



# A Comparative Analysis of Smoking Rates by Sex and Socioeconomic Status Among Ultra-Orthodox City Residents and Non-Ultra-Orthodox City Residents in Israel

Ronit Pinchas-Mizrachi<sup>1</sup> · Adi Finkelstein<sup>2</sup>

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## Abstract

The aim of this cross-sectional study is to examine the differences in smoking rates between ultra-Orthodox Jews and non-ultra-Orthodox Jews and to understand the role of sex and socioeconomic status (SES) in predicting smoking among the two populations. The study population included all Maccabi Healthcare Services members aged 50 or older ( $N=30,170$ ) who lived in two cities in the center of Israel: Bnei Brak—a city with a high concentration of ultra-Orthodox, and Ramat Gan—a non-ultra-Orthodox city. After adjusting for age, sex, and SES, the prevalence of smoking in the ultra-Orthodox city was significantly lower than that in the non-ultra-Orthodox city. A significant interaction was found between sex and degree of religiosity in predicting smoking. The smoking differences between men and women in the ultra-Orthodox city were high compared with those in the non-ultra-Orthodox city. Similarly, a significant interaction was found between SES and degree of religiosity in predicting smoking. These results in the effects of sex and SES in predicting smoking between ultra-Orthodox Jews and non-ultra-Orthodox Jews require further research to better understand these differences and plan intervention programs tailored to different populations accordingly.

**Keywords** Ultra-orthodox · Israel · Smoking · Sex · Socioeconomic status

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✉ Ronit Pinchas-Mizrachi  
pinchas.ronit@gmail.com

Adi Finkelstein  
adilan@netvision.net.il

<sup>1</sup> Faculty of Life and Health Sciences, Jerusalem College of Technology, Jerusalem, Israel

<sup>2</sup> Department of Nursing, Faculty of Life and Health Sciences, Jerusalem College of Technology, Jerusalem, Israel

## Introduction

Smoking remains a leading risk for morbidity and mortality around the world and continues to require sustained political attention (Reitsma et al. 2017). Previous research has shown relationships between smoking and socioeconomic status (SES), sex, and religiosity.

### Socioeconomic Status and Smoking

Studies conducted around the world show a higher prevalence of smoking among groups with low SES relative to groups with high SES (Casetta et al. 2017; Cohen et al. 2011; Gallagher et al. 2010). Furthermore, smokers residing in socioeconomically disadvantaged neighborhoods are more likely to be heavy smokers (Chuang et al. 2005). Kendzor et al. (2012) reported that greater neighborhood unemployment and poverty were associated with reduced chances of smoking avoidance. Research conducted by the World Health Organization (WHO) during the period 2002–2004, which included 48 low- and middle-income countries, showed that for most countries, smoking was more prevalent among the poor. However, some countries, such as Georgia and Mexico, showed a higher prevalence of smoking in men with higher SES than in those with low SES. A similar trend was observed among women from Kazakhstan, Mexico, and South Africa (Hosseinpoor et al. 2012).

### Smoking and Level of Religiosity

Studies have found a lower prevalence of smoking among religious populations in comparison with general society (Ahrenfeldt et al. 2018; Gillum et al. 2008; Nunziata and Toffolutti 2019; Whooley et al. 2002). According to Koenig (2012), about 90% of studies that have examined the relationship between religion and/or spirituality and smoking have found statistically significant inverse associations between religious involvement and negative health behaviors. Bowie et al. (2017) showed that attending religious services served as a buffer against cigarette use among Black men in the United States who attended almost every day or weekly compared with men who reported never attending religious services. Furthermore, Gillum (2005) reported that in a national sample of American smokers aged 20 and over, those who frequently attended religious services smoked significantly fewer cigarettes a day than infrequent or never-attenders, independent of ethnicity, age, or sex.

Several factors may explain this inverse association. First, some religions are against the consumption of certain substances, such as tobacco; other religions promote behavioral norms that are specifically anti-smoking (Stylianou 2004). Second, religious beliefs provide a more optimistic worldview. This can help individuals develop positive coping mechanisms, lessening the effect of stress that can lead to risk-taking behaviors such as alcohol abuse, drug use, and smoking (Mason and Windle 2001; Levin 2013). Third, religions object to most behaviors that harm the body or control the mind. Finally, religious community life and participation in religious activities can help strengthen the individual by offering social support and

healthier alternatives for coping with stress and reducing risky health behaviors, such as smoking (Hall et al. 2008; Lee and Newberg 2005).

## Smoking and Sex

Although there is a stronger cultural stigma against female smokers, social advancement raises the risk of smoking for women, while reducing the risk for men (Yang 2017). However, young women report specific forms of stigmatization related to smoking compared with young men who smoke. When the latter begin to smoke, they are understood to be just having fun and letting loose (Nichter et al. 2006; Triandafilidis et al. 2017), whereas women who smoke are stigmatized as less educated and of lower class (Mackay and Amos 2003). McCready et al. (2019) highlight that smoking-related stigma can intertwine with other forms of stigmatization, such as sex, which worsen social inequalities. The women living in areas or neighborhoods associated with higher deprivation had fewer places available to them to smoke socially than did wealthier women, and fewer opportunities to escape the existing stereotype. Therefore, the stigma remains.

