BMC Public Health

RESEARCH

Open Access

Relationship between health literacy, health fatalism and attitudes towards cancer screenings: latent profile analysis

Fatoş Uncu[1], Hasan Evcimen[2], Necmettin Çiftci[3] and Metin Yıldız[4*]

Abstract

Background The aim of this study is to examine the relationship between health literacy, health fatalism and attitudes towards cancer screening using latent profile analysis (LPA).

Methods This study was conducted in a cross-sectional descriptive design between December 2023- December 2024. The study was conducted with 1262 adult individuals living in a province in eastern Turkey.

Results As a result of LPA, Class 1 was named as "High Health Awareness" and when the indicators in Class 1 were analyzed, it was found that health literacy and attitude towards cancer screenings were high and health fatalism was low. Class 2 is labeled as "Low Health Awareness" and when the indicators in this class are examined, it is determined that health literacy and attitude towards cancer screening are low and health fatalism is high.

Conclusions In our study, individuals were divided into two classes as "High Health Awareness" and "Low Health Awareness" according to the level of health awareness; in the first class, health literacy and attitudes towards cancer screenings were high and health fatalism was low; in the second class, health literacy and attitudes were low and health fatalism was high.

Keywords Health literacy, Health fatalism, Cancer Screenings, Attitude, Latent profile analysis

Introduction

Cancer is a major public health problem that is straining global health systems, increasing the burden of disease and growing at an alarming rate worldwide [1]. According to 2022 data from the International Agency for Research on Cancer (IARC), approximately 20 million people worldwide have been diagnosed with cancer and nearly 10 million people have died from cancer-related causes. It is reported that the five-year prevalence of cancer in the USA is 7.8 million and 605 thousand people die due to cancer. In Turkey, the incidence of cancer is over 240,000 and nearly 130,000 people die from cancer [2, 3]. As the incidence of cancer is on the rise, it is of great importance for public health to examine the most common types of cancer and the risks associated with them, both globally and in Turkey. In Turkey, Cancer Early Diagnosis, Screening and Education Centers (Turkish acronym: KETEM) have been conducting standardized screening programs for breast, colorectal and cervical cancers as part of the national cancer screening program since 2008 [4–6]. For an effective screening program, it is aimed to reach at least 70% of the target population. However, according to Turkey's Cancer Control Plan published by the Turkish Directorate General of Public Health in 2016,

*Correspondence:
Metin Yıldız
metinyildiz@sakarya.edu.tr
[1] Department of Nursing, Firat University, Elazığ, Turkey
[2] Department of Therapy and Rehabilitation, Muş Alparslan University, Vocational School of Health Services, Muş, Turkey
[3] Department of Nursing, Faculty of Health Sciences, Muş Alparslan University, Campus, Muş 49100, Turkey
[4] Department of Midwifery, Sakarya University, Sakarya, Turkey

the coverage rate for breast cancer screening is 30–35%, 20% for cervical cancer screening and 20–30% for colorectal cancer screening. These rates are well below ideal targets [7]. There are many factors affecting this situation. One of these is health literacy, which refers to individuals' ability to acquire and use health information. Health literacy enables individuals to access accurate information when making health-related decisions, which in turn affects the utilization rates of health services. In order to increase the effectiveness of cancer screening programs, improving social awareness and health literacy is of great importance to ensure the participation of individuals in these screenings and to support the acceptance of these screenings [8–11]. Another important factor is individuals' beliefs about health. These beliefs are among the main factors that determine individuals' health-related attitudes and behaviors and have a direct impact on their health decisions. Fatalism, which is one of the health beliefs, leads individuals to believe that they do not have the ability to control their health and lives, and that such events are shaped by external factors or a determined destiny. Individuals with a fatalistic perspective believe that they do not have the power to change or control the factors that affect their health, attributing them to external forces, luck or a universal order. Such a belief may prevent people from engaging in proactive health-related behaviors and may create barriers to opportunities such as health measures and early diagnosis [12–16]. Individuals with high fatalism may avoid early detection and screening behaviors, especially for serious and fatal diseases such as cancer. Although early detection is a critical factor that increases the treatability of cancer, individuals with a fatalistic perspective may see participation in such health measures as useless [17–19].

Therefore, the relationship between health literacy and fatalism may be an important factor affecting attitudes towards cancer screening. The aim of this study is to examine the effect of health literacy on individuals' attitudes towards cancer screenings and also to determine how fatalism shapes this relationship.

Research questions

1. What are the participants' health literacy level, health fatalism and attitudes towards cancer screening?
2. Is there a significant relationship between health literacy, health fatalism and attitudes towards cancer screening?
3. In which groups are the participants gathered in terms of health literacy, health fatalism and cancer screening attitudes with the Latent Profile Analysis (LPA) method?
4. How do the health literacy level and health fatalism affect the attitudes of individuals towards cancer screening?

Methods

Type of research

This study was conducted in a cross-sectional descriptive design between December 2023 and December 2024.

