



The association between religiosity, spirituality, and breast cancer screening: A cross-sectional analysis of Alberta's Tomorrow Project

Susan Mirabi¹, Ashok Chaurasia, Mark Oremus^{*}

School of Public Health Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

ARTICLE INFO

Keywords:

Screening
Cancer
Breast
Religion
Spirituality
Mammography
Alberta's Tomorrow Project

ABSTRACT

Breast cancer is the leading cause of cancer-related mortality among women. Screening permits the early detection and treatment of malignancies, thereby reducing mortality. A woman's religiosity and spirituality (R/S) may facilitate screening through encouragement of healthy behaviors. Population-level data from Alberta's Tomorrow Project (ATP) were used to explore the cross-sectional association between R/S and breast cancer screening among women aged 50 to 69 years who did not have a history of breast cancer. Two variables were used to measure R/S: (1) R/S Saliency was defined as the importance of religion and spirituality in one's life; (2) R/S Attendance was defined as the frequency of attendance at religious or spiritual services. We regressed breast cancer screening (mammogram: yes/no) on each R/S variable in separate multivariable logistic regression models. At baseline ($n = 2569$), 94% of women reported receiving a mammogram. Greater R/S Saliency was not associated with receipt of mammogram: the adjusted odds ratio (aOR) was 1.04 (95% confidence interval [CI]: 0.71–1.51). R/S Attendance also showed no association with mammogram: attending at least once monthly versus never attending (aOR: 1.10; 95% CI: 0.71–1.69); attending one to four times yearly versus never attending (aOR: 0.95, 95% CI: 0.57–1.58). Further research could examine specific subgroups of the population, e.g., whether use of R/S to promote breast cancer screening may be more effective among females with strong pre-existing connections to faith.

1. Introduction

Breast cancer is the most diagnosed cancer among females globally and it is the leading cause of cancer death in women (Bray et al., 2018; Brenner et al., 2020). The Canadian Task Force on Preventive Health Care (CTFPHC) and the United States Preventive Services Task Force (USPSTF) both recommend biennial breast cancer screening via mammography for women between 50 and 74 years of age (Canadian Task Force on Preventive Health Care, 2019; Siu, 2016). Mammography screening has been found to reduce breast cancer mortality in women by 40% (Seely and Alhassan, 2018). As well, screening reduces morbidity and medical costs because the detection of cancer in its early stages often permits the use of less invasive therapies to treat the illness (Seely and Alhassan, 2018).

Despite the successful uptake of breast cancer screening in many countries, not all eligible women are screened for the disease. For example, 62% of female respondents to the Canadian Community Health

Survey, aged between 50 and 69 years, reported receiving mammograms over the two years prior to the survey (Canadian Partnership Against Cancer, 2017). Therefore, opportunities exist to increase screening rates by investigating factors associated with screening behavior in eligible women who do not get screened.

Religion and spirituality (R/S) may be positively associated with screening behavior (Leyva et al., 2015). The overlapping concepts of religion and spirituality often involve a connection between the individual and a sacred being or supernatural force. Religion is a set of organized beliefs and practices related to community traditions and governed through institutional structures, e.g., 'organized religion'. Spirituality is a more personalized and individual relationship with divinity, often expressed through private prayer and devotion instead of through the established practices of a religious organization (Koenig et al., 2012).

Not all religious or spiritual belief systems rely on a connection between an individual and a supernatural force. For example, nontheistic

^{*} Corresponding author.

E-mail address: moremus@uwaterloo.ca (M. Oremus).

¹ Author's present institutional address is the following: Faculty of Health Sciences, Department of Health Research Methods, Evidence & Impact, McMaster University, Hamilton, Ontario L8S 4L8, Canada.

<https://doi.org/10.1016/j.pmedr.2022.101726>

Received 23 August 2021; Received in revised form 31 January 2022; Accepted 5 February 2022

Available online 9 February 2022

2211-3355/© 2022 The Author(s).

Published by Elsevier Inc.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

belief systems are characterized by the absence of a belief in one or more gods and are often based on seeking philosophical knowledge or achieving states of betterment or enlightenment (e.g., achieving Nirvana in Buddhism). Nontheistic belief systems were captured under the umbrella of spirituality in this research.

R/S regulate health behaviors (Kretzler et al., 2020; Litalien et al., 2021). For example, the Bible states that Christians should maintain good physical health to honor their bodies and become closer to God (1 Corinthians 6:19–20); the Qur'an prohibits Muslims from consuming alcohol (Al Qur'an 5:90) due to the adverse health and social consequences of alcohol dependence. Regulation of health behaviors is not the only means by which R/S exert positive impacts on health. Ellison and Levin's (1998) seminal examination of the connection between religion and health also lists factors such as the provision of social support and self-coping resources, generation of positive emotions and self-perceptions, and encouragement of lifestyle choices that confer health benefits (e.g., centering life around marriages and families, discouraging consumption of meat or spicy foods). Taken together, these factors suggest R/S can provide additional motivation for women to engage in health-seeking behaviors, thereby prompting the question as to whether an association exists between R/S and breast cancer screening. We explored this issue via the following question: does an association exist between R/S and breast cancer screening in a population-level sample of adult females in Alberta, Canada?