## Differences in Smoking Rates Between Men and Women in Various Population Groups: A Four-Stage Model

Lopez et al. (1994) proposed a four-phase model of the smoking epidemic, which highlights the difference between men and women in terms of smoking adoption and cessation. This model is based on nearly 100 years of observations in countries with a long history of cigarette use. Transition through phases can be characterized by changes in smoking prevalence and consumption within a population, as well as smoking-related mortality prevalence. Also, certain prevalence levels among a defined subgroup (such as sex or social class) indicate the progression in adoption of smoking behavior in the population and, therefore, are important for implementing tobacco control programs.

During the first phase there is a significant increase in smoking among men; 10–20 years later, there is a moderate increase in the prevalence among women. Next, smoking prevalence increases among both men and women, and while the prevalence is higher among men, the disparity between the sexes is not great. The third phase is characterized by a sharp decrease in smoking prevalence among men so that it is similar to that in women. Among women, the decrease in smoking prevalence is more moderate. In the final phase, the prevalence continues to decrease among both men and women, and they are almost identical (Lopez et al. 1994).

There is a well-established interaction between sex, SES, and smoking. WHO estimates that, globally, the prevalence of smoking among men is around five times that of women. This model can be used to explain the differences in smoking rates between men and women in the various population subgroups based on the degree of cultural development and advancement of the subgroup.

Indeed, greater disparity is found among less developed countries in Asia, China, and India, indicating that these countries are in the earlier stages of the Lopez et al.

model. In developed countries such as Australia, Canada, and the United States, the smoking prevalence is almost identical, which indicates that these countries are in the later stages of the Lopez et al. model (World Health Organization 2011; Hitchman and Fong 2011). Additionally, these findings are consistent with other studies on the interaction between economic development, smoking, and sex (Yang 2017).

### **The Ultra-Orthodox (UO) Society in Israel**

UO Jews comprise 9.7% of the Israeli Jewish population aged 20 or older (Social Survey 2017). This group maintains a stringent religious lifestyle, has distinctive cultural elements that separate them from the general population, and is characterized by a well-known hierarchy and by their obedience to the rules set forth by the rabbinical authorities (Heilman and Friedman 2010; Popovsky 2010; Schnall 2006).

The practice of sex segregation from a young age is very common in UO communities. Furthermore, modest dress is a community norm. Family life constitutes an important factor in the strict UO worldview, and having families with a large number of children is encouraged (Baskin 2011; Kulik 2016).

These characteristics can also significantly affect healthcare attitudes and behavior (Lazarus et al. 2015; Edelstein et al. 2017; Freund et al. 2014; Werner et al. 2003). Findings from a study by Zalberg and Block (2021) showed the central role of religion in health outcomes among the UO community during the COVID-19 pandemic. Wright et al. (2021) found that during the COVID-19 pandemic, Jews who identified as Orthodox were significantly less likely to experience mental health difficulties than those in non-Orthodox denominations.

The UO society in Israel is also characterized by low SES compared with the general Jewish population (Central Bureau of Statistics 2018). In addition, fertility rates within the UO community are notably higher than in general Israeli society. The demographic growth rate of the UO population exceeds all other population groups in the developed world. The annual natural growth rate of the UO population in Israel is rapid—4.2% per year since 2009, compared with 1.9% of the total population and 1.4% of the general Jewish population in Israel. This rapid growth is due to a combination of a high fertility rate and a young age of marriage and child-birth, both of which characterize the UO population. In 2020, the fertility rate for the UO community was 6.6 children per woman, and this rate has been consistently higher than fertility rates among other subgroups of the Israeli population (Malach and Cahaner 2020). The difference in fertility rates between the UO community and the general Israeli population means that the UO community is becoming a larger and more significant segment of the Jewish Israeli population. This highlights the need to better study this population.

Another distinction between the UO community and general Israeli society is seen in the realm of education. In 2017, 36% of 12th grade UO Israeli students took matriculation exams, compared with 94% of 12th grade students in general Israeli society (Israel Democracy Institute 2017). On a political level, UO have opposing

opinions to secular Jews about the government's involvement in personal life, which specifically limits participation in the military (Berman 2000).

Lifestyles of Israel's UO differ greatly from their non-UO counterparts, stemming from their choice to deliberately live such separate lives. A Pew study showed that fewer secular Jews would feel uncomfortable if their child were to marry outside the Jewish faith than if their child were to marry a UO Jew (Pew Research Center 2016). It could be argued that because of such divergent lifestyles and health behaviors, there is a need for separate policies that consider these cultural differences (Arbel 2020).

Members of the UO community also have a relatively low awareness of health issues and healthy behaviors. Furthermore, there is a lower rate of healthcare service utilization among the UO population. The relative isolation of the community from the general Israeli population also means that people in this community are less likely to be exposed to health-related information (Zalcberg and Block 2021), including information about the risks of smoking and the importance of cessation among smokers (Coleman-Brueckheimer and Dein 2011; Lazarus et al. 2015). The UO community is characterized by other health behaviors including lower mammography compliance (Pinchas-Mizrachi et al. 2021a, b), higher rates of obesity (Arbel et al. 2021), and relatively low rates of childhood immunization (Keshet and Popper-Giveon 2021). The COVID-19 pandemic highlighted the disparities in health behaviors between the UO society and non-UO society (Muhsen and Cohen 2021; Schattner and Klepfish 2020). However, other studies found that mortality rates among UO men and women are lower than mortality rates among non-UO men and women (Pinchas-Mizrachi et al. 2021a, b).

