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Breast cancer mortality among ultra-orthodox and non-ultra-orthodox Israeli women: A retrospective cohort study

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ABSTRACT

Background: Breast cancer is the leading cause of cancer death in Israeli women. Previous studies found socioeconomic status and other risk factors impact breast cancer outcomes. The ultra-orthodox community is characterized by a longer life expectancy, lower rates of mammography performance, higher fertility rates and other sociodemographic variables that may be related to breast cancer mortality. This study examined disparities in breast cancer mortality between ultra-Orthodox and non-ultra-Orthodox Israeli women.

Methods: This retrospective cohort study for breast cancer mortality included the all Jewish Israeli citizens women born between 1940 and 1960 and lived in communities with over 20,000 residents (n = 628,617). Data was collected from various sources, monitoring a period of 31 years; for each participants, their sociodemographic characteristics were compiled from the population registry, the tax authority, the education registry, and the Central Bureau of Statistics (CBS). Variables included religiosity, age, marital status, children, origin, education, and income. Multivariable Cox models evaluated predictors of mortality.

Results: Of the 628,617 women in the study, 29,611 were ultra-Orthodox. Ultra-Orthodox women had higher marriage rates, more children, and lower secular education and income. Mortality was 108.8/100,000 overall, lower among ultra-Orthodox (83.4/100,000) than non-ultra-Orthodox women (110.1/100,000) despite their risk factors. Using a multivariate model to evaluate the association between ultra-Orthodoxy and breast cancer mortality, the study found higher breast cancer mortality rate among non-ultra-Orthodox women compared to ultra-Orthodox women (HR = 1.491; 99% CI = 1.232, 1.804). Associations with sociodemographic variables were different for each group.

Conclusions: Although ultra-Orthodox women have socioeconomic risk factors, breast cancer mortality was lower than non-ultra-Orthodox women. Further research on potential cultural and religious factors influencing mortality is warranted. These findings highlight the importance of evaluating predictors within specific populations.

1. Introduction

Breast cancer is the most common cancer and the leading cause of cancer deaths among women globally (World Health Organization [WHO], 2023). In Israel, the breast cancer incidence rate is approximately 78.3 cases per 100,000 women (Ben-Lessen, Silverman, & Keinan-Boker, 2022). The survival rate for breast cancer in Israel is relatively high, with an estimated five-year survival rate of around 88%. Recently, there is an increase in the survival rate for breast cancer over the past five years, and it maintains a low mortality rate as compared to other countries worldwide. Despite these statistics, there are a number of challenges facing healthcare professionals in the country with regard to breast cancer (Ben-Lessen et al., 2022).

Breast cancer incidence is associated with various sociodemographic risk factors. These factors include ethnicity, reproductive factors, socioeconomic status (SES), and religion (DeSantis et al., 2019; National Cancer Institute, 2023). Ethnicity is a significant factor associated with mortality, and different ethnicities have different risk profiles for breast cancer. For instance, one in 40 Ashkenazi women are carriers for the BRCA gene mutation, increasing their risk of breast cancer (Center for Disease Control, 2023).

Reproductive factors also play a role in breast cancer incidence. Women who have never had children, or who had their first child after the age of 30, have a higher risk of breast cancer (National Cancer

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Institute, 2023). Studies have found that people with social support and social networks, such as marriage, may have a lower risk of breast cancer mortality (Kroenke et al., 2013).

SES has been identified as a critical determinant of breast cancer outcomes. Women with lower SES are at a higher risk of receiving a breast cancer diagnosis at a later stage of the disease, which is harder to treat (Orsini, Trétarre, Daurès, & Bessaoud, 2016). Bradley, Given, and Roberts (2015) observed that women with lower education and income levels were more likely to be diagnosed with advanced-stage breast cancer. Additionally, multiple studies have demonstrated that women with lower SES face a higher risk of breast cancer mortality (DeSantis, 2019; Akinyemiju, Pisu, Waterbor, & Altekruse, 2015).

The association between SES and breast cancer outcomes is complex. One possible explanation for this association is that women with lower SES have less access to high-quality healthcare, which can result in delays in diagnosis and treatment, thus increasing their mortality risk (Dreyer, Nattinger, McGinley, & Pezzin, 2018; Quaglia et al., 2011; Silber et al., 2018). Additionally, women with lower SES may be more likely to have comorbidities, which can negatively impact breast cancer outcomes (Silber et al., 2018). Individuals with lower SES are more likely to have low health literacy and are also less likely to engage in healthy behaviors, such as mammogram performance or self-breast exams (Furuya, Kondo, Yamagata, & Hashimoto, 2015; Neter, Hagoel, Ore, Almog, & Rennert, 2004).