We note that one other Canadian study (Speed, 2018) examined the association between three R/S variables and mammography in a sample of persons from two Canadian provinces and reported equivocal results. Given the general thrust of the primarily American-focused literature on R/S and screening, which reports positive associations, we wanted to examine whether these earlier Canadian results were an aberration or perhaps indicative of the situation in Canada.

2. Methods

Data came from Alberta's Tomorrow Project (ATP), a panel study designed to investigate risk and protective factors for cancer and other chronic conditions (Alberta Health Services, 2019). ATP conducted recruitment using a two-stage sampling design: the first stage involved the use of random digit dialing to identify households in the territories of the Regional Health Authorities (RHAs) that existed in Alberta between 2000 and 2008; the second stage involved identifying one or more individuals within an identified household who were willing to be enrolled within the study. The random digit dialing procedure captured most Albertans because 97% of households during the recruitment period had a land-based telephone line. Further details of the sampling and recruitment methods are available elsewhere (Robson et al., 2016).

ATP enrolled participants between 35 and 69 years of age who had no known history of cancer (except non-melanoma skin cancer), planned to reside in the Canadian province of Alberta for at least one year, and could complete mailed study questionnaires in English. We excluded all males and females aged less than 50 years or greater than 69 years from the analytical sample. The female exclusion criterion removed participants who fell outside of the range of women whom the CTFPHC recommended for breast cancer screening.

Data came from ATP's baseline Health and Lifestyle Questionnaire (HLQ), which asked participants about personal health, reproductive history, family history, psychosocial factors, anthropometric measures, use of cancer screening services, smoking behavior, sun exposure and socio-demographic characteristics (Alberta Health Services, 2019). ATP conducted rolling recruitment and our analysis included baseline data from females enrolled between 2001 and 2009. Further information about ATP is available elsewhere (Alberta Health Services, 2019). The University of Waterloo's Office of Research Ethics approved our study (file # 21726).

2.1. Exposure variables

The HLQ included two questions about religion and spirituality (R/S). We referred to the first question as R/S Saliency: "Do spirituality values or faith [religion] play an important role in your life"? Participants responded "Yes" or "No", with "No" being the reference category for the regression analyses described below. The second question was R/S Attendance: "Other than on special occasions (such as weddings, funerals or baptisms), have you attended religious services or spiritual meetings in the past 12 months"? The original version of R/S Attendance in the HLQ contained five response categories (Supplementary Material – Appendix A), which we collapsed into three categories to avoid low cell counts: "Once a month or more", "1 to 4 times per year", or "Not at all", using "Not at all" as the reference category.

2.2. Outcome variable

Breast cancer screening behavior was the outcome variable. Participants were asked "Have you ever had a mammogram (a breast x-ray)?" Responses were "Yes" or "No", with "No" serving as the reference category.

2.3. Covariates

We included several covariates in the regression models, chosen based on previously published literature (Allen et al., 2014; Azaiza et al., 2010; Benjamins and Brown, 2004; Benjamins et al., 2011; Husaini et al., 2002; Katz et al., 2008; Kinney et al., 2002; McFall and Davila, 2008; Melvin et al., 2016; Nguyen et al., 2012; O'Reilly et al., 2013; Ochoa-Frongia et al., 2012; Sen and Kumkale, 2016; Steele-Moses et al., 2009) and their availability in the HLQ: marital status, education, income, employment status, age, smoking status, self-rated health, presence of chronic diseases, and functional social support (Supplementary Material - Appendix A).

2.4. Statistical analyses

All data were explored descriptively using means, standard deviations, and histograms for continuous variables, and bar charts and frequency tables for categorical variables. We used logistic regression and the PROC LOGISTIC procedure in SAS v9.4 (The SAS Institute, Cary NC) to model the cross-sectional associations between R/S and breast cancer screening. The alpha (α) level was 5%.

We built separate sets of regression models for R/S Saliency as the main exposure variable and R/S Attendance as the main exposure variable. This reflected inherent differences between the two variables. Saliency measures the self-perceived importance of R/S in one's life; attendance measures participation in R/S events.

Each set of regression models contained a crude model and a full model. The crude model regressed mammography screening on the R/S variable in question. The full model incorporated all the covariates described above. For each model, participants with missing data on any covariate were excluded from the analysis. We used PROC QLIM in SAS to obtain the marginal effects of the R/S variables on mammography, adjusted for the covariates. The marginal effect is the change in probability of ever having a mammogram for each level of R/S Saliency or R/S Attendance, compared to the variable's reference category.