Previous studies conducted in Israel demonstrated that smoking prevalence among the UO society was lower than that in the non-UO society.

According to the 2017 Social Survey conducted by the Central Bureau of Statistics (CBS), 31.5% of men and 14.7% of women in Israel are smokers (Social Survey 2017). In a study conducted by the Israel Center for Disease Control during 2008–2009, the prevalence of smoking among UO men and women was 19.5% and 2.6%, respectively (Israel Ministry of Health 2011). In another study conducted in 2010 and 2011 among 782 UO Jewish men in Israel, the prevalence of smoking was 12.8% (Kopel et al. 2013). This prevalence is low compared with the prevalence of smoking among the general population in Israel.

Over the past few decades, the tendency for geographical segregation of the UO population has expanded, creating homogeneous UO neighborhoods and cities (Waitzberg et al. 2020). The population density in UO neighborhoods is three to four times the national average in non-UO neighborhoods and is affected by the density of apartments, density of houses in the neighborhood, and the number of public areas (Tsachor-Shai and Kasir 2020).

In 2015, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) indicated that the pace of progress in reducing smoking prevalence had been “heterogeneous across geographies, development status, and sex” (Reitsma et al. 2017, 1885).

To summarize, previous studies found higher rates of smoking among individuals of low SES and lower smoking rates among more traditional communities,

mainly among women. The UO community is characterized on one hand by a low level of secular education and low income—which can be associated with higher smoking rates. On the other hand, this community is more traditional, which may be associated with lower smoking rates, as well as larger disparities in smoking rates between men and women. It seems, therefore, that the different elements that characterize this community may act in contrast to one another, once again highlighting the importance of studying the smoking behaviors of this community.

These points led us to study the association between SES and smoking among UO men and women in comparison with non-UO Jews. This can provide a better understanding of the sociological factors related to health behaviors among UO and non-UO Jews in Israel. The recent COVID-19 pandemic has underscored the need to understand these factors.

## Research Aim

The current research entails a comparative analysis of the correlations between the degree of ultra-Orthodoxy and SES and smoking prevalence among residents aged 50 years and older of two neighboring cities in central Israel—Bnei Brak and Ramat Gan. Bnei Brak is characterized by the homogeneity of its residents who are mostly UO, while the residents in the neighboring Ramat Gan are mostly non-UO. Bnei Brak also has a lower SES, while Ramat Gan has a higher SES.

## Methods

### Settings

Both Bnei Brak and Ramat Gan are located within the geographical and economic center of Israel. Bnei Brak is characterized by the homogeneity of its residents, most of whom are UO. Data from the election results for the 19th Knesset (Israeli Parliament) in 2013 showed that the majority of the residents of Bnei Brak (130 out of 163 streets) voted for UO parties. Ramat Gan, in contrast, is characterized as nonreligious, also evidenced by the results of the elections for the 19th Knesset. Results of this election showed that less than 10% of the residents of the city's streets voted for UO parties.

In 2017, the populations of Bnei Brak and Ramat Gan numbered 195,000 and 154,000 residents, respectively, with 8% and 21% of the population of each city, respectively, aged 65 years or older. The current study utilized the databases of Maccabi Healthcare Services (MHS), the second-largest healthcare maintenance organization (HMO) in Israel, which provides medical care to roughly a quarter of the Israeli population. Almost half of the residents of both cities were enrolled with MHS (47.5% and 46.9% of Bnei Brak and Ramat Gan residents, respectively).

## Study Population

The study included MHS policyholders, i.e. people who owned an MHS insurance policy, aged 50 years and older from Bnei Brak and Ramat Gan. A total of 18,691 Bnei Brak residents and 11,479 Ramat Gan residents were MHS policyholders and were included in the study.

## Data Collection

Data retrieved from MHS databases included birth year, sex, SES, religious homogeneity of the neighborhood of residence, and smoking status.

## Study Variables

Socioeconomic status (SES) was derived using a commercial index developed by Points Location Intelligence (<http://www.point.co.il>). SES was assigned a score of 1 (lowest) to 10 (highest) according to place of residence. Each statistical area was scored according to financial measures including credit card usage and housing prices. Together with this variable we also utilized an SES index provided by the CBS (2015) which ranged from 1 (lowest) to 20 (highest). This index is based on several parameters, including household income, educational qualifications, household crowding, material conditions, and car ownership. A preliminary test found a statistically significant correlation between the indices. The decision to use the Points Location Intelligence index was due to fewer occurrences of missing data.

Relative socioeconomic status (RSES): There is a highly significant difference between the two cities on the basis of SES, and the obvious importance of the relationship between smoking status and SES in both cities led us to build a new variable. Each study participant was assigned an RSES according to his/her place of residence and the variable distribution in each of the cities (described in Table 2). In Bnei Brak, the RSES was defined as follows: an SES of 2–3 as low, an SES of 4 as medium, and an SES of 5–6 as high. In Ramat Gan, definitions for RSES were different, with SES of 5–6 defined as low, SES of 7 as medium, and SES of 8–10 as high (Table 2).