The relationship between religiosity level and breast cancer mortality has been the subject of several studies. While there is no definitive evidence regarding the impact of religiosity on individual cases, a number of studies have shown a negative relationship between religious observance and breast cancer mortality, indicating that religious observance may be a protective factor (Tarakeshwar et al., 2006; Schulz et al., 2005).

1.1. The ultra-orthodox community in Israel

The ultra-Orthodox community in Israel makes up about 13% of the population and is growing at a faster rate than any other demographic group in the country. According to the Israel Democracy Institute, over 95% of ultra-Orthodox Israeli citizens live in urban areas (Malach & Cahaner, 2022). The ultra-Orthodox community has relatively high poverty rates and lower levels of high school matriculation and employment, particularly among men (Baikovitz, Wasserman, & Pfefferman, 2022; Taub Center for Social Policy Studies, 2020). The lower rate of employment is because many ultra-Orthodox men choose to engage in Judaic studies full-time and do not enter the workforce. Moreover, the ultra-Orthodox community places a high value on religious education, which can limit opportunities for secular education and vocational training (Stopler, 2014). The high poverty rate is partially due to the high birth rate among ultra-Orthodox families, which strains their financial resources (Cohen, 2006).

The ultra-Orthodox place great value on early marriage and the marriage rate in this community is generally higher than that of the general population. (Okun, 2013). This community also has higher fertility rates compared to other Jewish and non-Jewish populations in the country (Weinreb, Chernichovsky, & Brill, 2018). According to a report by the Central Bureau of Statistics in Israel from 2020, the total fertility rate among the ultra-Orthodox population in Israel was 6.64 children per woman, which is more than double the national average of 2.9 children per woman (Navon & Engel-Zeevi, 2022).

Ultra-Orthodox societies emphasize social and family support systems, which are essential for the community's functioning. Family members provide emotional and financial assistance to each other, creating a strong sense of family cohesion (Auerbach & Kirmayer, 2007). Religious institutions also play a crucial role in providing social support (Hungerman, 2020). Life expectancy among the ultra-Orthodox has been found to be higher than in the general Israeli population (Pinchas-Mizrachi et al., 2021b). However, mammography rates in this community are significantly lower than in the general Israeli population (Pinchas-Mizrachi, Solnica, & Daoud, 2021a). This is in spite of the fact ultra-Orthodox Israelis are entitled to the same universal healthcare benefits as the general Israeli population. These rates may be due to the stigma associated with breast cancer, which is believed to effect marriageability within the ultra-Orthodox community (Trivedi et al., 2018; Yi, 2023).

The ultra-Orthodox are characterized by a higher marital rate, high fertility rates, young marriage and parity, which may be protective factors for breast cancer morbidity. On the other hand, they are also characterized by relatively lower income rates, lower rates of secular education, and lower rates of mammography performance, which may be risk factors for breast cancer survival and mortality.

1.1.1. Study objectives

The aim of this study was to evaluate the disparity of breast cancer mortality between ultra-Orthodox Jewish women and non-ultra-Orthodox Jewish women in Israel, considering the differences between the groups in a number of sociodemographic characteristics, including marital status, number of children, country of birth, and socioeconomic status.

2. Methodology

This was a retrospective cohort study on breast cancer mortality. Data was collected from several sources, including the Population Authority, Education Ministry, Tax Authority, the Central Bureau of Statistics (CBS) and Health Ministry. Data received from each source included individual-level data, with a fictitious ID number, which was identical for the individual in all files. Thus, the data in the different files for each individual was able to be combined.

The Ethics Committees of the Population Registry, Tax Authority, and CBS approved the study. The information used in this study was processed in the research room of CBS, and outcomes were analyzed only after special ethical approval from the staff of the research room.

The cohort included all Jewish Israeli women born between 1940 and 1960, who lived in communities with over 20,000 residents (n = 628,617). Approximately 5% of these women were ultra-Orthodox. Data was collected over a period of 31 years, from January 1, 1990, to December 31, 2020.

