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Article

Relative deprivation and its association with health indicators: Lower inequality may not improve health

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A B S T R A C T

This study tested the hypothesis of relative deprivation (RD) to investigate how inequality is associated with health and health related behaviors in a developing country context. Data from two nationally representative surveys in 2010, 2012, and 2014 were used to estimate logit and ordered logit models stratified by sex. RD was calculated based on both income and education, unlike most studies in the earlier literature that relied only on income. All results of the study were found to be robust to alternative reference groups. First, consistent with the earlier literature, RD was found to be positively correlated with indicators of poor health. Secondly, and more interestingly, unlike the results in the earlier RD literature, women with more income or education (and lower *RD*) were found to be more likely to be current smokers and more likely to consume a higher number of cigarettes. The main policy implication is that reducing inequality can help improve self-rated health indicators, but it will not be sufficient to achieve health policy goals. Unless smoking patterns change, reducing inequalities in income or education among women will not necessarily lead to better health; because smoking is more common among better educated and richer women.

1. Introduction

Understanding the association between inequality and health outcomes is important in designing policies that aim to improve public health. The literature on the socioeconomic determinants of health provides us with a large number of studies which suggest that inequality has adverse consequences for health (Subramanyam, Kawachi, Berkman, & Subramanian, 2009; R. Wilkinson & Pickett, 2011; Richard G Wilkinson & Pickett, 2006). One explanation offered in the literature about why inequality damages health is the relative deprivation (*RD*) hypothesis (Adjaye-Gbewonyo & Kawachi, 2012; Kawachi & Kennedy, 1999; Smith, Pettigrew, Pippin, & Bialosiewicz, 2012; Wilkinson, 1997). The idea behind this hypothesis is that an individual's health or health related behavior is determined both by his own resources (such as own income or educational attainment) and by his relative position in terms of these resources (i.e., how much others have versus how much he has).

The concept of *RD* is based on the feeling of being deprived of something while others have it (Runciman, 1966, p. 10). Higher inequality in socioeconomic status generates a higher sense of RD. People compare themselves to those in their reference group and if they feel disadvantaged they experience a sense of RD.

In theory, there are two channels through which *RD* may affect one's health: Material pathway and psychosocial pathway. In the material pathway channel, *RD* limits one's access to goods, services, and social activities such as employment or social networks that represent the standards of living in a society and thereby adversely affects one's health. In the second channel, increased inequality produces shame, frustration and stress among those who are relatively deprived, leading to negative health impacts (Adjaye-Gbewonyo & Kawachi, 2012; Kuo & Chiang, 2013; Lhila & Simon, 2010; Sweet, 2011; Åberg Yngwe, Fritzell, Lundberg, Diderichsen, & Burström, 2003). According to psychosocial theory, psychological stress may impact mental or physical well-being either directly, or indirectly via health behaviors (e.g. substance use) (Elstad, 1998; R. Wilkinson & Marmot, 2003; Wilkinson, 1997). Evidence suggests that social deprivation is associated with high rates of smoking and low rates of quitting (Wilkinson & Marmot, 2003).

A large literature examined the link between *RD* and health, relying

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on health outcome measures such as self-rated health (*SRH*). *SRH* is an important measure known to be a good predictor of mortality (Idler & Benyamini, 1997; Mossey & Shapiro, 1982). In the literature, the sign and strength of the link between *RD* and *SRH* vary. A significant relationship was found between RD (in the sense of Yitzhaki) and worse *SRH* status in the United States (Eibner & Evans, 2005; Subramanyam et al., 2009) and in Japan (Naoki Kondo, Kawachi, Subramanian, Takeda, & Yamagata, 2008). In Great Britain, the results depend on the econometric technique used (Gravelle & Sutton, 2009; Jones & Wildman, 2008). In China, no significant relationship was found between RD and *SRH* (Li & Zhu, 2006).

Another branch of the literature studied self–reported limitations (such as having a chronic illness, chronic pain, or a physical restraint). In the United States, high Yitzhaki *RD* was found to be associated with higher self-reported limitations (Eibner & Evans, 2005). In China, no significant association was found between community based Yitzhaki RD and physical functions and activities of daily living (for which data are available only for the elderly) (Li & Zhu, 2006). In Japan, it was found that Yitzhaki *RD* may be a mechanism that explains the link between income inequality and functional disability in older age, at least among males (Kondo et al., 2009).

Several studies examined the link between *RD* and risky health behaviors. In the United States, a significant relationship was found between higher *RD* and risky behaviors, such as higher rates of smoking and lower rates of seatbelt use and regular exercise. Moreover, the *RD* effect was found to be stronger for heart disease mortality and tobacco-related cancers than for all-cause mortality (Eibner & Evans, 2005). In China, one study found no significant association between Yitzhaki-based RD and smoking (Li & Zhu, 2006), whereas another one found that higher *RD* was associated with increased probability of smoking (Ling, 2009). In Taiwan, higher *RD* was associated with increased probability of smoking (Kuo & Chiang, 2013). In Australian data, no association was found, after controlling for perceived relative material well-being (Siahpush et al., 2006). In sum, this literature provided us with mixed evidence on the relationship between *RD* and smoking. None of these studies found that lower *RD* is associated with more smoking.