Population and sample

The study was conducted using a convenience sampling method by including literate individuals between 18 years and over who applied to a state hospital in Muş province in eastern Turkey on the dates of the study. Individuals with mental health problems, not in the relevant age range and illiterate individuals were not included in the study. Data were collected using face-to-face interview technique. When the sampling formula ($n = t^2.p.q/d.^2$) [$t = 1.96$ $p = q = 0.5$ and $d = 0.05$) was used to determine the sample size of the study, 384 individuals were found to be sufficient. The research was conducted with 1262 individuals. In the post hoc power analysis performed using the G*Power 3.1.9.7 statistical package program based on the results obtained from these participant, the power of our study was calculated as 99% with a medium effect size at 95% confidence level [20] The STROBE guidelines were used to report this research paper [21]

Data collection tools

Data were collected using a personal information form developed by the researchers, the Health Literacy Scale, the Health Fatalism Scale and the Attitudes Towards Cancer Screenings Scale.

Personal ınformation form

This form consists of questions on gender, age, marital status, educational status and income status of the participants.

Religious health fatalism scale

It was developed by Franklin, Schlundt and Wallston to assess the impact of fatalism on individuals' health behaviors [22]. The Turkish validity and reliability of the scale was conducted by Bobov and Çapık. The scale consists of Likert 5 type and 17 items. The lowest score is 17 and the highest score is 85. As the score obtained from the scale increases, the level of fatalism tendency increases.Bobov and Capik state that the Cronbach's alpha coefficient of the scale is 0.91 [23]. In our study, Cronbach's alpha coefficient was 0.93.

Attitude scale towards cancer screenings

It was developed by Öztürk, Uyar and Şahin to determine individuals' attitudes towards cancer screening. The scale consists of 24 items in Likert 5 type and one dimension. A minimum of 24 and a maximum of 120 points can be obtained from the scale. As scores approach 24, it is interpreted as indicating a negative attitude towards cancer screenings, while scores approaching 120 suggest positive attitudes. The cronbach alpha coefficient of the scale is 0.95 [24] In our study, Cronbach's alpha coefficient was 0.91.

Health literacy scale

This scale was developed by Suka et al. [25] To measure the health literacy levels of adults. The scale was adapted into Turkish by Türkoğlu and Kılıç. The Cronbach alpha value of the Turkish version of the scale was 0.85. The lowest score is 14 and the highest score is 70. The higher the total score, the higher the level of health literacy [26]. In our study, Cronbach's alpha coefficient was 0.95.

Ethical consideration

Ethical approval was obtained from the Scientific Research and Publication Ethics Committee before the research (08.11.2023/9–73). The purpose of the study was explained to the individuals involved in the study and their written and verbal consent was obtained. Pre-research study permission was obtained from the institution where the research was conducted. All processes of the study were conducted in accordance with the principles of the Declaration of Helsinki.

Data analysis

Analyses were performed using IBM SPSS 25 and R software. Necessary normality tests were performed with kurtosis and skewness -1.5 to + 1.5 [27]. For all analyses, $p < 0.05$ was set as the significance level. In the study, descriptive statistics were made with SPSS-25 package program. Demographic characteristics and scale scores now explicitly include calculated values of n (%), mean (±), and standard deviation (SD) to improve clarity and interpretability. In this study, latent profile analysis was performed with R programming language. Latent Profile Analysis is a statistical technique that identifies different subgroups within a population by analyzing patterns of responses to various observed variables [28]. Mclust library for LPA analysis [29], Tidylpa library for access to fit indexes in the reporting phase [30] has been used.

The initial step in Latent Profile Analysis (LPA) involves selecting the appropriate model. At this stage, Bayesian Information Criterion (BIC) values were obtained by iterating each model and class for two models and two classes. Akogul and Erisoglu (2017) emphasized that additional fit indices can also be considered when evaluating models [31]. However, Tein et al. (2013) highlighted in their review that BIC is the most commonly used evaluation criterion in the literature [32].

Results

In our study, 59.5% of the individuals were female, 61.8% were married, 40.1% were primary school graduates, 51.5% had income less than expenditure and the mean age was 53.67 ± 12.37 years (Table 1).

Table 1 Distribution of demographic characteristics

Variables		n	%
Gender	Male	511	40.5
	Female	751	59.5
Marital Status	Married	780	61.8
	Single	482	38.2
Education Status	Literate	284	22.5
	Primary Education	506	40.1
	Secondary Education	226	17.9
	Higher Education	246	19.5
Socioeconomic Status	Income Less than Expenditure	650	51.5
	Income Equal to Expenditure	376	29.8
	Income more than Expenditure	236	18.7
	$\overline{X} \pm$ SD		
Age (Years)	53.67 ± 12.37		
Religious Health Fatalism Scale	59.58 ± 14.57		
Attitude Scale Towards Cancer Screenings	41.95 ± 11.72		
Health Literacy Scale	41.87 ± 13.53		

Latent profile analysis process

The BIC values are presented in Table 2. Since the lowest BIC value was observed in the VVV model, this model was determined to be the most suitable for the study, and class analysis was conducted based on this model. Figure 1 illustrates the representation of each class for up to two classes in the VVI and VVV models.

The values for the fit index are given in Fig. 2.

Table 3 shows the extra indices and values used in the model evaluation. Figure 3 and Table 4, it is concluded that the best fitting class is the 2-class solution [33].

Table 2 BIC values of all models

Class	VVI	VVV
1	-14,619,10	-14166,17
2	-13188,62	-13179,41

Tables 3 and 4 show the class sizes and class averages. Figure 4 shows the line graphs of indicators' means by classes.

As a result of the LPA, Class 1 is named as High Health Awareness and when the indicators here are examined, it is determined that health literacy and attitude towards cancer screenings are high and health fatalism is low. Class 2 is labeled as Low Health Awareness and when the indicators here are examined, it is determined that the attitude towards health literacy and cancer screenings is low and health fatalism is high.