The probability of a participant being UO was determined using a scale which was divided into four categories—none, medium, high, and very high. Each statistical area for place of residence was scored according to various financial review measures including the results of municipal and national elections, characterization of the educational institutions, the mikva'ot [ritual baths], and the areas where roads are closed during the Jewish Sabbath, among others.

UO religiosity was defined as a dichotomous variable (UO/non-UO) based on the probability of being UO. This division is identical to the division based on the city where the participants reside. The variable was divided into four categories, low, medium, high, and very high. Since 100% of the Ramat Gan residents and none of the Bnei Brak residents were categorized as low UO homogeneity, but 85% of

Bnei Brak residents were categorized as high UO homogeneity, residents of Bnei Brak were considered to be UO, while residents of Ramat Gan were considered to be non-UO.

Smoking status was measured as a dichotomous variable (active smoker/non-active smoker).

Sex and age were defined according to the Maccabi HMO records, which were taken from the individual's identity card.

## Statistical Analysis

The data were analyzed using SPSS version 24.0 software. Covariates included age, sex, SES, the probability of being UO, and the city of residence. Complete data were obtained for age, sex, SES, probability of being UO, and the city of residence, while smoking status data were missing for 1784 (5.9%) participants. No statistically significant difference pertaining to the missing data was found between cities. Pairwise methods were used to avoid missing-value bias in the multiple regression models, and the significance level ( $p$  value) for all analyses was  $p < 0.5$ .

The first stage of the analysis examines the distribution of all study variables for the total sample, stratified by the city of residence. Differences between cities, as well as the statistical significance of the differences, were measured for each variable using chi-squared analysis (see Table 1).

During the second stage, a new variable was constructed—the RSES. Each participant's RSES was calculated by their SES relative to their place of residence (detailed in Table 2).

Next, the distribution of smoking status by sex, age, and RSES was examined in each of the cities separately using a chi-squared test, which examined the disparities in smoking rates by variable (Table 3).

For the fourth stage, multivariate binary regression models were utilized to examine the degree to which each variable predicted smoking. In this analysis, two models were used, and each was adjusted for age. The following variables were input into the first model: city of residence, sex, and RSES. In the second model, the following variables were input: city of residence, sex, RSES, the interaction between sex and city of residence, and the interaction between city of residence and RSES (see Table 4).

The statistical significance of the interactions between sex and city of residence and between city of residence and RSES led to the fifth stage, where a multivariate analysis was conducted to assess the relationship between RSES and smoking status. A multivariate binary logistic regression model was run, which was adjusted for age. The study population was categorized into four groups based on sex and city of residence (Bnei Brak women, Bnei Brak men, Ramat Gan women, Ramat Gan men). An age-adjusted model which included RSES was run separately for each group (see Table 5).

Considering that the research objective was to examine the association between SES and smoking, as well as the significant interactions between sex and city of



**Table 1** Distribution of sociodemographic characteristics and smoking status for the total sample by city of residence

Variable	Bnei Brak <i>N</i> (%)	Ramat Gan <i>N</i> (%)	<i>p</i> value	Percentage missing
Total	11,479 (38.0%)	18,691 (62.0%)		0.00
Sex				
Men	5772 (50.30%)	8484 (45.40%)	<0.001	0.00
Women	5707 (49.70%)	10,207 (54.60%)		
Age				
50–59	4067 (35.4%)	6438 (34.4%)	<0.01	0.00
60–69	4362 (38.0%)	6060 (32.4%)		
70–79	1963 (17.1%)	3638 (19.5%)		
80 or above	1087 (9.5%)	2555 (13.7%)		
Socioeconomic status (SES)				
2	213 (2.7%)		<0.01	0.00
3	4144 (36.1%)			
4	5160 (45.0%)			
5	1145 (10.0%)	754 (4.0%)		
6	718 (6.3%)	3249 (17.4%)		
7		10,073 (53.9%)		
8		1475 (7.9%)		
9		2432 (13.0%)		
10		708 (3.8%)		
Ultra-Orthodox homogeneity by place of residence				
Low	0 (0.0%)	18,691 (100.0%)	<0.01	0.00
Medium	526 (4.6%)	0 (0.0%)		
High	1146 (10.0%)	0 (0.0%)		
Very high	9807 (85.4%)	0 (0.0%)		
Smoking	1241 (11.7%)	4485 (25.2%)	<0.01	5.9

**Table 2** Relative socioeconomic status (RSES) for each of the cities, based on SES geographical statistical area and population

RSES	Bnei Brak <i>N</i> = 11,479		Ramat Gan <i>N</i> = 18,691	
	SES	<i>N</i> (%)	SES	<i>N</i> (%)
Low	2–3	4456 (38.8%)	5–6	4003 (21.4%)
Medium	4	5160 (45.0%)	7	10,073 (53.9%)
High	5–6	1863 (16.2%)	8–9	4615 (24.7%)