The decision to focus only on women who live in cities was made due to the fact that most ultra-Orthodox women live in these areas, and based on a previous study that was conducted by the same authors, urban living is a risk factor for breast cancer mortality (Pinchas-Mizrachi, Jacobson Liptz, Zalcman, & Romem, 2022).

2.1. Study variables

The year of birth, country of origin, number of children, and marital status variable were collected from the Population Registry. Marital status was dichotomized into "married" and "unmarried", defined as participants who were single, divorced, or widowed at the beginning of the study period. The overall fertility rate in Israel is approximately three children per women. Therefore the number of children variable was dichotomized to "3 children or less" and "more than three children".

The variable "country of origin" was defined by the individual's father's country of birth. This variable was then merged into one of three categories: 1. Israel, 2. Asia or Africa, 3. Europe, America, or Australia.

Education was determined based on data from the Education Registry and income level was determined based on data from the Israeli Tax Authority. The highest relative income level per individual during the study period was based on data from the Tax Authority on individual income from salary or annual business earnings. Data was collected for the years 1990 through 2020 and for the year that the individual reached the age of 50 and/or 60 and/or 65 and/or 70 during the study period. To create a single variable, the income distribution of the study

population was divided into deciles for each of these years. As per this distribution, individual income level was determined separately by the relative decile for each year. These variables were grouped into a single variable that represented the highest relative income level of the individual during the study period. This variable was classified into three categories: low income level, if the individual reached the relative income level of the third decile at most; middle income level, if the highest relative income level was between the fourth and seventh deciles; and high income level, when the highest relative income level of the individual was at deciles 8–10.

To classify an individual as ultra-Orthodox, two variables were utilized. One variable, the degree of ultra-Orthodox homogeneity of the individual's street of residence, was comprised based on Knesset voting data during the years 2006, 2009, and 2013 (Gurovich & Cohen-Kastro, 2004). The second variable, the degree of ultra-Orthodoxy by attended educational institutions, was created based on the degree of religiosity of the educational institution were attended by the individual, their spouse, or their children, either as students or teachers since 1991. This variable was based on the method developed by researcher Haim Portnoy (2007). Study participants, whose last known street of residence was classified as being of high Haredi homogeneity (where at least 70 percent of voters voted for ultra-orthodox parties) and who, based on the Portnoy method (2007), were registered at or worked in ultra-orthodox educational institutions since 1991, were classified as being ultra-Orthodox.

The outcome variable for the study was mortality from breast cancer, and year of death data was obtained from the Health Ministry. All statistical analyses were conducted in the Research Room of the Israeli Central Bureau of Statistics.

2.2. Statistical analysis

The distributions of the following variables were analyzed among 599,006 non-ultra-Orthodox Jewish women and 29,611 ultra-Orthodox Jewish women: age, number of children, marital status, country of origin, ethnicity, education, and income level. The level of statistical significance of the discrepancies between the groups was calculated using a Chi-squared analysis for the categorical variables and the T-test for the age variable. The percentage of missing data of variables, except education, was less than one percent. The percentage of missing data of education was 8%.

Next, disparities in breast cancer mortality rates over the follow-up period per 100,000 population were evaluated according to the following study variables: religious observance (ultra-Orthodox/not ultra-Orthodox), marital status, number of children, country of origin, education and income level. The net effect of the disparities between groups and the level of statistical significance of these disparities was evaluated and the AHR (Adjusted Hazard Ratio) was used to calculate mortality from breast cancer after adjusting for age.

Using regression and adjusted Kaplan Meier curves, models were created to evaluate the relationship between religious observance (ultra-Orthodox/not ultra-Orthodox) and mortality from breast cancer. Effect estimates are presented as either hazard ratios (HRs) or 99% confidence intervals (CIs) of mortality associated with religious observance (ultra-Orthodox/not ultra-Orthodox) or other covariates.

The following variables were used in Model 1: religious observance, age, marital status and number of children. In Model 2, in addition to variables included in Model 1, country of origin was also included. Model 3 includes all the previous variables as well as education, and income level.

Finally, to better understand the significant interactions, the study population was divided into two groups, ultra-Orthodox women, and non-ultra-Orthodox Jewish women, using Cox regression and the adjusted Kaplan Meier curve. Then, a model was built for each group separately and the variables age, marital status, number of children, country of origin, education and income level were entered into this model.