Case-specific entropy contribution and MAP (Maximum A Posteriori) values are given in Fig. 5.

Discussion

It is known that attitudes towards cancer screening depend on many factors affecting individuals' health behaviors. In this context, health literacy and health fatalism stand out as two important concepts that shape

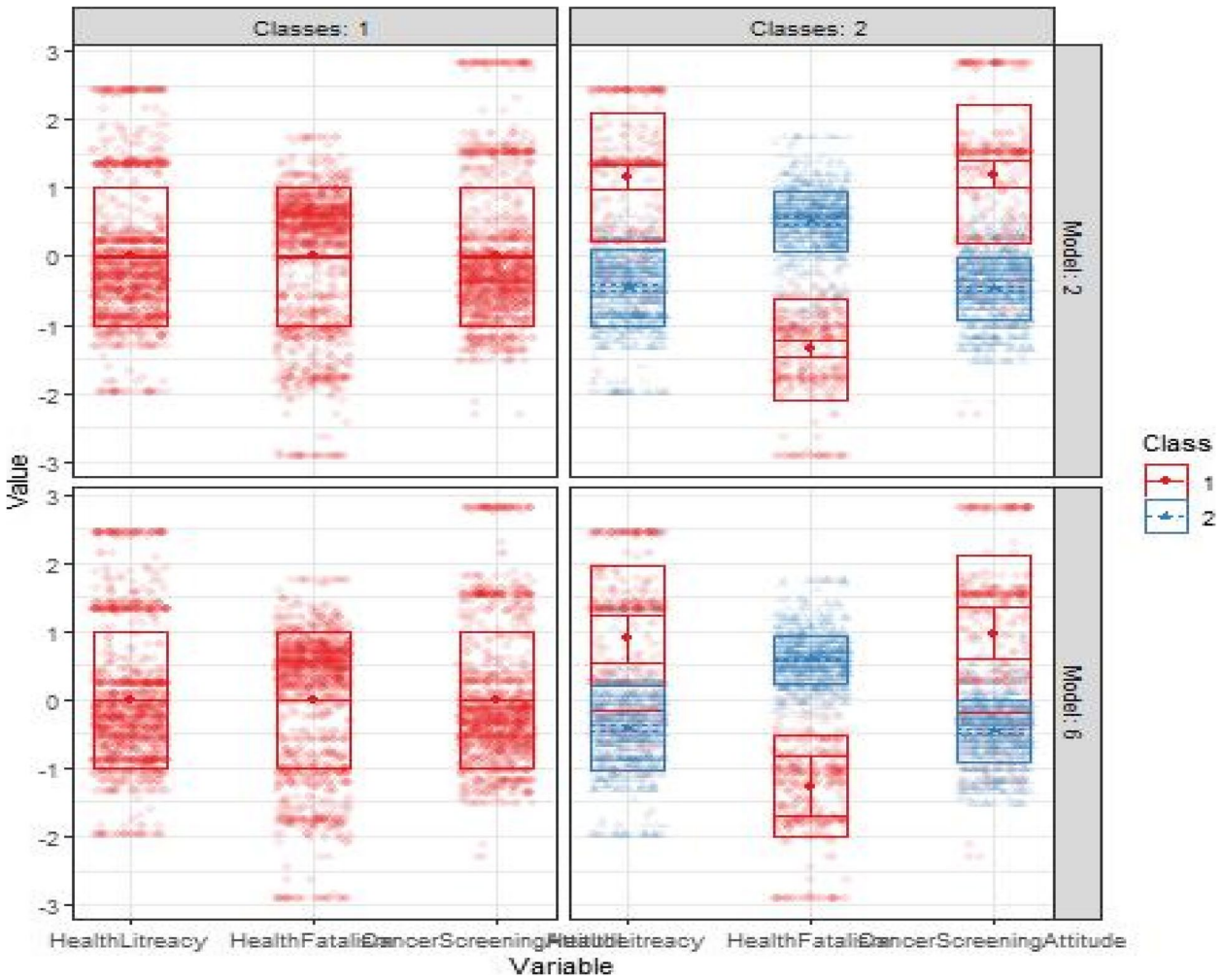

Fig. 1 BIC values

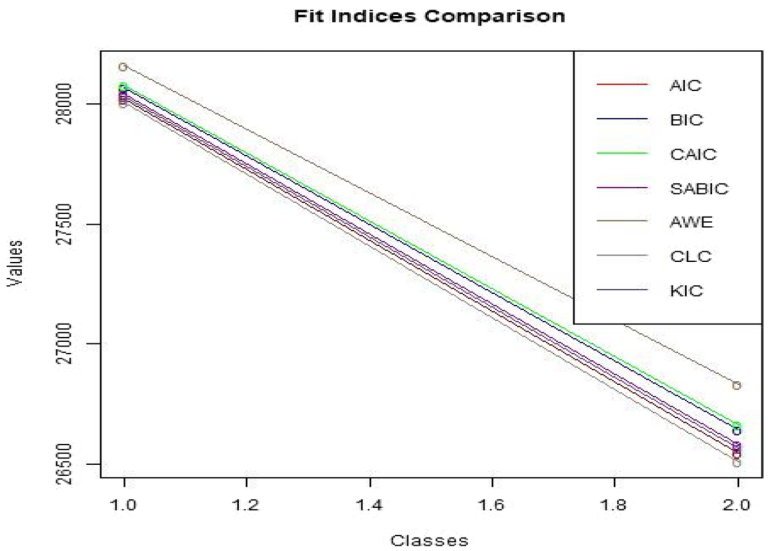

Fig. 2 Elbow plots of AIC, BIC, CAIC, SABIC, AWE, CLC and KIC values

individuals' decisions to participate in cancer screening. The findings show that as health literacy increases, cancer screening attitude is positively affected, whereas as health fatalism increases, cancer screening attitude is negatively affected. These results emphasize the impact of individuals' access to health-related information and their level of making sense of this information, as well as their belief that health-related events are controllable, on their health behaviors.