**Table 3** Distribution of smoking status by sex, age, and relative socioeconomic status (RSES)—in each of the cities separately

	Bnei Brak <i>N</i> = 11,479		Ramat Gan <i>N</i> = 18,691	
	Smoking <i>N</i> (%)	<i>p</i>	Smoking <i>N</i> (%)	<i>p</i>
Total	1241 (11.7%)		4485 (25.2%)	
Sex				
Male	910 (17.5%)	< 0.01	2208 (27.5%)	< 0.01
Female	331 (6.1%)		2277 (23.3%)	
Age				
50–59	493 (13.5%)	< 0.01	1927 (32.0%)	< 0.01
60–69	487 (12.0%)		1629 (28.1%)	
70–79	199 (10.6%)		686 (19.3%)	
80 or above	62 (6.1%)		243 (10.0%)	
RSES				
Low	349 (8.3%)	< 0.01	1091 (28.7%)	< 0.01
Medium	677 (14.7%)		2509 (26.1%)	
High	215 (12.1%)		885 (20.1%)	

**Table 4** Multivariable logistic regressions for the correlation between sociodemographic characteristics and smoking status

	Model 1 OR (95% CI)	Model 2 OR (95% CI)
City of residence		
Ramat Gan	2.76 (2.57–2.96)***	3.25 (2.68–3.93)***
Bnei Brak	1.00	1.00
Sex		
Male	1.55 (1.46–1.65)***	3.23 (2.83–3.69)***
Female	1.00	1.00
Relative socioeconomic status (RSES)		
Low	1.41 (1.31–1.53)**	0.60 (0.50–0.72)**
Medium	1.25 (1.14–1.37)*	1.19 (1.01–1.41)*
High	1.00	1.00
City of residence × sex		0.39 (0.33–0.45)***
City of residence × RSES		
Low		2.73 (2.21–3.38)***
Medium		1.21 (1.01–1.47)*
High		1.00

*N* = 31,170

OR, age-adjusted odds ratio

\**p* < 0.05\*\**p* < 0.01\*\*\**p* < 0.001

**Table 5** Univariate analysis to assess the relationship between relative socioeconomic status (RSES) and smoking status, adjusted for age and separated into four groups based on sex and city of residence

	Male		Female	
	Ramat Gan <i>N</i> =8484	Bnei Brak <i>N</i> =5772	Ramat Gan <i>N</i> =10,207	Bnei Brak <i>N</i> =5707
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<b>RSES</b>				
Low	1.69 (1.46–1.96)**	0.77 (0.62–0.95)*	1.57 (1.36–1.81)**	0.30 (0.21–0.43)***
Medium	1.52 (1.34–1.73)**	1.23 (0.96–1.43)	1.38 (1.22–1.57)**	1.14 (0.86–1.51)
High	1.00	1.00	1.00	1.00

OR, age-adjusted odds ratio

\* $p < 0.05$

\*\* $p < 0.01$

\*\*\* $p < 0.001$

residence and between SES and city of residence in predicting smoking, we chose to examine each group separately. The SES that was examined in this case was RSES.

## Results

Data for the study were collected from an anonymous database of 31,170 MHS policyholders aged 50 years and older for the years 2015 and 2016. Of the total number of policyholders, 11,509 were listed as residents of Bnei Brak and 18,891 as residents of Ramat Gan. The population distribution for each city revealed a number of distinct differences with regard to distribution by sex, age, SES, and level of UO religiosity.

The average age of the policyholders in Ramat Gan was 65.99, higher than the average age of the policyholders in Bnei Brak (64.74). None of the residents of Ramat Gan resided on streets defined as “UO homogeneity,” while the vast majority of Bnei Brak residents resided on streets with “very high UO homogeneity” (85.4%). The place of residence of the participant therefore became an indicator of UO religiosity.

None of the residents of Ramat Gan had low SES (1–3), whereas 38% of the residents of Bnei Brak had low SES. In contrast, 78.6% of Ramat Gan residents and no Bnei Brak residents had high SES (7–10).

The difference in distribution of SES between the two cities led to the creation of the RSES variable, where individual SES was considered in the context of the place of residence. RSES distribution for each of the cities is described in Table 2.

A separate analysis of the distribution of smoking status among residents of each city was conducted based on demographic variables (see Table 3). Higher smoking prevalence was found among Ramat Gan residents than among Bnei Brak residents (25.2% vs. 11.7%, respectively).

When stratifying by sex, higher prevalence of smoking was found among men than among women. This disparity between men and women was greater in Bnei Brak than in Ramat Gan (17.5% vs. 6.1%, respectively, in Bnei Brak compared with 27.5% vs. 23.3%, respectively, in Ramat Gan).

In both cities, higher prevalence of smoking was found in younger age groups. An analysis of the relationship between smoking status distribution and RSES in Bnei Brak showed that smoking prevalence was lower among residents with lower RSES than residents with medium RSES (8.3% vs. 14%, respectively), while smoking prevalence was slightly lower among residents with higher RSES than those with medium RSES (12.1% vs. 14.7%, respectively).

Smoking prevalence in Ramat Gan followed a different trend, where smoking prevalence was higher among residents with low RSES than those with medium RSES, and smoking prevalence was higher among residents with medium RSES than among those with high RSES (26.1% vs. 20.1%, respectively).