Although suggestive, the extant *RD* research suffers from two key limitations: First, almost all of the studies are conducted on developed countries. The exception is a few studies on China; however, they usually rely on small-area measures of inequality, hence they may underestimate nationwide inequality. Literature search revealed only two published relevant studies about Turkey, which focused on the relationship between inequality and health. Both are macro-level data analyses. One of them used region-level data in 1975–2001 to examine the effects of income inequality (as measured by Theil index) on infant and under-five child mortality (Çukur & Bekmez, 2011). The other study examined inequality in income and education on infant and adult mortality in years 1980–2006 (Çoban, 2008).

Secondly, almost all studies relied on income as the indicator of socioeconomic status (SES). There are several issues with taking income as a SES indicator: it is difficult to measure precisely in surveys; it is difficult to know how income is shared within a household; and current income may be a weak indicator of lifetime income and thereby a weak indicator of SES. Education may be used as an alternative and a better indicator of SES, since the level of educational attainment usually stays constant during adulthood (unlike income that varies), and it shapes one's labor market experience as well as social network. It is also much easier to measure the level of education than income at the individual level.

This paper used micro-level data from two nationally representative surveys from Turkey to illustrate that *RD* is correlated with health and health related behavior. This research carefully extended previous results in two important ways: (1) by using new data with a large set of outcome measures (*SRH*, having a chronic illness, chronic pain or a physical restrain, smoking status, and the amount of smoking) from a developing country with high population and one of the highest rates of income inequality among the OECD countries (OECD, 2014), and (2), by using education as an alternative indicator of socioeconomic status and showing that a reduction in education deprivation will not necessarily improve health. The robustness of the results were tested against alternative reference groups.

2. Materials and methods

2.1. Data

Two nationally representative datasets were examined: The first dataset was the Survey of Income and Living Conditions (SILC) (Turkish Statistical Institute, 2014), which aimed to collect data comparable with the European Union countries, in order to generate official statistics on income distribution and poverty. The health module of the survey included questions on SRH and the existence of a chronic illness or a physical restraint.

The second dataset was the Turkish Health Research Surveys (HRS) conducted by the Turkish Statistical Institute (TurkStat) every two years. The surveys collected comprehensive data on health status, daily activities, and substance use of the Turkish population. The module that collected data on individuals in ages 15 or older, which was used in this study, was the Eurostat survey translated into Turkish (Turkish Statistical Institute, 2013).

Both datasets consisted of independent cross-sections. In this study, data from the 2010, 2012, and 2014 waves of the two surveys were pooled. In each year, individual-level sample weights were used to ensure that the results are representative of the Turkish population. In line with the practice in the literature, the samples were restricted to the working-age population (ages 25 to 64). Under this restriction, there were 23,213 women and 19,303 men in the HRS dataset (except for chronic illness, for which there were 15,991 women and 13,201 men) and 46,796 women and 40,995 men in the SILC dataset.

2.2. Outcome measures

Data on *SRH* and *chronic illness* are collected in both surveys, whereas the data on *physical restraint* is collected by the SILC. Data on *chronic pain*, *smoking status* and *the amount of daily smoking* come from the HRS. For all outcome measures (except for the number of cigarettes smoked) new binary variables were defined. They take the value of 1 in case of poor health or adverse health behavior, and 0 otherwise, as explained below:

- The SRH question in the two surveys: "Generally, how would you rate your current health status?" It has a 5-point Likert scale (excellent, good, fair, poor, very poor). The binary variable is equal to 1 if the person rates own health as poor or very poor, and zero otherwise.
- The chronic illness question in the SILC asks the respondents if they have any chronic illnesses (1: Yes, 0: No). The HRS is more detailed; it asks the existence of a number of chronic illnesses (such as diabetes, asthma, kidney failure, or rheumatism) one by one. The binary variable is 1 if the person has any of those illnesses. Since the wording of the survey question was changed in 2014, only the data from years 2010 and 2012 were pooled. The sample is therefore smaller in the chronic illness regressions in the HRS.
- The chronic bodily pain question in the HRS asks how much pain or physical discomfort the individual experienced within the last 4 weeks. It has a 6-point Likert scale (None, Very little, Little, Medium, Severe, Very severe). The binary variable is 0 if the person has no or very little pain, and 1 otherwise.
- The physical restraint question in the SILC asks "Do you experience a restraint in your daily activities because of a physical or mental problem that has been going on for at least 6 months?". The binary

variable is 1 if there is physical restraint and 0 if not.