Health literacy is defined as the ability of individuals to access, understand and use information to protect, maintain and improve their health and to make informed decisions about health. It is known that individuals with high levels of health literacy are more effectively integrated into the health system and benefit more from preventive health services by understanding the importance of these services [34]. There are studies in the literature demonstrating the strong link between health literacy and cancer screening behaviors. Rakhshkhorshid et al. stated that health literacy is a critical factor that encourages participation in breast cancer screening and showed that individuals with high health literacy have significantly higher rates of participation in screening [35] Roh et al. (2018) found a strong relationship between health literacy and breast cancer awareness and screening behaviors in their study on American Indian women [36]. Similarly, Yılmazel has shown that health literacy positively affects health outcomes by increasing mammography awareness and screening participation rates [37]. A similar result was obtained in Tayhan and Özmen's study on prostate cancer screening and it was reported that men with high health literacy participated in screening programs more frequently [38]. Zanobini et al. reported a positive correlation between high health literacy and mammography screening behavior of adult women in Italy [10] Our study supports these literature findings and reveals a statistically significant positive effect of health literacy on cancer screening behaviors. Recent evidence also supports this finding. Baccolini et al. (2022) conducted a systematic review and meta-analysis and concluded that health literacy is an independent determinant of participation in breast, cervical, and colorectal cancer screenings [11]. Similarly, Holden et al. (2021) highlighted that lower health literacy is associated with difficulties in understanding cancer information and poorer screening experiences [39]**.** These findings clearly demonstrate that interventions to increase health literacy are a critical public health strategy to encourage participation in cancer screening and increase early detection rates.

Fatalism, a deterministic perspective that one's health is controlled by external forces and therefore there is no need to engage in positive coping behaviors, was seen as an important barrier to cancer prevention and screening behaviors [40]. Duru and Topatan examined the relationship between barriers to participation in cervical cancer screening programs and fatalism beliefs. In this study, fatalism was found to be one of the main factors preventing individuals from participating in screening programs [12]. In the study conducted by Bakır, it was found that women with high perception of fatalism performed breast cancer early diagnosis behaviors less frequently [41]. The study conducted by Bakan et al. revealed that women's religious orientation and fatalistic beliefs significantly negatively affected

Table 3 Extra indices and values used in model evaluation

Model	Classes	LogLik	AIC	AWE	BIC	CAIC	CLC	KIC	SABIC	ICL	Entropy	LMR_val	LMR_p	LMR_mean
6	1	-14001,735	28021,470	28156,998	28067,734	28076,734	28005,470	28033,470	28039,146	-28067,734	-	-	-	-
6	2	-13254,236	26546,472	26834,993	26644,141	26663,141	26510,289	26568,472	26583,788	-26698,519	1494.998	0.001	1 < 2	1494.998