To explore whether the effects of both R/S variables would change when they were considered together, we ran a third full model that contained both R/S Saliency and R/S Attendance as independent variables, along with the aforementioned covariates.

3. Results

Over 11,000 participants were enrolled in ATP and completed the HLQ. After removing all males and retaining females aged between 50

and 69 years (Canadian Task Force on Preventive Health Care, 2019; Siu, 2016), and removing females for whom we had no data on exposure, outcome, or covariates (Fig. 1, our final analytical sample included 2569 females whose mean age was 57 years (standard deviation [SD]: 5.5).

Approximately 76% of women responded that religion or spirituality was important to them (“yes” response to R/S Salience) and 82% said they attended religious or spiritual services at least once in the past 12 months (Fig. 2). Ninety-four percent of women reported ever receiving a mammography. Almost 25% of women reported annual earnings \geq \$100,000. The perceived health of the analytical sample was high, with most women reporting very good (48%) or excellent (24%) health. Most of the analytical sample (87%) reported having at least one chronic condition and a majority with 13% reporting having two or more chronic conditions, and <1% reporting having none. Most patients did not have a history of prior cancer as a prior history was reported among only 2% of patients. Regarding smoking status, most women were non-smokers (49%) or former smokers (38%). Table 1 and Appendix B in the Supplementary Material outline the sample characteristics.

3.1. Regression analysis

Results of the crude and fully adjusted models for both R/S Salience and R/S Attendance are reported in Tables 2 and 3, respectively. The crude model for R/S Salience suggested an approximately 2% greater odds of getting a mammography among women who considered R/S to be important compared to women who did not (odds ratio [OR]:1.02, 95% confidence interval [CI]: 0.72 to 1.46). The crude estimate for R/S Attendance suggested that women who attended R/S services between one and four times a year had 5% greater odds of getting a mammogram (OR:1.05; 95% CI: 0.64 to 1.72), and women who attended services at least once a month had 20% greater odds of obtaining a mammogram (OR:1.20; 95% CI: 0.79 to 1.83) compared to women who did not attend

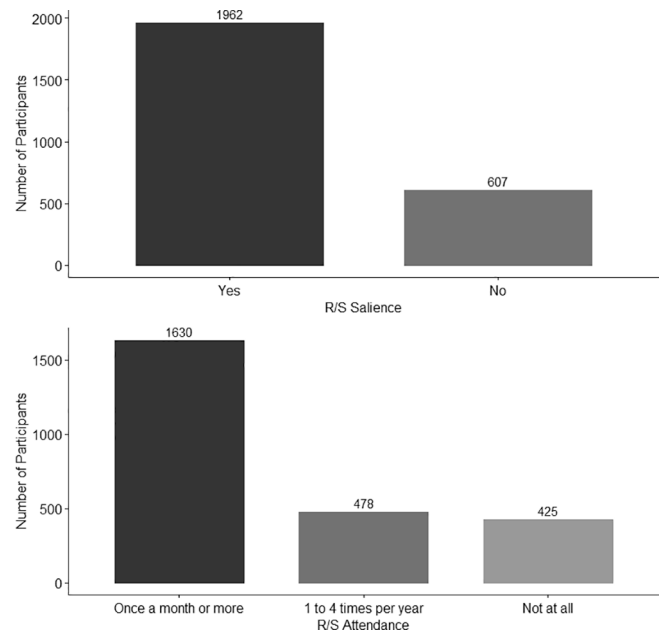


Fig. 2. Distribution of Participants – Religion/Spirituality Salience and Attendance.

services at all. However, the crude associations for both R/S Salience and R/S Attendance were not statistically significant, and the bounds of the confidence intervals suggested the associations could be negative or positive.

The adjusted regression models also suggested that women who were religious or spiritual had greater odds of getting screened for breast