- Two smoking-related outcome measures were built based on the HRS data. Current smoking status (1: Yes, 0: No); the intensity of smoking is a categorical variable based on the number of cigarettes smoked per day (0: None, 1: 1–10, 2: 11–20, 3: 21–30, 4: 31 or more).

2.3. Relative deprivation

Following the recent studies in the literature (Adjaye-Gbewonyo & Kawachi, 2012; Kuo & Chiang, 2013), the Yitzhaki Index (Yitzhaki, 1979) was used to measure RD:

$$RD_i = \frac{1}{n}\sum (y_j - y_i),\ \text{ for all }\ y_j > y_i, \tag{1}$$

In equation (1), RD_i is the relative deprivation of individual i whose socio-economic status indicator is y_i. The index sums up the differences and divides by n, the size of the reference group. According to the relative deprivation hypothesis, individual i compares himself to others who are in the same reference group and who have a better socio-economic status (SES), i.e. to all j such that $y_j > y_i$. The individual with the highest SES has an RD of zero. *RD* was standardized (it has a mean of zero and a variance of one) (Siahpush et al., 2006), so that a one-unit increase in RD could be interpreted as a one standard deviation increase.

To calculate *RD*, (equivalent) household income and years of education were used as two alternative SES indicators. Usually, household income is used in the literature, but it is not clear if income is the most relevant indicator when individuals compare themselves with others (Barnett, Moon, & Kearns, 2004). For this reason, and for reasons explained in the Introduction, education (years of education obtained) was considered as an alternative SES indicator.

In the SILC, household income was a continuous variable. In the HRS, it was available in brackets, so income was defined as the midpoint of the bracket. In the top open-ended bracket, the median value for the bracket was calculated following the Pareto curve approach (Parker & Fenwick, 1983). In both datasets, equivalent household income was defined as income divided by the number of household members. The Consumer Price Index (2003 = 100) was used to adjust for inflation. Years of education was inferred from the highest degree earned (0 if individual is illiterate, 2 if literate but no degree, 5 if completed primary school, 8 if completed middle school, 11 if completed high school, and 15 if completed university or more).

Several alternative reference groups were considered in this study: All individuals in the sample; individuals with the same sex (female versus male), individuals in the same age group (25–34, 35–44, 45–54, 55–64); region of residence (12 regions); and individuals with the same educational attainment (illiterate, literate but no degree, primary school graduate, middle school graduate, high school graduate, university graduate or more). Moreover, these characteristics were combined to create more complex and smaller reference groups (sex-age, sex-education, age-region, age-education, sex-region, education-region, sex-region-education, sex-region-age, sex-age-education, and region-age-education when the SES indicator was equivalent income; and sex-age, age-region, sex-region, and sex-region-age, when the SES indicator was education).

2.4. Empirical strategy

In the empirical analyses, the estimated regression equations had the following specification:

$$H_i = \beta_0 + \beta_1 RD_i + \gamma' X_i + \varepsilon_i \tag{2}$$

where H_i represented a health-related outcome measure, RD_i the relative deprivation index, and X_i a matrix that contained dummy variables for sex, marital status, employment status, region of residence, and survey year, all for individual *i*. The matrix also included real equivalent household income, since it is important demonstrate the contribution of *RD* independent of absolute income (Naoki Kondo et al., 2008). With a similar motivation, X_i also included years of completed education. Equation (2) was estimated by logistic regression (for binary outcome variables) or ordered logit regression (for categorical outcome variables). In line with the literature, odds ratios were estimated in order to assess the percentage change in the probability of having a bad health outcome in response to a change in the RD variable.

To decide whether the RD effect differs across the two sexes, equation (2) was estimated with an extra 'RD*sex' interaction term. Since the interaction term was statistically significant in almost all regressions, regressions were stratified by sex. This approach also follows the earlier studies in the literature that stratified their analyses by sex (Kondo et al., 2009).

One challenge in estimating β_1 in equation (2) is the multicollinearity introduced by the correlation between *RD* and the SES indicator in the definition of *RD*. To check whether multicollinearity poses an econometric problem, the variance inflation factor (VIF) was calculated for *RD* in all regressions (Kuo & Chiang, 2013). While there is no clear consensus regarding what is considered as high for the VIF, many sources mention a VIF of > 4 as high. Another concern to keep in mind when determining the set of control variables is the difficulty of knowing which are genuine confounders and which are mediating variables, or pathways. If the variables that proxy for social class are included, then the true effect of *RD* on health cannot be measured. In Turkey, household income level and educational attainment can in fact be seen as proxies for social class. If so, then income and education should not be in the regression (Richard G Wilkinson & Pickett, 2006). To account for these concerns, robustness checks were done by excluding education and income from the regressions.

3. Results

Table 1 shows the weighted descriptive statistics for socio-demographic characteristics in the two Turkish surveys. As shown in Table 1, the demographic and socioeconomic compositions of the two samples are, in general, similar. The majority of the individuals (about 84%) are married; more than half (66–72% of women and 47–50% of men) have completed only five years of education. Employment rate is lower among women (24–43%) than among men (74–79%). The household income variable is collected in income brackets in the HRS.