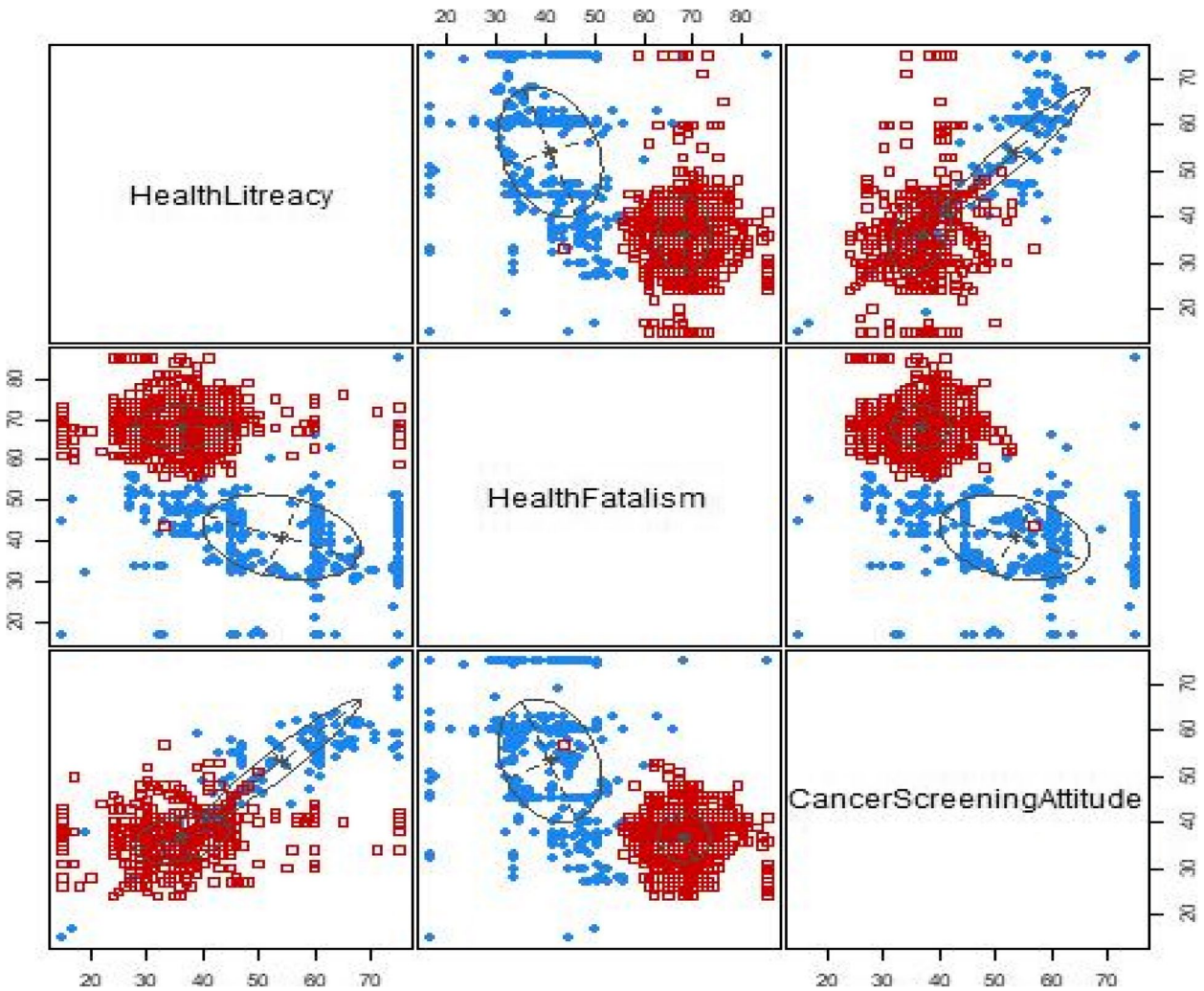

Fig. 3 Density and uncertainty distributions of classes

Table 4 Class classification

Classes	1	2	Total
1	1262 (1)		1262
2	384 (0.3)	878 (0.7)	1262

their attitudes towards breast and cervical cancer screening [42]. Similarly, Foust's study in a population with limited access to health care in Southern California emphasized that fatalism is one of the main barriers that undermines confidence in cervical cancer screening and reduces participation rates [43]. The study by Marván, Ehrenzweig, and Catillo-López on Mexican women clearly showed that fatalistic beliefs negatively affect screening behaviors [44]. This relationship has also been confirmed in more recent studies. For instance, Güneş and Atalıkoğlu Başkan (2024) showed that fatalistic beliefs significantly reduced willingness to participate in screening programs in a Turkish sample [45]. In a meta-analysis, Chen and Kim (2023) emphasized that cancer fatalism remains a strong negative predictor of screening behaviors across diverse populations [46]. Similarly, in our study, fatalistic beliefs were found to have a negative impact on cancer screening participation rates. This finding is consistent with the existing literature and confirms that fatalistic beliefs are one of the most important psychosocial barriers to cancer screening. Our study makes a significant contribution to the literature that such beliefs reduce the perceived benefit and risk perception of individuals towards screening programs, making behavior change difficult. In this context, it is clear that targeted interventions that address individuals' fatalistic beliefs have the potential to improve screening behaviors.