A multivariate binary logistic regression analyzing the effect of city of residence on smoking status was used to run two age-adjusted models. In the first age-adjusted model, the following variables were input: city of residence, sex, and RSES (see Model 1 Table 4). In this model, higher smoking prevalence was found among Ramat Gan residents than Bnei Brak residents (odds ratio [OR]=2.76; 95% confidence interval [CI]=2.57, 2.96). Smoking prevalence was also higher among men than among women (OR=1.55, CI=1.46, 1.65), and among those with low RSES than those with higher RSES (OR=1.41, 95% CI=1.31, 1.53). Similarly, higher smoking prevalence was found among residents with medium RSES than those with high RSES (OR=1.25, 95% CI=1.14, 1.37). In the second age-adjusted model, the following variables were input: city of residence, sex, RSES, the interaction between sex and city of residence, and the interaction between city of residence and RSES (see Model 2 Table 4).

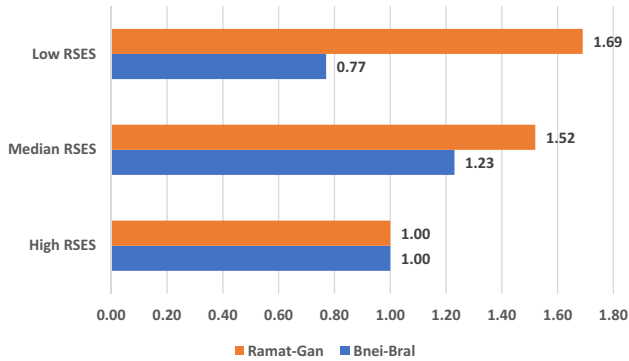
Additionally, this model showed that smoking prevalence was higher among Ramat Gan residents than Bnei Brak residents (OR=3.25, 95% CI=2.68, 3.93), and smoking prevalence was higher among men than among women (OR=3.23, CI=2.83, 3.69).

Similarly, this model showed a higher smoking prevalence among participants with medium RSES than participants with higher RSES (OR=1.19, 95% CI=1.01, 1.41).

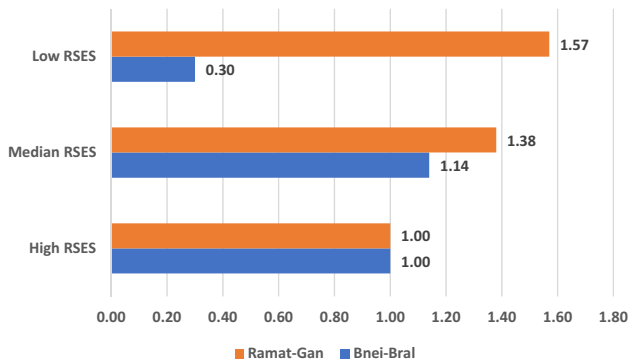
In contrast to the results of the first model, this model demonstrated an association with opposite directionality between RSES and smoking (OR=0.60, 95% CI=0.50, 0.72).

The main contribution of this model is in demonstrating the significant interactions between sex and city of residence (OR=0.39, 95% CI=0.33, 0.45), the interaction between city of residence and low RSES versus high RSES (OR=2.73, 95% CI=2.21, 3.38), and the interaction between city of residence and medium RSES versus high RSES (OR=1.21, 95% CI=1.01, 1.47).

These findings led us to the next stage, in which the study population was separated into four groups, to examine how RSES could predict smoking among each of the groups separately [Bnei Brak women, Bnei Brak men, Ramat Gan women, and Ramat Gan men (see Table 5)].



**Fig. 1** Univariate analysis to assess the relationship between relative socioeconomic status (RSES) and smoking status, adjusted for age, among men in Bnei Brak and Ramat Gan. OR, age-adjusted odds ratio



**Fig. 2** Univariate analysis to assess the relationship between relative socioeconomic status (RSES) and smoking status, adjusted for age, among women in Bnei Brak and Ramat Gan. OR, age-adjusted odds ratio

Results from an age-adjusted univariate analysis of the effect of RSES among men showed that in the city of Ramat Gan, the prevalence of smoking was higher among men with low RSES (31.5%) than men with high RSES (21.4%) (OR = 1.69, 95% CI = 1.46, 1.96). In contrast, in the city of Bnei Brak, lower prevalence of smoking was found among men with low RSES (14.0%) than men with high RSES (17.1%) (OR = 0.77, 95% CI = 0.62, 0.95) (see Table 5 and Figs. 1, 2).

Nonetheless, in the city of Ramat Gan, higher smoking prevalence was found among men with medium RSES than men with high RSES (OR = 1.52, 95% CI = 1.34, 1.73). In Bnei Brak, no significant differences in smoking prevalence were found between men with medium RSES and men with high RSES (OR = 1.23, 95% CI = 0.96, 1.43).

Results from an age-adjusted univariate analysis of the effect of RSES among women showed that in Ramat Gan, the prevalence of smoking was higher among women with low RSES (26.5%) than among women with high RSES (19.0%)

(OR = 1.57, 95% CI = 1.36, 1.81). In contrast, in Bnei Brak, the prevalence of smoking was lower among women with low RSES (2.5%) than among women with high RSES (OR = 0.30, 95% CI = 0.21, 0.43).