Table 2A–2B present the weighted shares of the two samples in which the binary outcome measures are equal to 1, estimated across socio-demographic groups in the two surveys. As shown in the tables, women have poorer SRH than men in both surveys. In both surveys, the prevalence of having poor or very poor SRH is higher among the older age groups, among the divorced than married or singles, among those who are not employed, among those with less education, and among those with lower household income. For chronic illness, chronic bodily pain, and physical restraint, the prevalence of having a poor health outcome has a remarkably similar pattern to the SRH measure. In each, the prevalence of poor health is higher among the older age groups, among the divorced than married or singles, among those who are not employed, among those with less education, and among those with lower household income. Important for this study, all of these measures are negatively correlated with both education and income (Tables 2A–2B).

Current smoker status is a health behavior-related outcome measure. As shown in Table 2A, compared to the other measures, smoking displays a quite different distribution across socio-demographic groups. The smoking rate is higher among men than women, higher among ages 25–44 than older ages, higher among singles and divorced than married individuals, and higher among the employed. Smoking rate is higher among those with 8 or 11 years of education (corresponding to middle school and high school graduates) and lower among those with at most

Table 1
Socio-demographic characteristics in the two Turkish surveys.
Source: Authors' calculations based on data from the HRS and the SILC.

	HRS				SILC			
	Women		Men		Women		Men	
	N	%	N	%	N	%	N	%
Total	**23,213**	**100%**	**19,303**	**100%**	**46,796**	**100%**	**40,995**	**100%**
Survey Year								
2010	5,564	23.97%	4,323	22.40%	10,861	23.21%	9,381	22.88%
2012	10,428	44.92%	8,885	46.03%	15,757	33.67%	13,894	33.89%
2014	7,221	31.11%	6,095	31.58%	20,178	43.12%	17,720	43.22%
Age Group								
25–34	6,851	29.51%	5,227	27.08%	15,073	32.21%	14,020	34.20%
35–44	6,618	28.51%	5,422	28.09%	13,594	29.05%	13,065	31.87%
45–54	5,662	24.39%	5,016	25.99%	10,943	23.38%	9,596	23.41%
55–64	4,082	17.58%	3,638	18.85%	7,186	15.36%	4,314	10.52%
Marital Status								
Single	1,727	7.44%	2,239	11.60%	3,656	7.81%	5,027	12.26%
Married	19,293	83.11%	16,559	85.78%	38,675	82.65%	34,979	85.33%
Divorced	2,193	9.45%	505	2.62%	4,465	9.54%	989	2.41%
Employment Status								
Not employed	17,730	76.38%	5,073	26.28%	26,802	57.27%	8,575	20.92%
Employed	5,483	23.62%	14,230	73.72%	19,994	42.73%	32,420	79.08%
Years of Education								
0–5	15,367	66.20%	9100	47.14%	34,048	72.76%	20,548	50.12%
8	1,840	7.93%	2,558	13.25%	3,095	6.61%	5,336	13.02%
11	3,280	14.13%	4,075	21.11%	5,314	11.36%	8,430	20.56%
More Than 11	2,726	11.74%	3,570	18.49%	4,339	9.27%	6,681	16.30%
Real Household Income (TL)								
164.14	404	1.74%	292	1.51%	1,586	(mean)	1,678	(mean)
192.47	453	1.95%	313	1.62%	1,485	(median)	1,576	(median)
199.32	436	1.88%	324	1.68%				
217.99	2,154	9.28%	1,571	8.14%				
233.71	482	2.08%	326	1.69%				
262.63	324	1.40%	251	1.30%				
307.95	540	2.33%	370	1.92%				
321.25	932	4.01%	704	3.65%				
376.68	643	2.77%	463	2.40%				
386.91	1,291	5.56%	1,042	5.40%				
453.67	558	2.40%	442	2.29%				
469.45	1,297	5.59%	1,102	5.71%				
531.24	1,470	6.33%	1,193	6.18%				
550.45	602	2.59%	476	2.47%				
563.24	677	2.92%	560	2.90%				
660.43	344	1.48%	272	1.41%				
703.93	1,689	7.28%	1,480	7.67%				
751.25	1,185	5.10%	1,045	5.41%				
825.41	787	3.39%	650	3.37%				
938.42	1,381	5.95%	1,242	6.43%				
1,080.25	1,223	5.27%	1,157	5.99%				
1,100.36	495	2.13%	433	2.24%				
1,301.88	1,997	8.60%	1,888	9.78%				
1,504.54	660	2.84%	578	2.99%				
1,521.48	1,189	5.12%	1,129	5.85%				

Notes: Weighted statistics are shown in the table. Household income is available in brackets in the HRS (the table shows the mid-points of the income brackets). All income data are adjusted for inflation using the Consumer Price Index (2003 = 100). For SILC, mean and median values of income are reported.

elementary school education or with at least some college experience.