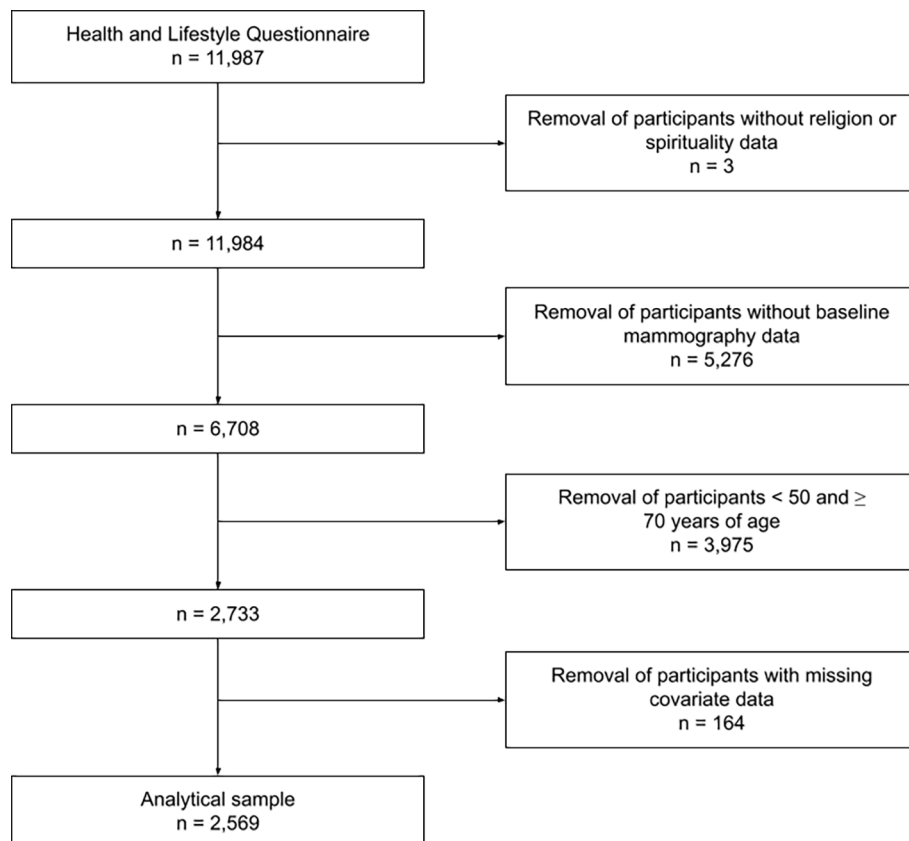


Fig. 1. Derivation of Analytical Sample.

cancer compared to women who were not. Women who considered R/S to be important had 4% greater odds of ever having a mammogram compared to women who did not consider R/S to be important (adjusted odds ratio [aOR]:1.04, 95% CI: 0.71 to 1.51). Women who attended religious or spiritual services once a month or more had 10% greater odds of having a mammogram compared to women who did not attend any religious or spiritual services (aOR: 1.10, 95% CI: 0.71 to 1.69). Women who attended services between one and four times per year had 5% lower odds of ever having a mammogram (aOR: 0.95, 95% CI: 0.57 to 1.58) compared to women who did not attend religious/spiritual services. As with the crude results, none of the aORs were statistically significant and the bounds of the confidence intervals suggested the associations could be positive or negative.

The marginal effect was 0.002 (95% CI: 0.000 to 0.007) for women who considered R/S to be important compared to women who did not consider R/S to be important. The marginal effects were 0.006 (95% CI: 0.000 to 0.018) for attending services once a month or more, and -0.003 (95% CI: -0.010 to 0.000) for attending between one and four times a year, versus never attending.

When R/S Salience and R/S Attendance were both entered into the same regression model, controlling for all covariates (area under the curve = 0.67; Akaike information criterion = 1216.8), the direction of effect for R/S Salience reversed itself from the model described above, although the point estimate aOR remained statistically nonsignificant (aOR: 0.94, 95% CI: 0.58 to 1.53). For R/S Attendance, the aORs remained largely unchanged from the model described above: (1) the aOR for attending once a month or more versus never was 1.15 (95% CI: 0.66 to 1.98); (2) the aOR for attending between one and four times per year versus never was 0.97 (95% CI: 0.57 to 1.66).

3.2. Discussion

The results suggested statistically non-significant adjusted associations between both R/S Salience and R/S Attendance, and mammography, in this Canadian sample. The true direction of effect between both R/S variables and breast cancer screening was uncertain due to confidence intervals that included the null value. These equivocal findings may have emerged in part because of the absence of temporality in the cross-sectional analysis. Indeed, the outcome asked women to report whether they had ever received a mammogram, whereas the exposure asked women to identify their R/S behavior within the past 12 months.

Previously published literature (primarily cross-sectional studies) reported positive and statistically significant associations between R/S and breast cancer screening (Allen et al., 2014; Azaiza et al., 2010; Benjamins and Brown, 2004; Benjamins et al., 2011; Leyva et al., 2015; McFall and Davila, 2008; Melvin et al., 2016; Nguyen et al., 2012; O'Reilly et al., 2013; Ochoa-Frongia et al., 2012; Sen and Kumkale, 2016; Steele-Moses et al., 2009). For example, in a sample of 37,140 women, O'Reilly et al. (2013) reported that Irish women with no religious affiliation had 30% lower odds of being screened for breast cancer compared to Irish women with a Catholic background (aOR: 0.77, 95% CI: 0.71–0.83). Similarly, McFall and Davila (McFall and Davila, 2008) reported a positive association between church attendance and mammography in 4,419 non-institutionalized participants aged between 70 and 85 years, although the association was not statistically significant (OR: 1.28, 95% CI: not reported; $p = 0.16$). As with our study, both O'Reilly et al. (2013) and McFall and Davila (2008) conducted analyses using large samples of women ($n = 37,140$ and $n = 2,846$, respectively).