3. Findings

3.1. Demographics

The study population included 628,617 Jewish women, of whom 29,611 (4.71%) were ultra-Orthodox and 599,006 (95.28%) were non-ultra-Orthodox. On average, the non-ultra-Orthodox population was older, more educated, and had higher incomes than their ultra-Orthodox peers ($p < 0.001$). The proportion of married women among ultra-Orthodox women at the beginning of the study period was higher than that of non-ultra-orthodox women (90.1% vs. 73.1%) ($p < 0.001$). The average number of children per woman was higher among ultra-Orthodox women (Mean = 5.76, SD = 3.453) compared to non-ultra-Orthodox women (Mean = 2.22, SD = 1.69) (Table 1).

3.2. Mortality

The overall breast cancer mortality rate during the study period was 108.84 per 10,000 women. Examination of the distribution of breast cancer mortality rate by study variable (Table 2) showed that the breast cancer mortality rate was lower among ultra-Orthodox women compared to non-ultra-Orthodox women (83.41/10,000 vs 110.10/10,000) even after adjusting for age (AHR = 1.234, 99% CI = 1.044, 1.458). In addition, a higher breast cancer mortality rate was found among those who were unmarried at the beginning of the study period, compared to those who were married, even after adjusting for age (AHR = 1.064; 99% CI = 1.058, 1.069). The breast cancer mortality rate per 10,000 women was lower among women with more than 3 children (104.99/10,000) compared to women with up to 3 children (111.44/10,000). However, after adjusting for age, it seems that this relationship is of borderline significance (AHR = 1.059, 99% CI = 0.980, 1.143).

The breast cancer mortality rate was higher among women whose country of origin was Israel (121.2/10,000), compared to women whose country of origin was Asia/Africa (101.33/10,000), and to women whose country of origin was Europe/America (108.63/10,000). After adjusting for age, a higher rate of mortality was found among women whose country of origin was Israel, compared to women whose country of origin was Asia/Africa (AHR = 1.176, 99% CI = 1.081, 1.280).

Table 1
The distribution of the research variables among ultra-Orthodox Jewish women and among non-Orthodox Jewish women.

	Categories	Non-ultra-Orthodox (N = 599,006) % (n)	ultra-Orthodox (N = 29,611) % (n)	p-value
Age		39.27(±-5.66)	37.76 (±5.49)	<0.001
Married		73.1% (437,873)	90.1% (26,680)	<0.001
Number of children		2.22(±1.69)	5.76 (±3.453)	<0.001
Country of Origin	Asia/Africa	33.7% (201,865)	35.0% (10,364)	<0.001
	Europe/America	45.4% (271,949)	35.8% (10,601)	
	Israel	20.9% (125,192)	29.2% (8646)	
Highest Relative Income Level	8–10	18.0% (107,821)	11.4% (3376)	<0.001
	4–7	38.7% (231,815)	41.1% (12,170)	
	1–3	43.3% (259,370)	47.5% (14,065)	
Education	Matriculation certificate or high school diploma	61.3% (342,671)	44.4% (13,029)	<0.001

Table 2
Breast cancer mortality rate by research variables among study population (N = 628,617).

		Breast cancer mortality per 10,000 women	AHR (Age-adjusted Hazard Ratio), 99%CI
Religiosity	ultra-Orthodox	83.41	1.00
	Non-ultra-Orthodox	110.10	1.234 (1.044–1.458)
Family status	Married	107.90	1.00
	Unmarried	111.73	1.064 (1.058–1.069)
Number of children	0–3	111.44	1.059 (0.980–1.143)
	>3	104.99	1.00
Country of Origin	Asia/Africa	101.33	1.00
	Europe/America	108.63	1.062 (0.988–1.142)
	Israel	121.20	1.176 (1.081–1.280)
Highest Relative Income Level	8–10	80.960	1.00
	4–7	92.27	1.151 (1.040–1.274)
	1–3	134.97	1.674 (1.521–1.842)
Education	Has a matriculation certificate or high school diploma	112.51	1.00
	Does not have a matriculation certificate or high school diploma	118.44	1.072 (1.001–1.148)

Conversely, after adjusting for age, no significant difference in cancer mortality rates was found between women whose country of origin was Europe/America compared to women whose country of origin was Asia/Africa (AHR = 1.062, 99% CI = 0.988, 1.142).