The number of cigarettes smoked is another health behavior related outcome measure. To save space, only the descriptive statistics for the "number of cigarettes" binary variable (not the categorical variable used in the regressions) are presented. This variable is equal to 1 if the individual smokes more than a pack of cigarettes (or more than 20) per day. 11.13% males are in this category, in contrast to 4.51% of women. This binary variable is negatively correlated with education, as can be seen in Table 2A. For men, smoking rate and intensity decline with education, but for women no decline is observed. On the contrary, women with more education are more likely to smoke. Although smoking rates are lower among those with the least schooling (especially among women), smoking intensity is the highest among the least educated in the population. Income appears to have a negative correlation with the "number of cigarettes".

In Tables 3–5, the estimates of the odds ratios are reported along with the confidence intervals for the odds ratios. All regressions are stratified by sex. In Table 3, the results from the SILC data clearly show that those who are relatively more deprived are more likely to report bad health, more likely to have a chronic illness, and more likely to have a physical restraint. It is important that the finding is robust to alternative definitions of the SES indicator or the reference group, and to different outcome measures, with a few exceptions.

In Table 3, based on the first set of estimations that include all control variables, the results indicate that a one standard deviation increase in *RD* increases the likelihood of having an adverse health-related outcome by 10%–90% (typically by 25–65%), depending on the outcome variable, the SES indicator, and the reference group. In most

Table 2A
Outcome measures (%) in the Health Research Survey (HRS) across socio-demographic groups.
Source: Authors' calculations based on data from the HRS

	Bad Self-Rated Health (SRH)		Chronic Illness		Bodily Pain		Smoking Status		Number of Cigarettes	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
All	8.96	4.94	41.33	27.37	27.34	14.65	20.52	47.76	4.51	11.13
Marital Status										
Single	3.48	3.61	18.58	11.32	14.38	8.77	26.51	48.30	8.67	7.34
Married	9.19	5.08	42.61	30.03	27.99	15.51	18.36	47.30	3.13	11.68
Divorced	12.02	7.65	51.59	26.79	33.70	18.42	32.37	60.33	7.22	13.57
Employment Status										
Not employed	9.77	11.34	43.46	36.61	28.29	17.68	18.97	41.30	4.93	10.78
Employed	6.25	2.70	34.25	24.13	24.18	13.58	25.68	50.03	3.51	11.23
Age Groups										
25–34	3.35	2.17	20.22	14.07	16.24	10.63	22.18	52.72	1.84	8.54
35–44	6.88	4.15	36.65	22.79	24.62	15.47	25.19	51.58	4.97	11.41
45–54	10.56	5.48	53.12	35.79	33.19	15.36	19.58	46.91	8.01	13.27
55–64	20.10	10.63	69.55	47.51	43.10	19.75	11.37	33.52	3.04	13.75
Survey Year										
2010	11.57	5.56	44.51	28.93	30.58	16.88	20.21	50.90	4.35	12.47
2012	7.28	4.45	39.28	26.13	25.24	12.86	20.73	45.26	4.61	9.93
2014	18.34	15.20	73.44	63.32	45.14	28.67	21.53	49.92	5.66	19.40
Years of Education										
0–5	12.04	7.58	48.02	32.44	31.64	18.68	15.20	49.08	5.09	14.47
8	5.26	4.12	35.14	26.70	24.57	15.62	31.36	54.53	4.20	10.41
11	2.61	2.12	29.01	21.39	19.10	9.94	34.56	49.20	3.71	8.56
More than 11	1.62	1.88	22.27	21.52	14.71	8.83	26.31	48.43	4.28	3.79
Income group (percentiles)										
Lowest 25%	13.92	8.46	46.77	30.21	33.69	20.58	16.41	49.67	5.80	15.18
Next 25%	8.87	5.07	42.30	27.97	26.75	15.01	17.64	48.20	2.26	10.68
50–75%	6.36	3.55	38.08	25.88	24.64	11.85	23.83	46.33	5.26	9.90
75–90%	7.32	2.51	38.31	27.24	23.69	10.68	26.48	49.35	4.77	6.43
Top 10%	4.55	1.12	34.57	23.03	20.39	10.40	27.97	46.07	3.17	7.59

Notes: Weighted statistics are shown in the table. "Number of cigarettes" shows the shares of individuals who are current smokers and who smoked more than one pack per day.

cases, the estimated odds ratio for *RD* is greater than 1, both for men and for women. The variance inflation factors (VIF) of most RD variables are small (i.e., less than 4), so there is no evidence for a multicollinearity problem. As robustness checks, the regressions were estimated by excluding income and education in the second set of estimates. The estimated *RD* effect was usually higher in the second set of regressions.