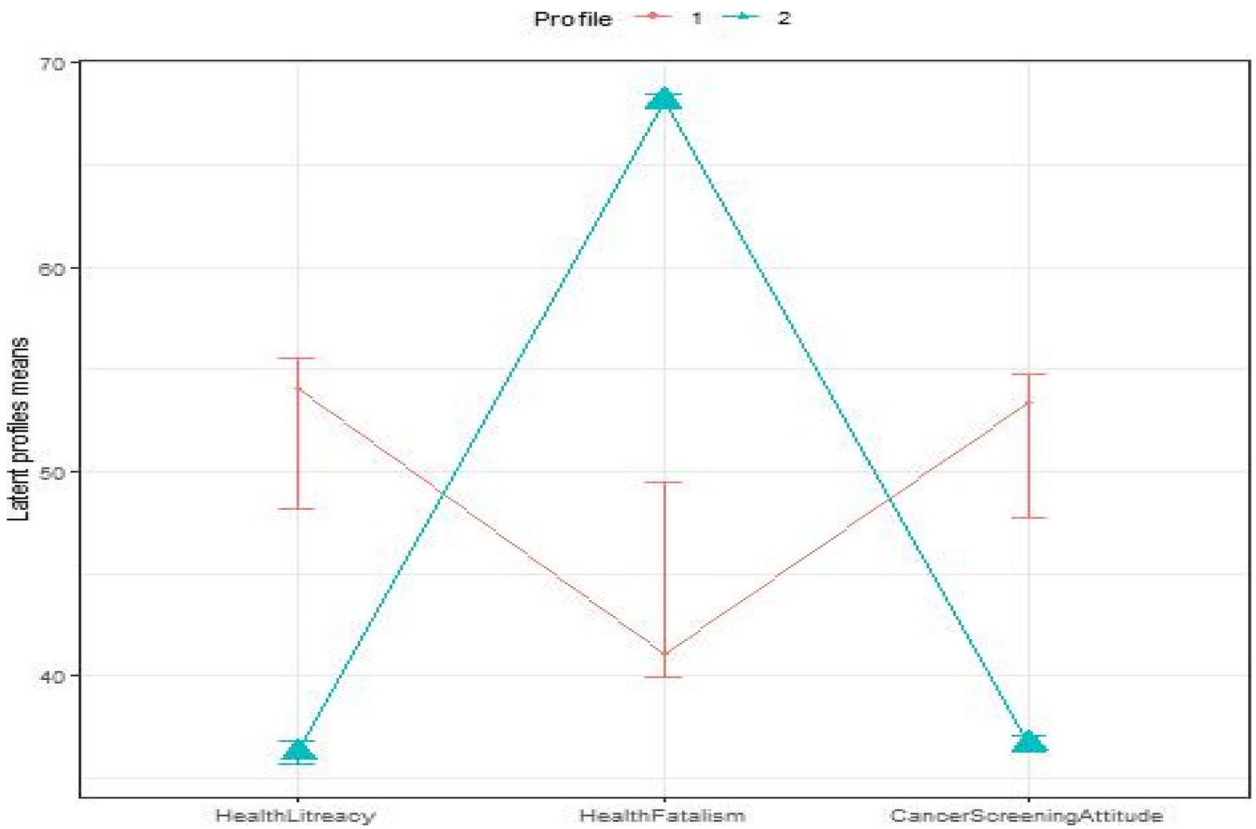

Fig. 4 Line graph of indicators' means by classes

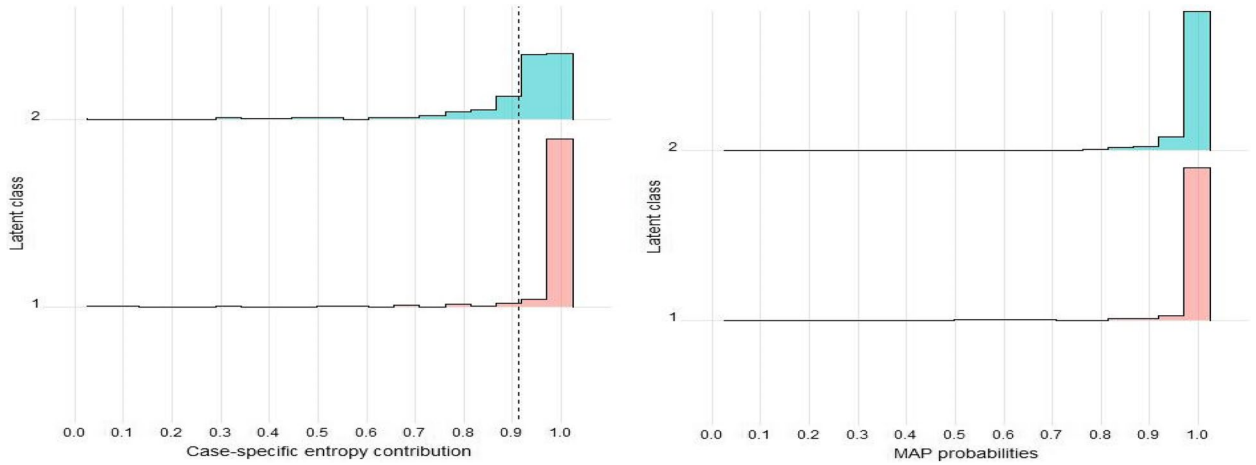

Fig. 5 Entropy and MAP values

This opposing effect between health literacy and health fatalism has important implications for public health. On the one hand, initiatives to increase health literacy can facilitate individuals' access to health services and enable them to make more informed health decisions. It is clear that health education programs and public awareness campaigns have great potential, especially in the context of preventive health services such as cancer screenings. On the other hand, interventions need to be developed to reduce the negative impact of health fatalism on individuals' health behaviors. For example, culturally sensitive educational programs that address the belief in health

fatalism can strengthen individuals' belief that they can control their health. In this regard, recent global policy guidelines also recommend addressing psychosocial barriers like fatalism alongside literacy efforts. The WHO (2020) Global Cancer Strategy identifies both factors as crucial for designing equitable and sustainable early detection programs [47].

Conclusion

In this study, individuals were categorized into two groups based on their level of health awareness: "High Health Awareness" and "Low Health Awareness." Participants in the high-awareness group had higher levels of health literacy and more positive attitudes toward cancer screening, along with lower levels of health fatalism. Conversely, those in the low-awareness group demonstrated lower health literacy and screening attitudes, and higher fatalistic health beliefs.

These findings indicate that improving health literacy and reducing health fatalism can significantly enhance individuals' participation in cancer screenings. This would not only improve individual health outcomes but also lead to substantial gains in overall public health.

From a public health perspective, implementing community-based interventions aimed at increasing health literacy and addressing fatalistic beliefs can help promote early diagnosis and reduce the burden of disease. Developing health policies that incorporate these psychosocial factors will contribute to the improvement of national health indicators and support the adoption of a more sustainable and effective public health strategy in the fight against cancer.

Limitations

This study has some limitations. First, it was conducted in a single province in eastern Turkey, which limits the generalizability of the findings to other regions. Since the data were collected through self-report scales, responses may be affected by recall or social desirability bias. Additionally, cultural factors such as religious fatalism may differ across populations, which could limit the broader applicability of the results. Finally, some potentially influential variables—such as personal or family history of cancer or previous screening experience—were not included in the analysis.

