policy Technol.* **4**(4), 348–356. https://doi.org/10.1016/j.hlpt.2015.08.002 (2015).
142. Van Duong, T. et al. Validation of the short-form health literacy questionnaire (HLS-SF12) and its determinants among people living in rural areas in Vietnam. *Int. J. Environ. Res. Public. Health* **16**(18), 3346. https://doi.org/10.3390/ijerph16183346 (2019).
143. Xie, B. Effects of an eHealth literacy intervention for older adults. *J. Med. Internet Res.* **13**(4), https://doi.org/10.2196/jmir.1880 (2011).
144. Mitsutake, S., Shibata, A., Ishii, K. & Oka, K. Association of ehealth literacy with colorectal cancer knowledge and screening practice among internet users in Japan. *J. Med. Internet Res.* **14**, 6. https://doi.org/10.2196/jmir.1927 (2012).
145. Park, H., Moon, M. & Baeg, J. H. Association of eHealth literacy with cancer information seeking and prior experience with cancer screening. *CIN Comput. Inf. Nurs.* **32**(9), 458–463. https://doi.org/10.1097/CIN.0000000000000077 (2014).

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