Our analyses involved a population-based sample of mainly white women ($n = 2,569$), while most analyses in the published literature were conducted in smaller samples of women ($n \sim 100$ to 1000) who were recruited from specific cities and municipalities in the United States. Many studies also enrolled subsets of women from specific ethnic communities, including African American (Melvin et al., 2016; Ochoa-

Frongia et al., 2012), Vietnamese (Nguyen et al., 2012), or Hispanic (Allen et al., 2014; Melvin et al., 2016). Smaller samples focusing on specific racial or ethnic minorities may capture behaviors or beliefs that are not evident in larger population samples incorporating women from multiple different backgrounds.

Speed's (2018) secondary data analysis of 1,687 women in two Canadian provinces found positive associations between religious attendance and lifetime use of mammograms, although the confidence intervals were wide and a dose-response relationship between gradients of attendance and mammograms was not evident. Further, Speed did not find statistically significant associations between perceived religiosity and lifetime use of mammograms. These findings align with our results and suggest the association between R/S and mammography may be more equivocal in Canada compared to the United States. Speed (2018) writes that Canadian versus American differences may be attributable to the public versus private nature of the two countries' healthcare systems, and to cultural aspects of the populations, with Canadians being less religious on average than Americans.

Estimates from 2018 by the Centers for Disease Control and Prevention (CDC) showed that 72.8% of women aged 40 years or over in the United States reported a mammography within the past two years (National Cancer Institute, 2021). Data from the Canadian Partnership Against Cancer (CPAC) reported between 62% and 72% of Canadian women aged 50 to 69 years had a mammogram in 2011 or 2012 (Canadian Partnership Against Cancer, 2017). These percentages are lower than what was observed among our analytical sample, where over 90% of women reported having ever received a mammogram. Unlike data from the CDC or CPAC, which assessed women's mammography within a time frame of two years, our analysis was cross-sectional and assessed whether women had obtained a mammogram at any point in their lifetime. While the high rate of mammography screening in our analytical sample may partially be attributable to the successes of public health campaigns encouraging women to proactively get screened for breast cancer, selection bias could also have contributed to the effect sizes observed in the analyses. Women who agreed to participate in ATP might have been more health conscious and more likely to follow cancer screening guidelines than nonparticipants.

Despite the high screening rate observed in ATP, public health promotion of breast cancer screening is warranted, especially in targeted settings where screening messages may receive wider receptivity, because screening rates remain less than optimal in many jurisdictions. For example, only 54% of women in Canada reported a mammogram as part of an organized screening program, leaving a large proportion of women open to opportunistic screening (Canadian Partnership Against Cancer, 2017). Since we found non-statistically significant results in our study, R/S may not be conducive to promoting breast cancer screening among women at the population level. Instead, as previous literature has suggested, R/S may be better suited to promote screening in specific subpopulations (Allen et al., 2014; Nguyen et al., 2012; Ochoa-Frongia et al., 2012; Steele-Moses et al., 2009).

With regard to screening in subpopulations, one systematic review conducted among women from Muslim-majority countries who resettled in the United States found that women who were religious reported their beliefs placed importance on the maintenance of health and encouraged learning more information about chronic conditions, including cancer (Siddiq et al., 2020). While preventive services were reported to be underutilized in this group, the use of R/S was suggested as being a useful method to address barriers to screening that some subpopulations may face. A qualitative study of Persian women in Iran found that religion not only provided meaning and purpose in life, but also affected perceptions of health, illness, and disease (Safizade et al., 2020). Overall, the authors of the qualitative study concluded that having a greater sense of meaning and purpose in life encouraged the uptake of health behaviors. Another study found that cancer fatalism was higher among Blacks and Hispanics compared to Whites, and R/S attendance was inversely associated with cancer fatalism (Leyva et al., 2020). These

results suggested that use of R/S may beneficially impact opinions about cancer screening, especially among certain ethnic subpopulations.

Since the tenets of R/S include a health-centric focus, R/S communities may serve as one of the specific subpopulations described above. Women could be presented with screening messages during religious services or through mediums such as religious-affiliated websites. Public health authorities in the United States have successfully utilized religious venues to implement health promotion campaigns. For example, campaigns to increase physical activity have been implemented in underserved communities in the United States by delivering important public health messaging through faith-based organizations (Haughton et al., 2020). Targeting religious or spiritual institutions, such as churches, also targets important social environments that may influence individual's thinking and behavior, including cancer screening. The utilization of religious or spiritual locations may further provide support for use of healthcare resources and encourage screening through platforms of worship which are important to individuals. This may be useful to address underutilization of breast cancer screening, which has been reported among ethnic subpopulations in Canada (Racine et al., 2021; Vahabi et al., 2017).