Abbreviations

IARC	International Agency for Research on Cancer
AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
LPA	Latent Profile Analysis
SABIC	Sample size-Adjusted BIC
CAIC	Consistent AIC
AWE	Adjusted Weight of Wvidence
CLC	Classification Likelihood Criterion
KIC	Kullback–Leibler Information Criterion
ICL	Integrated Classification Likelihood
LMR	Lo-Mendell-Rubin Likelihood Ratio Test

Acknowledgements

We thank the participants for taking part in the study.

Authors' contributions

1. Study design: F.U, H.E, M.Y, N.Ç 2. Data collection: H.E, F.U, N.Ç 3. Data analysis: M.Y, H.E 4. Study supervision: F.U, H.E, M.Y. 5.Manuscript writing: F.U, H.E, M.Y, N.Ç 6. Critical revisions for important intellectual content: F.U, H.E, M.Y, N.Ç

Funding

This study is funded by Sakarya University.

Data availability

Datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Approval for the research was obtained from the Ethics Committee of a State University (08.11.2023/9–73). Since individual rights should be protected in the research, the Helsinki Declaration of Human Rights was adhered to throughout the study. Written voluntary consent was obtained from all participants before the data collection process. Participants were informed about the purpose, scope and voluntary participation of the study; the research process was carried out in accordance with the principles of confidentiality and anonymity.

Consent for publication

Not applicable. This manuscript does not include identifying images or personal or clinical details of participants that compromise anonymity.

Competing interests

The authors declare no competing interests.

Received: 18 January 2025 Accepted: 21 May 2025
Published online: 03 June 2025

References

1. Ferlay J, Colombet M, Soerjomataram I, Parkin DM, Piñeros M, Znaor A, Bray F. Cancer statistics for the year 2020: An overview. Int J Cancer. 2021;149(4):778–89.
2. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A: Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: Can J Clin. 2024, 74(3):229–263.
3. Global Cancer Observatory: Cancer Today. https://gco.iarc.who.int/today.
4. Sarı C, Adıgüzel L, Demirbağ BC. The relationship between men's health literacy levels and their health beliefs and attitudes towards prostate cancer screening: A case study in a rural area. Support Care Cancer. 2024;32(9):612.
5. Büyüközmen E, Babaoğlu A, Can F. İzmir'de Toplumda Kanser Tarama Testleri Farkındalığı ve Bireylerin Kanser Tarama Testlerine Katılımını Etkileyen Faktörler. Med J Western Black Sea. 2021;5(2):173–81.
6. Kanser İstatistikleri. https://hsgm.saglik.gov.tr/tr/kanser-istatistikleri.html.
7. Turkey Cancer Control Programme . https://www.iccp-portal.org/system/files/plans/Ulusal_Kanser_Kontrol_Plani_2013_2018.pdf.
8. Poon PK, Tam KW, Lam T, Luk AK, Chu WC, Cheung P, Wong SY, Sung JJ. Poor health literacy associated with stronger perceived barriers to breast cancer screening and overestimated breast cancer risk. Front Oncol. 2023;12:1053698.
9. Yalçın Gürsoy M, Bulut Ayaz C. Does Health Literacy Affect Colorectal Cancer Screening Rates? J Community Health Nurs. 2023;40(2):147–56.
10. Zanobini P, Bonaccorsi G, Giusti M, Minardi V, Possenti V, Masocco M, Garofalo G, Mereu G, Cecconi R, Lorini C: Health literacy and breast cancer