Next, Tables 4 and 5 report the estimates obtained from the HRS dataset. Several important findings emerge: The first outcome variable was SRH. Consistent with the results in Table 3, Table 4 shows that those who are relatively more deprived are more likely to report bad SRH (by about 45–65%). For both men and women, stronger results were obtained by excluding income and education from the regression. The second outcome variable was having a chronic illness. Here, the results were weaker, with no *RD* effect for men in many regressions and a small effect (about 8–17%) for women.

The third outcome variable in Table 4 was chronic pain (having severe or very severe bodily pain). Those with high RD are, in general, more likely to experience severe or very severe pain. Considering the regressions that exclude both income and education, it was found that RD increased having chronic pain by about 35–40% among men and about 20% among women.

The next set of results is related to smoking. Table 5 presents the estimation results for two outcome variables (being a current smoker and the number of cigarettes smoked (categorical)).

For men, when RD is based on income, statistical significance of odds ratios is higher when income and education are excluded from the regressions (the second column for each outcome). Odd ratios vary in the range of 1.07–1.15. When RD is based on education, the estimated odds ratios are in the range of 0.75–0.89 in the first column, but around 1.11–1.25 in the second column (where both income and education are excluded). For women, when RD is based on income, statistical significance is higher when income and education were excluded from the regressions. Odd ratios are less than 1 and in the range of 0.74–0.93. When RD is based on education, all estimates are statistically significant and all of them are less than 1. Odd ratios in the second columns are in the range 0.60–0.71.

Therefore, the estimated odds ratios for smoking behavior are usually greater than 1 for men, especially when income and education are not in the regression. They are less than 1 for women in most specifications. In other words, women with more education or income (and lower *RD*) are more likely to be current smokers and are more likely to consume a higher number of cigarettes.

4. Discussion and conclusions

Turkey provides researchers with a rich laboratory to test the RD hypothesis, since it is a developing country with a high population and substantially high inequality, with one of the highest rates of income inequality among the OECD countries. In 2014, the Gini coefficient was 0.393 in Turkey, whereas the OECD average was 0.318 (OECD, 2014). Average education level in the country has increased over time, yet, as of 2017, among the 25-64 year-olds about 61% have below upper secondary, only 19% have upper secondary, and 20% have tertiary education, compared to the OECD averages of 20%, 43%, and 37%, respectively (OECD, 2018a). Turkish population is young compared to the OECD average. As of 2012, although the share of the working-age population is close to the OECD average, the share of those in ages 14 or less was higher in Turkey (25.1% in Turkey versus 18.38% in the OECD) (OECD, 2018b; 2018c). The large young population is a magnet that attracts the producers of pleasurable but harmful goods such as cigarettes. In 2012 (the latest available statistics), 27% of the population (41.5% of men and 13.1% of women) were current smokers. For both sexes, smoking was more common among the younger population

Table 2B
Outcome measures (%) in the Survey of Income and Living Conditions (SILC) across socio-demographic groups.
Source: Authors' calculations based on data from the SILC

	Bad Self-Rated Health (SRH)		Chronic Illness		Physical Restraint	
	Women	Men	Women	Men	Women	Men
All	13.05	7.79	35.87	23.54	28.86	18.64
Marital Status						
Single	10.78	8.35	20.27	13.17	18.97	13.18
Married	12.23	7.55	35.28	25.29	28.16	19.42
Divorced	22.67	11.94	56.10	29.02	44.61	25.68
Employment Status						
Not employed	15.90	17.81	39.17	32.88	32.42	28.44
Employed	9.02	5.45	31.21	21.36	23.82	16.35
Age Groups						
25–34	4.48	4.29	15.79	11.95	13.62	11.03
35–44	9.88	6.98	31.34	22.18	25.90	17.85
45–54	18.20	10.94	50.87	35.57	39.50	26.26
55–64	32.47	17.71	70.86	48.07	55.58	35.00
Survey Year						
2010	15.31	8.73	35.81	22.11	33.27	20.32
2012	12.39	7.31	33.92	22.13	27.79	18.70
2014	11.64	7.41	37.82	26.18	25.88	17.05
Years of Education						
0–5	17.01	12.14	42.85	30.17	35.24	25.96
8	6.86	5.88	25.44	19.93	19.27	15.68
11	3.31	3.65	20.03	16.87	14.52	12.02
More than 11	1.31	1.87	13.24	15.55	7.99	7.98
Income group (percentiles)						
Lowest 25	20.78	14.32	43.67	29.19	38.40	27.87
Next 25	13.86	8.58	38.03	24.25	31.33	20.32
50–75	11.58	6.42	34.97	22.61	27.75	16.81
75–90	8.93	4.53	31.03	19.52	22.29	13.33
Top 10	4.51	2.23	23.69	19.82	15.38	10.40

Notes: Weighted statistics are shown in the table.

(who have higher educational attainment than the older generations). In the 25–44 age group, 52.1% of men and 19% of women were current smokers (Public Health Institution of Turkey, 2014, p. 948).