3.3. Strengths

Our study focused on mammography, which is the gold-standard for breast cancer screening. In addition, we used data from ATP, a large and population-based sample with a wealth of information on participants' health and sociodemographic information. The richness of the ATP dataset also allowed us to include many covariates relevant to R/S and cancer screening, thereby reducing the potential for residual confounding in the regression analyses. In addition, much of the existing research in this area was undertaken in samples from the United States. Our research added to the current body of Canadian literature on the subject by supplementing previous work conducted in other provincial samples (Speed, 2018), or in highly-select samples of women from particular religious faiths (Lofters et al., 2018; Vahabi and Lofters, 2016). Of note, our measure of R/S Saliency was different from the three R/S measures used in Speed's (2018) study. Given the complexity of religion and spirituality, and the resulting multiplicity of different measures of these constructs, our work demonstrated that the equivocal results linking R/S and breast cancer screening in Canada were robust across different measures of R/S.

3.4. Limitations

We did not include an ethno-cultural variable because ATP captured ethnicity in over 20 response categories. These categories could not easily be combined for analysis due to their non-mutually exclusive nature. We were also unable to adjust for participants' religious denominations because ATP did not collect these data. Our findings pertain to the means of measuring R/S in ATP, which may limit comparisons with studies that utilized different measures of R/S. However, R/S has frequently been assessed with self-reported frequencies of religious or spiritual service attendance (Allen et al., 2014; Benjamins and Brown, 2004; Benjamins et al., 2011; McFall and Davila, 2008). Our two measures of R/S-saliency and attendance-did not capture the totality of the constructs of religion and spirituality; therefore, interpretations of our research are limited to the impact of saliency and attendance on breast cancer screening.

4. Conclusion

We found statistically nonsignificant associations between R/S and breast cancer screening among Albertan women enrolled in ATP. Our work aligns with recent publications showing equivocal results for religion as a protective factor for health (e.g., Hill et al. (2020) and their research on religious attendance and cognitive function in later life).

Future research should include broader measures of R/S and move from cross-sectional to longitudinal data analyses (Suh et al., 2019).

Funding

The specific analyses of Alberta's Tomorrow Project data reported in this paper were undertaken without any grant from funding agencies in the public, commercial, or not-for-profit sectors.

The research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRedit authorship contribution statement

Susan Mirabi: Conceptualization, Methodology, Software, Data curation, Writing – original draft. **Ashok Chaurasia:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration. **Mark Oremus:** Methodology, Software, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Alberta's Tomorrow Project is only possible due to the commitment of its research participants, its staff, and its funders: Alberta Health and the Alberta Cancer Prevention Legacy Fund, Alberta Cancer Foundation, Canadian Partnership Against Cancer and substantial in-kind funding from Alberta Health Services. The views expressed herein represent the views of the authors and not of Alberta's Tomorrow Project or any of its funders.

The authors wish to thank Dr. John Garcia for his advice throughout the project, and we wish him a happy retirement.

Ethical approval

This study received ethic clearance from the University of Waterloo's Office of Research Ethics (file# 21726).

Data Statement

Persons interested in accessing the data used to conduct this study are required to submit a data access application to Alberta's Tomorrow Project.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2022.101726>.

References

- Alberta Health Services. (2019). All About Alberta's Tomorrow Project. *Alberta's Tomorrow Project*. <https://myatp.ca/about-atp>.
- Allen, J.D., Pérez, J.E., Pischke, C.R., Tom, L.S., Juarez, A., Ospino, H., Gonzalez-Suarez, E., 2014. Dimensions of religiousness and cancer screening behaviors among church-going Latinas. *J. Relig. Health* 53 (1), 190–203. <https://doi.org/10.1007/s10943-012-9606-9>.
- Azaiza, F., Cohen, M., Awad, M., Daoud, F., 2010. Factors associated with low screening for breast cancer in the Palestinian Authority: relations of availability, environmental barriers, and cancer-related fatalism. *Cancer* 116 (19), 4646–4655. <https://doi.org/10.1002/cncr.v116:1910.1002/cncr.25378>.
- Benjamins, M.R., Brown, C., 2004. Religion and preventative health care utilization among the elderly. *Social Sci. Med.* 58 (1), 109–118. [https://doi.org/10.1016/S0277-9536\(03\)00152-7](https://doi.org/10.1016/S0277-9536(03)00152-7).