When examining the role of the socioeconomic variables in predicting breast cancer mortality, after adjusting for age, mortality rates were found to be higher for people who did not matriculate or have any high school education (AHR = 1.072; 99% CI = 1.001–1.148) compared to those who matriculated or had a high school education. Likewise, higher mortality rates were found among low-income (AHR = 1.674; 99% CI = 1.521, 1.842) and middle-income (AHR = 1.151; 99% CI = 1.040, 1.274) earners compared to high-income earners.

Multivariable models were used to evaluate the relationship between religious observance and mortality. The multivariable Cox model included the following variables: religious observance, age, marital status, and number of children (Model 1, Table 3). A higher breast cancer mortality rate was found among non-ultra-Orthodox women compared to ultra-Orthodox women (HR = 1.282; 99% CI = 1.073, 1.532). In this model, as well as in all other models below, the mortality rate increased with age (HR = 1.063; 99% CI = 1.057, 1.069).

(See Table 3, Model 1)

Model 2 included the variables from Model 1 and country of origin. This model showed a higher breast cancer mortality rate among non-ultra-Orthodox women compared to ultra-Orthodox women (HR = 1.312; 99% CI = 1.097, 1.571). A significantly higher breast cancer mortality rate was found among women with 3 or less children compared to women with more than 3 children (HR = 1.027; 99% CI 1.007, 1.047). Additionally, a higher mortality rate was found among women whose country of origin was Israel (AHR = 1.190, 99% CI = 1.093, 1.296) and among women whose country of origin was Europe/America (AHR = 1.081, 99% CI = 1.001–1.167), compared with women whose country of origin was Asia/Africa.

(See Table 3, Model 2)

Model 3 included all variables from Models 1 and 2, and education

Table 3
Multivariate Cox models for breast cancer mortality prediction among study population (N = 628,617).

		Model 1	Model 2	Model 3
		HR CI 99%	HR CI 99%	HR CI 99%
Religiosity	Ultra-Orthodox	1.00	1.00	1.00
	Non-ultra-Orthodox	1.282 (1.073–1.532)	1.312 (1.097–1.571)	1.491 (1.232–1.804)
Age		1.063 (1.057–1.069)	1.063 (1.058–1.069)	1.059 (1.053–1.066)
Family status	Married	1.00	1.00	1.00
	Unmarried	1.037 (0.962–1.119)	1.040 (0.964–1.122)	1.040 (0.954–1.134)
Number of children		1.013 (0.994–1.031)	1.017 (0.997–1.037)	0.986 (0.963–1.008)
Origin country	Asia/Africa		1.00	1.00
	Europe/ America		1.081 (1.001–1.167)	1.152 (1.048–1.267)
	Israel		1.190 (1.093–1.296)	1.408 (1.278–1.551)
Highest Relative Income level	8–10			1.00
	4–7			1.239 (1.110–1.383)
	1–3			2.524 (2.269–2.807)
Education	Has a matriculation certificate or high school diploma			1.00
	Does not have a matriculation certificate or high school diploma			1.046 (0.962–1.136)

and income level. A higher mortality rate was found among non-ultra-Orthodox women compared to ultra-Orthodox women (HR = 1.491; 99% CI = 1.232, 1.804). Higher breast cancer mortality rates were found among women whose country of origin was Israel (AHR = 1.408, 99% CI = 1.278, 1.551) and women whose country of origin was Europe/America origin country (AHR = 1.152, 99% CI = 1.048–1.267). Mortality rates were higher among women who did not matriculate or have any high school education (AHR = 1.096; 99% CI = 1.045–1.136). Likewise, higher mortality rates were found among low-income (AHR = 2.524; 99% CI = 2.269, 2.807) and middle-income (AHR = 1.239; 99% CI = 1.110, 383) earners compared to high-income earners.

(See Table 3, Model 3)

The study population was divided into ultra-Orthodox women and non-ultra-Orthodox women by Cox regression and adjusted Kaplan Meier survival curve (Fig. 1). The models were built separately for each of the groups with the following variables: age, marital status, number of children, country of origin, education, and income level.

Among the ultra-Orthodox Jewish women, a higher mortality rate was found among women with three or less children compared to women with more than 3 children (HR = 1.215; 99% CI 1.101, 1.329). A higher mortality rate was also found among ultra-Orthodox women with low-income (AHR = 2.216; 99% CI = 1.127, 4.359) compared to those with high-income. Conversely, a lower rate of mortality was found among ultra-Orthodox Jewish women who did not matriculate or have any high school education (AHR = 0.710; 99% CI = 0.563, 0.956).