Several important results emerge from this study: First, consistent with the earlier findings in the literature, in both datasets *RD* is positively correlated with indicators of poor health, such as bad *SRH*, having a chronic illness or pain, or a physical restraint. This is true regardless of whether deprivation is in income or in education, which means that both low-income groups and low-education groups are the ones with poor self-rated health. The relationship between *RD* and poor health is robust to changes in reference groups and across different health indicators. Given that *RD* is closely related to inequality, the findings imply that economic policies should be concerned with the adverse effects of inequality on subsequent health outcomes.

The second set of results are on current smoking status and smoking intensity. Here, the findings are new to the *RD* literature; therefore, the greater part of the discussion is devoted to this set of results. The exclusion of the SES indicators from the regressions minimizes the multicollinearity problem as measured by the variance inflation factor; therefore, that specification should be preferred to the other two. The estimated odds ratios for smoking behavior are usually greater than 1 for men, especially when income and education are not in the regression. The magnitude of the RD effect is somewhat larger when education is used as the SES indicator (with odds ratios about 1.11–1.25), compared to when income is used as the SES indicator (with odds ratios about 1.07–1.15). Therefore, men with lower education or income (hence higher *RD*) are more likely to be current smokers and are more likely to consume a higher number of cigarettes.

For women, the odds ratios are less than 1 in most specifications. In other words, in contrast to men, women with more education or income (hence lower *RD*) are more likely to be current smokers and are more likely to consume a higher number of cigarettes. When RD is based on income, the odds ratios are in the range of 0.74–0.93. When RD is based on education, the odds ratios are in the range 0.60–0.71. Therefore, a one-standard deviation increase in education *RD* is associated with a 29–40% decrease in odds for smoking among women. Earlier findings in the *RD* literature indicated otherwise; i.e., smokers had higher *RD*.

Several factors may contribute to the explanation of the finding that an increase in *RD* reduces smoking among women: First, compared to those with low education, smoking may be a more socially-acceptable behavior among the richer, better educated, hence more powerful women. Such women usually live in big cities and have adopted a more modern lifestyle. They are influenced by many factors such as tobacco marketing, emancipation, globalization and urbanization (Kilic & Ozturk, 2014). With declining tobacco consumption in the developed world, tobacco companies have turned to developing countries, targeting educated youth and especially women by marketing their products as modern and fashionable, creating a further challenge to policy makers. Smoking is being presented not only as a stress companion, but also as a symbol of emancipation and even as an assistant in weight control (Erten & Aslan, 2008; Kilic & Ozturk, 2014).

Secondly, smoking is expected to be more affordable to women with higher income or better education. In Turkey, the total tax rate has been increasing in the last decade in compliance with tobacco control legislation, thereby causing cigarette prices to rise at least as fast as inflation (Arslanhan, Caner, Helvacioglu, Saglam, & Teksoz, 2012; Bilir, Ozcebe, Erguder, & Mauer-Stender, 2012; Cetin, 2017).

An extensive review of the literature shows that this is the first study to demonstrate how RD is correlated with health and health related behaviors in Turkey, and one of the few studies in a developing country context. In this study, *RD* is defined on objective measures of socioeconomic status; therefore, it is less prone to problems of endogeneity or reverse causation, unlike some recent papers that study how subjective measures of RD affect subjective health (Beshai, Mishra, Meadows, Parmar, & Huang, 2017). Since nationally representative samples were used, the analyses capture country-wide inequality in income and education. Therefore, the RD variables in this study reflect the full scale of social class differences in the society, unlike some studies (cited in Wilkinson and Pickett (2006)) that rely on small areas. Large sample sizes also allow us to increase the precision of the estimates.

The current study has some limitations. The cross-sectional design does not allow causal inferences; therefore, the results should be interpreted as correlations. There may be individual-specific omitted variables that might influence health, such as personality, lifestyle factors or neighborhood characteristics. In the HRS (which aims to collect health data) income data are in brackets; thus, they do not yield a highly precise depiction of income distribution. Fortunately, reliable income data are available from the Survey of Income and Living Conditions, which is the main data source for income distribution statistics in Turkey. A common problem in most studies in the literature is the lack of information on how reference groups are formed (Åberg Yngwe et al., 2003). As other empirical researchers have done, reference groups were built on alternative multiple characteristics to address this limitation.

The results about women's smoking behavior contradict with the earlier *RD* literature which finds that higher smoking is associated with higher *RD* (Giskes, van Lenthe, Turrell, Brug, & Mackenbach, 2006). In many countries, smoking has been found to work as a mediator in the education-mortality gap (Denney, Rogers, Hummer, & Pampel, 2010). However, as we have seen, that argument does not seem to be valid for Turkish women. Turkey is a middle-income country where the government has been following tobacco control policies such as price hikes and bans in public places (Kilic & Ozturk, 2014). In response to those policies, smoking has decreased somewhat, but not sharply. Although smoking rates are currently lower among women than among men, with an increase in economic power women may adopt the smoking patterns of men. A major challenge is that formal education in schools is

Table 3
Estimated odds ratios and 95% confidence intervals (SILC results).
Source: Authors' calculations based on data from the Survey of Income and Living Conditions.