In the city of Ramat Gan, higher smoking prevalence was found among women with medium RSES than women with high RSES (OR = 1.38, 95% CI = 1.22, 1.57). On the other hand, in Bnei Brak, no significant differences in smoking prevalence were found between men with medium RSES and men with high RSES (OR = 1.14, 95% CI = 0.86, 1.51).

## Discussion

Our study presents three major findings. First, the prevalence of smoking is lower among the Bnei Brak population than the Ramat Gan population. Second, the disparity between the prevalence of smoking among men and women is greater within the Bnei Brak population than in the Ramat Gan population. Third, there are significant interactions between sex and city of residence (Bnei Brak/Ramat Gan) and between city of residence and RSES, and the indication of a different directional correlation between differing SES relative to the place of residence and smoking. An inverse correlation between SES relative to the place of residence and smoking was found among the non-UO population, while the UO population showed a lower prevalence of smoking among those of lower SES than those with medium or high SES.

The first finding, indicating lower prevalence of smoking in the UO population in comparison with the non-UO population, even after adjusting for age, sex, and SES, is consistent with findings from other studies carried out among the UO population in Israel (Israel Ministry of Health 2011; Kopel et al. 2013) and among other religious societies (Ahrenfeldt et al. 2018; Gillum et al. 2008; Whooley et al. 2002). One possible explanation for this is that the UO community is a relatively isolated community, less likely to adopt a change in habits, as well as less exposed to cigarette advertising channels (El-Or 1994; Freund et al. 2014; Glinert and Shilhav 1991). However, at the same time, this finding is surprising, as our study population is characterized by low SES, which has been linked to an increased risk of smoking. In addition, there are relatively low levels of health literacy and health-promoting behaviors among the UO population (Coleman-Brueckheimer and Dein 2011; Lazarus et al. 2015), which one would expect to cause higher smoking prevalence.

We can attribute this contradictory finding to the fact that low SES among UO is ideologically driven, specifically because the choice of yeshiva attendance over earning a living is considered an ideal which strengthens the community (Berman 2000). In addition, a prominent feature of the UO community is its strong social networks. Ahern et al. (2009) found that neighborhoods characterized by stronger network anti-smoking norms had lower smoking prevalence. It should be noted that one of the commandments of the Jewish religion is to maintain one's health (Kopel et al. 2013). However, UO Jews display a lack of faith in government institutions, preferring the statements of rabbinical leaders on healthcare guidelines and recommendations (Hermann and Anabi 2020).

Orthodox Jews may comprise an atypical group of cigarette smokers. Since it is strictly forbidden to light fire on the Sabbath (from sundown on Friday until the appearance of the night stars on Saturday), they regularly abstain from smoking for about 25 hours. Thus, it is possible that the Sabbath-observing smokers are different in their everyday smoking behavior and motivation (Dar et al. 2005; Munter et al. 2017).

Several different conceptual models have attempted to explain the relationships between religion and health. The model of religion and bio-psycho-social health introduced by Marks (2005) is an example of a conceptual model that links three dimensions of religious experience (religious practices, spiritual beliefs, and faith community) with three dimensions of health (biological, psychological, and social). Lozano et al. (2016) found that smokers who lived in neighborhoods with stronger social networks smoked fewer cigarettes than smokers in other neighborhoods. This was supported by other studies (Echeverría et al. 2015; Patterson et al. 2012; Wang et al. 2017). Muhsen et al. (2017) found that Orthodox Jews have larger families and a greater chance of living in poverty compared with secular or traditional Jews. However, despite these characteristics, an inverse association was found between living in Orthodox neighborhoods and all-cause mortality and mortality from heart disease. A possible explanation is the high degree of social support in the Orthodox community. It is, therefore, possible that being religious is related to low smoking prevalence through various psycho-cultural-sociological mechanisms.

The second finding, indicating that the disparity between the prevalence of smoking among men and women is greater within the UO population than the general population, is also consistent with results from earlier studies (Prevalence of tobacco smoking, Global Health Observatory 2019).

As mentioned previously, according to WHO, globally, smoking is more common among men (Prevalence of tobacco smoking, Global Health Observatory 2019). The disparity in smoking prevalence between men and women is greater in less developed and developing countries than in developed countries (World Health Organization 2008). Furthermore, there is a correlation between the degree of female empowerment and smoking prevalence among women (Hitchman and Fong 2011).

The relatively large disparity in smoking prevalence by sex in the UO society compared with general society accords with the larger disparity found in developing countries than in developed countries (World Health Organization 2008). It may be that there is less female empowerment in the UO community, in light of the high fertility rates and the observance of devout, traditional norms. This could explain how the disparity in smoking prevalence in this population is more consistent with that of developing countries (Hitchman and Fong 2011).