- Benjamins, M.R., Ellison, C.G., Krause, N.M., Marcum, J.P., 2011. Religion and preventive service use: do congregational support and religious beliefs explain the relationship between attendance and utilization? *J. Behav. Med.* 34 (6), 462–476. <https://doi.org/10.1007/s10865-011-9318-8>.
- Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L., Torre, L.A., Jemal, A., 2018. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J. Clin.* 68 (6), 394–424. <https://doi.org/10.3322/caac.v68.6.10.3322/caac.21492>.
- Brenner, D.R., Weir, H.K., Demers, A.A., Ellison, L.F., Louzado, C., Shaw, A., Turner, D., Woods, R.R., Smith, L.M., 2020. Projected estimates of cancer in Canada in 2020. *Can. Med. Assoc. J.* 192 (9), E199–E205. <https://doi.org/10.1503/cmaj.191292>.
- Canadian Partnership Against Cancer. (2017). *Breast Cancer Screening in Canada: Monitoring and Evaluation of Quality Indicators - Results Report, January 2011 to December 2012*. <https://www.partnershipagaincancer.ca/wp-content/uploads/2019/01/Breast-Cancer-Screen-Quality-Indicators-Report-2012-EN.pdf>.
- Canadian Task Force on Preventive Health Care. (2019). *CTFPHC Recommendation for Screening for Breast Cancer with Mammography*. Canadian Task Force on Preventive Health Care. <https://canadiantaskforce.ca/wp-content/uploads/2016/06/2011-breast-cancer-clinician-mammography-recommendation-en.pdf>.
- Ellison, C.G., Levin, J.S., 1998. The religion-health connection: evidence, theory, and future directions. *Health Educ. Behav.* 25 (6), 700–720. <https://doi.org/10.1177/109019819802500603>.
- Houghton, J., Takemoto, M.L., Schneider, J., Hooker, S.P., Rabin, B., Brownson, R.C., Arredondo, E.M., 2020. Identifying barriers, facilitators, and implementation strategies for a faith-based physical activity program. *Implem. Sci. Commun.* 1, 51. <https://doi.org/10.1186/s43058-020-00043-3>.
- Hill, T.D., Carr, D.C., Burdette, A.M., Dowd-Arrow, B., 2020. Life-course religious attendance and cognitive functioning in later life. *Res. Aging* 42 (7–8), 217–225. <https://doi.org/10.1177/0164027520917059>.
- Husaini, B.A., Sherkat, D.E., Levine, R., Bragg, R., Van, C.A., Emerson, J.S., Montes, C.M., 2002. The effect of a church-based breast cancer screening education program on mammography rates among African-American women. *J. National Med. Assoc.* 94 (2), 100–106.
- Katz, M.L., Kauffman, R.M., Tatum, C.M., Paskett, E.D., 2008. Influence of church attendance and spirituality in a randomized controlled trial to increase mammography use among a low-income, tri-racial, rural community. *J. Relig. Health* 47 (2), 227–236. <https://doi.org/10.1007/s10943-008-9159-0>.
- Kinney, A.Y., Emery, G., Dudley, W.N., Croyle, R.T., 2002. Screening behaviors among African American women at high risk for breast cancer: do beliefs about god matter? *Oncol. Nurs. Forum* 29 (5), 835–843. <https://doi.org/10.1188/02.Onf.835-843>.
- Koenig, H., King, D., Carson, V., 2012. *Handbook of Religion and Health*, 2nd. ed. Oxford University Press Inc., New York.
- Kretzler, B., König, H.-H., Hajek, A., 2020. Religious attendance and cancer screening behavior. *Front. Oncol.* 10 (2133) <https://doi.org/10.3389/fonc.2020.583925>.
- Leyva, B., Nguyen, A.B., Cuevas, A., Taplin, S.H., Moser, R.P., Allen, J.D., 2020. Sociodemographic correlates of cancer fatalism and the moderating role of religiosity: Results from a nationally-representative survey. *J. Prevent. Interv. Comm. 48* (1), 29–46. <https://doi.org/10.1080/10852352.2019.1617521>.
- Leyva, B., Nguyen, A.B., Allen, J.D., Taplin, S.H., Moser, R.P., 2015. Is religiosity associated with cancer screening? results from a national survey. *J. Relig. Health* 54 (3), 998–1013. <https://doi.org/10.1007/s10943-014-9843-1>.
- Litalien, M., Atari, D.O., Obasi, I., 2021. The influence of religiosity and spirituality on health in Canada: a systematic literature review. *J. Relig. Health*. <https://doi.org/10.1007/s10943-020-01148-8> [online ahead of print].
- Lofters, A.K., Slater, M., Vahabi, M., 2018. Cancer screening among patients who self-identify as Muslim: combining self-reported data with medical records in a family practice setting. *J. Immigr. Minor. Health* 20 (1), 44–50. <https://doi.org/10.1007/s10903-016-0508-x>.