(See Table 4, Model A)

Among the non-ultra-Orthodox women, a significantly higher mortality rate was found among women whose country of origin was Israel (AHR = 1.435, 99% CI = 1.299, 1.586) and among women whose country of origin was Europe/America (AHR = 1.196, 99% CI = 1.084–1.321). Significantly higher mortality rates were also found among low-income (AHR = 2.511; 99% CI = 2.290, 2.841) and middle-

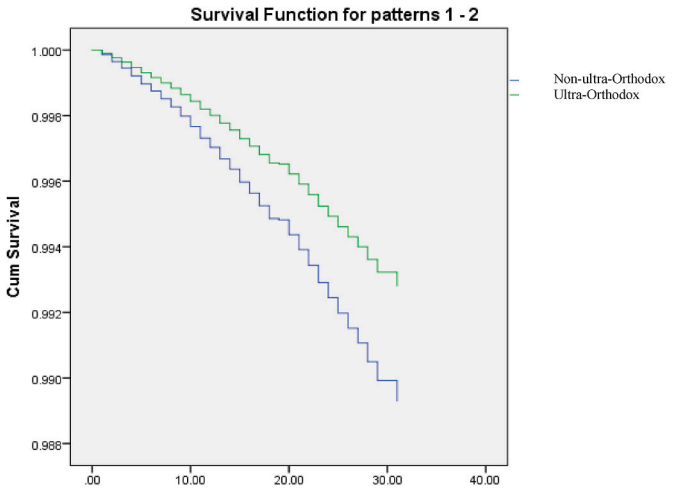

Fig. 1. Heading: Kaplan Meier Survival Curve of breast cancer mortality rates among ultra-Orthodox Jewish women (N = 29,611) (green line) and non-ultra-Orthodox Jewish women (N = 599,006) (blue line), adjusted for age and marital status, number of children, country of origin, income level, and level of education.

Table 4
Multivariate Cox model for prediction breast cancer mortality among ultra-Orthodox Jewish women (N = 29,611) and among non-Orthodox Jewish women (N = 599,006).

		Model A: ultra-Orthodox (N = 29,611)	Model B: non-ultra-Orthodox (N = 599,006)
		HR (99%CI)	HR (99%CI)
Age		1.034 (1.002–1.066)	1.060 (1.054–1.067)
Family status	Married	1.00	1.00
	Unmarried	0.872 (0.476–1.597)	1.055 (0.967–1.152)
Number of children		0.900 (0.820–0.956)	1.004 (0.978–1.029)
Country of Origin	Asia/Africa	1.00	1.00
	Europe/America	0.862 (0.557–1.324)	1.196 (1.084–1.321)
	Israel	1.259 (0.822–1.928)	1.435 (1.299–1.586)
Highest Relative Income level	8–10	1.00	1.00
	4–7	1.463 (0.740–2.891)	1.230 (1.101–1.376)
	1–3	2.216 (1.127–4.359)	2.551 (2.290–2.841)
Education	Has a matriculation certificate or high school diploma	1.00	1.00
	Does not have a matriculation certificate or high school diploma	0.710 (0.563–0.956)	1.046 (0.960–1.139)

income earners (AHR = 1.230; 99% CI = 1.101, 1.376). Higher mortality rates were also found among non-ultra-Orthodox Jewish women who did not matriculate or have any high school education (AHR = 1.066; 99% CI = 1.110, 1.139).

(See Table 4, Model B).

4. Discussion

This study compared breast cancer mortality rates among ultra-Orthodox and non-ultra-Orthodox Jewish women in Israel. The study also looked at the associations between different sociodemographic variables and breast cancer mortality in each group. Results show a lower overall mortality rate among ultra-Orthodox women compared to non-ultra-Orthodox women. This result remained significant even after adjusting for marital status, number of children, income, education, and country of origin. When investigating each group separately, results show that a higher number of children and lower education level are protective factors among ultra-Orthodox women. These are not protective factors among non-ultra-Orthodox women.