screening adherence: results from the population of Tuscany, Italy. Health Promotion Int. 2023, 38(6):daad177.
11. Baccolini V, Isonne C, Salerno C, Giffi M, Migliara G, Mazzalai E, Turatto F, Sinopoli A, Rosso A, De Vito C. The association between adherence to cancer screening programs and health literacy: A systematic review and meta-analysis. Prev Med. 2022;155: 106927.
12. Duru G, Topatan S. A barrier to participation in cervical cancer screenings: fatalism. Women Health. 2023;63(6):436–44.
13. Clarke N, Kearney PM, Gallagher P, McNamara D, O'Morain CA, Sharp L. Negative emotions and cancer fatalism are independently associated with uptake of Faecal Immunochemical Test-based colorectal cancer screening: Results from a population-based study. Prev Med. 2021;145: 106430.
14. Brevik TB, Sæther KW. Approaching religious fatalism in cancer screening education. J Eval Clin Pract. 2024;30(5):842–7.
15. Cohen M, Rosenfeld M, Greenblatt-Kimron L: Associations between cancer fatalism, causal attributions, and perceptions of benefits and barriers to screening for colorectal cancer. Int J Behavioral Med. 2022:1–10.
16. Guo XM, Tom L, Leung I, O'Brian C, Zumpf K, Simon M. Associations between fatalistic cancer beliefs and cancer-screening behaviors in Chinese American immigrant women. J Immigr Minor Health. 2021;23:699–706.
17. Perrodin-Njoku EC, Rao SR, Moreland CJ, Wang RM, Kushalnagar P. Cancer Worry and Fatalism at the Intersection of Race and Hearing Status. Cancer Control. 2024;31:10732748241291616.
18. Han B, Baysal HY. Relationship of Women's Breast Cancer Fatalism Perceptions with Health Beliefs and Early Diagnosis Behaviors. Adv Women's Stud. 2024;6(2):38–47.
19. Zaidi M, Sarkar S, Arakelyan S, Poghosyan H. Relationship Between Fatalistic Cancer Beliefs and Risky Health Behaviors. West J Nurs Res. 2024;46(10):757–65.
20. Cohen J. Statistical power analysis. Curr Dir Psychol Sci. 1992;1(3):98–101.
21. Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, Poole C, Schlesselman JJ, Egger M. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. Epidemiology. 2007;18(6):805–35.
22. Franklin MD, Schlundt DG, Wallston KA. Development and validation of a religious health fatalism measure for the African-American faith community. J Health Psychol. 2008;13(3):323–35.
23. Bobov G, Capik C. The reliability and validity of the religious health fatalism scale in Turkish language. J Relig Health. 2020;59(2):1080–95.
24. Öztürk ENY, Uyar M, Şahîn TK: Development of an attitude scale for cancer screening. Turkish J Oncol. 2020, 35(4).
25. Suka M, Odajima T, Kasai M, Igarashi A, Ishikawa H, Kusama M, Nakayama T, Sumitani M, Sugimori H. The 14-item health literacy scale for Japanese adults (HLS-14). Environ Health Prev Med. 2013;18(5):407–15.
26. Türkoğlu N, Kılıc D. Sağlık Okuryazarlığı Ölçeğinin Türkçeye Uyarlaması: Geçerlilik ve Güvenilirlik Çalışması. Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi. 2021;24(1):25–33.
27. Tabachnick BG, Fidell LS, Ullman JB: Using multivariate statistics, vol. 6: pearson Boston, MA; 2013.
28. Gabriel AS, Daniels MA, Diefendorff JM, Greguras GJ. Emotional labor actors: a latent profile analysis of emotional labor strategies. J Appl Psychol. 2015;100(3):863–79.
29. Scrucca L, Fraley C, Murphy TB, Raftery AE: Model-based clustering, classification, and density estimation using mclust in R: Chapman and Hall/CRC; 2023.
30. Rosenberg JM, Beymer PN, Anderson DJ, Van Lissa C, Schmidt JA. tidyLPA: An R package to easily carry out latent profile analysis (LPA) using open-source or commercial software. J Open Source Software. 2019;3(30):978.
31. Akogul S, Erisoglu M. An approach for determining the number of clusters in a model-based cluster analysis. Entropy. 2017;19(9):452.
32. Tein J-Y, Coxe S, Cham H. Statistical power to detect the correct number of classes in latent profile analysis. Struct Equ Modeling. 2013;20(4):640–57.
33. Ferguson SL, G. Moore EW, Hull DM: Finding latent groups in observed data: A primer on latent profile analysis in Mplus for applied researchers. Int J Behavioral Development 2020, 44(5):458–468.
34. Sørensen K, Pelikan JM, Röthlin F, Ganahl K, Slonska Z, Doyle G, Fullam J, Kondilis B, Agrafiotis D, Uiters E, et al. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). Eur J Public Health. 2015;25(6):1053–8.
35. Rakhshkhorshid M, Navaee M, Nouri N, Safarzaii F. The Association of Health Literacy with Breast Cancer Knowledge, Perception and Screening Behavior. Eur J Breast Health. 2018;14(3):144–7.
36. Roh S, Burnette CE, Lee YS, Jun JS, Lee HY, Lee KH. Breast cancer literacy and health beliefs related to breast cancer screening among American Indian women. Soc Work Health Care. 2018;57(7):465–82.
37. Yılmazel G. Health literacy, mammogram awareness and screening among tertiary hospital women patients. J Cancer Educ. 2018;33:89–94.
38. Tayhan A, Özmen D. Relationship between knowledge levels of men about prostate cancer screenings and their health literacy. Cukurova Med J. 2019;44:233–40.
39. Holden CE, Wheelwright S, Harle A, Wagland R. The role of health literacy in cancer care: a mixed studies systematic review. PLoS ONE. 2021;16(11): e0259815.
40. Zhang L, Jiang S. Examining the Role of Information Behavior in Linking Cancer Risk Perception and Cancer Worry to Cancer Fatalism in China: Cross-Sectional Survey Study. J Med Internet Res. 2024;26: e49383.
41. Bakır G: Kadınların meme kanseri korkusu, kadercilik algısı ve seçilmiş faktörlerin erken tanı davranışlarına etkisi. İzmir: İzmir Ekonomi Üniversitesi; 2022.
42. Bakan AB, Aslan G, Yıldız M. Determination of Breast Cancer Fatalism in Women and the Investigation of the Relationship Between Women's Cervical Cancer and Pap Smear Test Health Beliefs with Religious Orientation and Fatalism. J Relig Health. 2021;60(3):1856–76.
43. Foust D: Fatalism and Cervical Cancer Screening Beliefs and Behaviors in a Medically Underserved Population in Southern California: A Pilot Study. Masters Thesis. California State University, San Marcos; 2018.
44. Marván ML, Ehrenzweig Y, Catillo-López RL. Fatalistic Beliefs and Cervical Cancer Screening Among Mexican Women. Health Care Women Int. 2016;37(1):140–54.
45. Güneş D, Başkan SA. Does Fatalism Affect Cancer Screenings? J Oncol Sci. 2024;10(1):1–8.
46. Chen M, Kim HK. Cancer fatalism in the information age: a meta-analysis of communicative and behavioral correlates. Commun Res. 2024;51(1):83–111.
47. Organization WH: Global strategy to accelerate the elimination of cervical cancer as a public health problem: World Health Organization; 2020.

Publisher's Note