- McFall, S.L., Davila, M., 2008. Gender, social ties, and cancer screening among elderly persons. *J. Aging Health* 20 (8), 997–1011. <https://doi.org/10.1177/0898264308324682>.
- Melvin, C.L., Jefferson, M.S., Rice, L.J., Cartmell, K.B., Halbert, C.H., 2016. Predictors of participation in mammography screening among Non-Hispanic Black, Non-Hispanic White, and Hispanic Women. *Front. Public Health* 4, 188. <https://doi.org/10.3389/fpubh.2016.00188>.
- National Cancer Institute. (2021). *Cancer Trends Progress Report*. National Cancer Institute. <https://progressreport.cancer.gov/>.
- Nguyen, A.B., Hood, K.B., Belgrave, F.Z., 2012. The relationship between religiosity and cancer screening among Vietnamese women in the United States: the moderating role of acculturation. *Women Health* 52 (3), 292–313. <https://doi.org/10.1080/03630242.2012.666225>.
- O'Reilly, D., Kinnear, H., Rosato, M., Mairs, A., Hall, C., 2013. Uptake of breast screening is influenced by current religion and religion of upbringing. *J. Relig. Health* 52 (4), 1168–1176. <https://doi.org/10.1007/s10943-011-9556-7>.
- Ochoa-Frongia, L., Thompson, H.S., Lewis-Kelly, Y., Deans-McFarlane, T., Jandorf, L., 2012. Breast and cervical cancer screening and health beliefs among African American women attending educational programs. *Health Promotion Practice* 13 (4), 447–453. <https://doi.org/10.1177/1524839910385900>.
- Racine, L., Andsoy, I., Maposa, S., Vatanparast, H., Fowler-Kerry, S., 2021. Examination of breast cancer screening knowledge, attitudes, and beliefs among Syrian refugee women in a Western Canadian province. *Can. J. Nurs. Res.* <https://doi.org/10.1177/08445621211013200> [online ahead of print].
- Robson, P.J., Solbak, N.M., Haig, T.R., Whelan, H.K., Vena, J.E., Akawung, A.K., Rosner, W.K., Brenner, D.R., Cook, L.S., Cszimadi, I., Kopciuk, K.A., McGregor, S.E., Friedenreich, C.M., 2016. Design, methods and demographics from phase I of Alberta's Tomorrow Project cohort: a prospective cohort profile. *CMAJ Open* 4 (3), E515–E527. <https://doi.org/10.9778/cmajo.20160005>.
- Safizade, H., Amirzadeh, N., Mangolian Shahrabaki, P., 2020. Motivational factors for breast cancer screening behaviors in Iranian women: a qualitative study. *Asian Pac. J. Cancer Prev.* 21 (10), 3109–3114. <https://doi.org/10.31557/APJCP.2020.21.10.3109>.
- Seely, J.M., Alhassan, T., 2018. Screening for breast cancer in 2018-what should we be doing today? *Curr. Oncol.* 25 (Suppl 1), S115–S124. <https://doi.org/10.3747/co.25.3770>.
- Sen, C.K., Kumkale, G.T., 2016. Who does not get screened? A simple model of the complex relationships in mammogram non-attendance. *J. Health Psychol.* 21 (12), 2838–2850. <https://doi.org/10.1177/1359105315587138>.
- Siddiq, H., Alemi, Q., Montes, J., Pavlish, C., Lee, E., 2020. Preventive cancer screening among resettled refugee women from muslim-majority countries: a systematic review. *J. Immigr. Minor. Health* 22 (5), 1067–1093. <https://doi.org/10.1007/s10903-019-00967-6>.
- Siu, A.L., 2016. Screening for Breast Cancer: U.S. Preventive Services Task Force Recommendation Statement. *Ann. Intern. Med.* 164 (4), 279–296. <https://doi.org/10.7326/m15-2886>.
- Speed, D., 2018. Mixed blessings? Religion/spirituality predicts better and worse screening behaviours. *J. Relig. Health* 57 (1), 366–383. <https://doi.org/10.1007/s10943-017-0493-y>.
- Steele-Moses, S.K., Russell, K.M., Kreuter, M., Monahan, P., Bourff, S., Champion, V.L., 2009. Cultural constructs, stage of change, and adherence to mammography among low-income African American women. *J. Health Care Poor Underserved* 20 (1), 257–273. <https://doi.org/10.1353/hpu.0.0123>.
- Suh, H., Hill, T.D., Koenig, H.G., 2019. Religious attendance and biological risk: a national longitudinal study of older adults. *J. Relig. Health* 58 (4), 1188–1202. <https://doi.org/10.1007/s10943-018-0721-0>.
- Vahabi, M., Lofters, A., Kim, E., Wong, J.P., Ellison, L., Graves, E., Glazier, R.H., 2017. Breast cancer screening utilization among women from Muslim majority countries in Ontario, Canada. *Prev. Med.* 105, 176–183. <https://doi.org/10.1016/j.ypmed.2017.09.008>.
- Vahabi, M., Lofters, A., 2016. Muslim immigrant women's views on cervical cancer screening and HPV self sampling in Ontario, Canada. *BMC Public Health* 16, 868. <https://doi.org/10.1186/s12889-016-3564-1>.