Several potential risk factors of breast cancer mortality are characteristic of ultra-Orthodox society in Israel. These characteristics include low SES, lower rates of education, a relatively high proportion of ethnic groups at risk, and low rates of mammography screenings (DeSantis et al., 2019; Neter et al., 2004; Tonin et al., 1996). Despite these characteristics, breast cancer mortality rates were lower in comparison to non-ultra-Orthodox women.

Earlier studies have indicated an inverse relationship between religious observance and negative outcomes. For instance, one study that compared health outcomes between ultra-Orthodox Jews and non-ultra-Orthodox Jews found a significantly lower overall mortality rate among ultra-Orthodox Jews. These health outcomes may be indicative of an association between health outcomes and social capital and the role played by family and community groups (Holt-Lunstad, Smith, & Layton, 2010; Kroenke et al., 2013; Pinchas-Mizrachi et al., 2021b). Social support has been found to be significantly related with better overall health outcomes. It is believed that social support buffers against the negative effects of acute stressors, thus improving an individual's health (Hinzey, Gaudier-Diaz, Lustberg, & DeVries, 2016).

It should be noted that differences in breast cancer mortality rates imply differences in morbidity rates and/or differences in survival rates. However, as the data collected for this study did not have information related to the disease course or stage of diagnosis, this can only be hypothesized. It can be hypothesized that the high fertility rates, high breastfeeding rates, and low maternal age at first birth may constitute a protective factor against breast cancer morbidity (Weinreb et al., 2018; Islami, Liu, Jemal, & Zhou, 2015; National Cancer Institute, 2023). If this is the case, it is possible that the survival rates among the ultra-Orthodox women is in fact relatively low. This strengthens the finding from an earlier study that found low mammography screening rates in this population, and which possibly contributes to relatively late detection of the disease and a lack of financial resources to cope with it (Pinchas-Mizrachi, et al., 2021a; Stier & Lewin, 2013).

When examining each of the groups separately, higher parity was not a protective factor among non-ultra-Orthodox women but was a protective factor among ultra-Orthodox women. It is possible that this phenomenon can be attributed to the differences in breastfeeding rates between the groups. A number of studies have shown an inverse relationship between breastfeeding and breast cancer risk, and an inverse association between breast cancer risk and duration of breastfeeding (Zhou et al., 2015). Ultra-orthodox women have higher rates of initiating breastfeeding, as well as lower rates of reporting issues with breastfeeding, compared to other Jewish Israeli women. Furthermore, ultra-Orthodox women are more likely to breastfeed for a longer duration (Zimmerman et al., 2022).

Another notable difference found between the groups is the place of education in predicting breast cancer mortality. Among non-ultra-Orthodox women, higher mortality rates were found among women with a low level of education. However, among ultra-Orthodox women it was found that a low level of education is a protective factor against mortality. Considering this, the researchers posit that education can be influenced by breastfeeding habits in each society. It is possible that uneducated women in ultra-Orthodox society are more likely to breastfeed compared to uneducated women in non-ultra-Orthodox society.

4.1. Limitations

There are several limitations to this study. First, this study is based on

administrative data. Cause of death was based on the data collected from the death certificate by the Ministry of Health. We used two methods by which a participant was classified as "ultra-Orthodox", and participants were only identified as such if both criteria were met. Nevertheless, there may have been situations where an ultra-Orthodox individual was defined as non-ultra-Orthodox and vice versa. Another limitation of this study was the lack of incidence and prevalence rates of breast cancer among these groups. This would have provided a more complete picture and enabled the evaluation of mortality disparity by morbidity and survival disparities.

5. Conclusions

The results of this study further demonstrate how ultra-Orthodoxy is a protective factor against mortality, even as this group has certain characteristics which might put them at risk of higher mortality rates. As this association is not completely understood, future studies can focus on this relationship. Moreover, as seen in this study, a sociodemographic variable can be a risk factor in one group and a protective factor in another group. Sociodemographic factors that are known to be associated with morbidity, survival and mortality should be examined further when planning intervention programs.

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CRediT authorship contribution statement

Ronit Pinchas-Mizrachi: Writing – review & editing, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Beth G. Zalcman:** Writing – review & editing, Visualization, Investigation, Formal analysis. **Judith Jacobson-Liptz:** Writing – original draft, Methodology, Formal analysis. **Yifat Adler:** Writing – review & editing, Visualization, Investigation. **Anat Romem:** Writing – review & editing, Resources, Project administration, Investigation.

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.

Data availability

The data that has been used is confidential.

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