According to the Lopez model, the relatively low prevalence of smoking among men in the UO society compared with the non-UO society, as well as the greater disparity between men and women in the prevalence of smoking, indicates that the residents of the UO society are still in the first phase of smoking adoption (Lopez et al. 1994), while non-UO residents are in the third phase. This disparity is especially interesting given that Israel is considered a developed country and, therefore, should be past the earlier phases of the model. It is likely that the segregation and

conservatism among the UO population, however, translate into a late adoption of smoking habits, similar to less developed countries.

There was no previous literature supporting the third finding of our research, indicating a different directional correlation between differing SES and smoking prevalence based on different levels of religiosity for neighboring cities in the same country.

Similar to findings in other countries (Casetta et al. 2017), a higher prevalence of smoking was found within the non-UO population among people of lower SES relative to those of higher SES. On the other hand, smoking prevalence within the UO population was found to trend in the opposite direction: lower smoking prevalence was found among those with lower SES. This trend was demonstrated in both men and women. This finding is unusual and also appeared in the countries of Georgia and Mexico (Hosseinpoor et al. 2012).

There are a number of explanations for these differences.

The UO society is poorer than the general population, and the UO poor are relatively poorer than the non-UO poor. Perhaps at this level of poverty there is no budget for purchasing cigarettes.

It is also possible that individuals with lower SES in the UO society are more religious—or that individuals with higher SES in the UO society are more open and share workplaces with members of the non-UO society—and this impacts their smoking habits. This explanation appears to fit the results of the study conducted by Kopel et al. (2013) that found a lower prevalence of smoking among UO men who were full-time yeshiva students than among men who were employed.

## Research Limitations

There are several limitations in our study that should be considered when interpreting the results. Since the study utilized cross-sectional data, it was impossible to infer any causality or establish the causal direction of the associations. Furthermore, if our study had included smoking habits over time, we would have been better able to discuss our results as they pertain to the Lopez et al. (1994) four-phase model. However, we chose to include this model in the discussion due to its importance in understanding the findings.

Another limitation lies in the fact that this research was conducted using administrative data, which is limited in terms of validation. The lack of information concerning the resulting variable—active smoking—for 1784 (5.9%) participants could impact the research results.

The participants in this study are Maccabi Healthcare policyholders, who comprise about half of the residents of the two cities, so a situation was created in which only half of the residents of these cities were included in the study, which presents a major limitation. In addition, it is important to note the disparities in distribution of sex between the two cities, specifically in that in Ramat Gan, women made up 54.6% of the insured population, while in Bnei Brak they made up only 49.7% of the insured. Because we did not have access to data about the sex distribution among



the entire population of Bnei Brak and Ramat Gan, it is possible that some selection bias may have affected the study results.

The data about Maccabi Healthcare non-policyholders were not available, and it was not possible to examine the differences in the characteristics of those insured with various healthcare service providers in the city of residence.

In addition to the limitations above, it is important to point out that this study was conducted among insured people aged 50 years and older, and we cannot extrapolate or apply its results to the younger population.

## Implications of the Research Results

The results of this research highlight the need to develop culturally friendly smoking cessation programs for those of low SES, within the general population and within the relatively higher SES group of the Haredi population.

The results of this research indicate that religiosity is a sociocultural factor that may be associated with different aspects of smoking. Indeed, it appears that correlations between SES and smoking prevalence may differ for different adjacent populations in the same country, emphasizing the need for additional research. Furthermore, activities aimed at raising awareness about the risk of smoking among UO populations with high SES are warranted.

The results of this research highlight the need for evaluating the relationship between sex, SES, and health behaviors by comparing these relationships in different cultural groups. We believe that identifying the differences in these relationships will aid in developing more culturally appropriate interventions which are geared specifically to the cultural needs of the population.

Finally, this research was conducted among those who are aged 50 years and older. It is highly recommended that this type of investigation be carried out for a wider variety of age ranges.

Although this study was conducted in Israel, UO societies are also found in the United States and Europe. This raises the need for a similar investigation and planning of prevention programs tailored to UO communities around the world.

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## Declarations

**Conflict of interest** No conflict of interest arose during the course of this research.

**Ethical Approval** Institutional review board approval and waiver of informed consent was obtained from Bait-Balev hospital research ethics board, Bat-Yam, Israel. For this type of study, formal consent is not required. Number of committee approval: 0019-17-BBL.

**Statement on the Welfare of Animals** This article does not contain any studies with human participants or animals performed by any of the authors.

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**Ronit Pinchas Mizrahi (MPH, Ph.D.)** is a Senior Lecturer in the Department of Nursing at the Jerusalem College of Technology (JCT). She completed her PhD in Public Health at the Hebrew University of Jerusalem (2013). Her doctoral research was conducted under the guidance of the late Professor JD Kark. She is a social epidemiologist. Her research deals with social health disparities in Israeli society.

**Adi Finkelstein** is a Senior Lecturer in the Department of Nursing at the Jerusalem College of Technology (JCT). She completed her PhD in Medical Anthropology (“Summa cum laude”) at the Hebrew University of Jerusalem (2009). In 2012 She was awarded the Ginsberg foundation Scholarship for post-doc studies. She was a visitor scholar at UC Berkeley (2012–2013) where she was trained in disability studies. Her primary research interests are the lived experience of people with chronic illness and their families, patient-doctor communication, social and cultural aspects of women’s health, end-of-life care and medical/nursing education.