Outcomes:	Self-Rated Health (SRH)				Chronic Illness				Physical Restraint			
	(1: Bad. 0: Good)				(1: Yes. 0: No)				(1: Yes. 0: No)			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
Relative Deprivation of Income												
All	1.33***	1.67***	1.23***	1.47***	1.14***	1.22***	1.08***	1.23***	1.23***	1.45***	1.13***	1.31***
	(1.24–1.43)	(1.59–1.75)	(1.16–1.30)	(1.42–1.53)	(1.09–1.18)	(1.19–1.26)	(1.04–1.13)	(1.20–1.27)	(1.18–1.29)	(1.40–1.49)	(1.09–1.18)	(1.28–1.35)
VIF	2.37	1.15	2.37	1.11								
Age Group	1.42***	1.72***	1.33***	1.53***	1.20***	1.26***	1.17***	1.28***	1.29***	1.48***	1.22***	1.37***
	(1.34–1.52)	(1.64–1.80)	(1.26–1.39)	(1.48–1.59)	(1.16–1.25)	(1.22–1.30)	(1.13–1.21)	(1.25–1.32)	(1.24–1.35)	(1.43–1.53)	(1.18–1.27)	(1.33–1.40)
VIF	2.31	1.15	2.27	1.11								
Sex	1.34***	1.67***	1.22***	1.47***	1.14***	1.22***	1.08***	1.23***	1.24***	1.45***	1.13***	1.31***
	(1.24–1.44)	(1.59–1.76)	(1.16–1.29)	(1.42–1.52)	(1.09–1.18)	(1.19–1.26)	(1.04–1.13)	(1.20–1.27)	(1.18–1.29)	(1.40–1.50)	(1.08–1.18)	(1.28–1.35)
VIF	2.39	1.15	2.35	1.11								
Education	1.26***	0.92***	1.21***	1.06***	1.17***	0.95***	1.08***	0.94***	1.24***	0.93***	1.11***	0.97*
	(1.17–1.35)	(0.89–0.96)	(1.14–1.29)	(1.02–1.10)	(1.12–1.21)	(0.93–0.98)	(1.04–1.13)	(0.91–0.97)	(1.18–1.29)	(0.90–0.96)	(1.07–1.16)	(0.94–1.00)
VIF	2.31	1.07	1.96	1.12								
Region	1.32***	1.66***	1.23***	1.48***	1.11***	1.20***	1.08***	1.22***	1.21***	1.41***	1.14***	1.31***
	(1.22–1.43)	(1.58–1.74)	(1.16–1.31)	(1.42–1.54)	(1.07–1.16)	(1.16–1.23)	(1.04–1.12)	(1.19–1.26)	(1.15–1.26)	(1.37–1.46)	(1.09–1.19)	(1.27–1.34)
VIF	2.51	1.21	2.50	1.17								
Sex, Education	1.27***	0.89***	1.19***	1.05***	1.18***	0.94***	1.08***	0.95***	1.25***	0.90***	1.11***	0.98*
	(1.18–1.37)	(0.85–0.93)	(1.12–1.26)	(1.02–1.09)	(1.14–1.24)	(0.91–0.97)	(1.04–1.12)	(0.92–0.97)	(1.19–1.31)	(0.87–0.93)	(1.06–1.15)	(0.95–1.00)
VIF	2.34	1.07	2.06	1.12								
Sex, Age	1.42***	1.72***	1.33***	1.53***	1.20***	1.26***	1.18***	1.29***	1.29***	1.48***	1.24***	1.37***
	(1.33–1.51)	(1.64–1.81)	(1.27–1.39)	(1.48–1.58)	(1.15–1.25)	(1.22–1.30)	(1.14–1.22)	(1.25–1.32)	(1.23–1.34)	(1.43–1.53)	(1.19–1.28)	(1.34–1.41)
VIF	2.37	1.15	2.15	1.10								
Age, Region	1.34***	1.65***	1.32***	1.52***	1.17***	1.23***	1.18***	1.28***	1.22***	1.41***	1.23***	1.36***
	(1.25–1.44)	(1.57–1.73)	(1.26–1.39)	(1.47–1.58)	(1.12–1.21)	(1.19–1.26)	(1.13–1.22)	(1.25–1.31)	(1.17–1.28)	(1.37–1.46)	(1.18–1.27)	(1.32–1.40)
VIF	2.35	1.23	2.21	1.13								
Age, Education	1.40***	0.93***	1.39***	1.10***	1.27***	0.98	1.21***	0.98	1.30***	0.93***	1.23***	1.01
	(1.31–1.49)	(0.90–0.96)	(1.32–1.48)	(1.06–1.15)	(1.22–1.32)	(0.96–1.01)	(1.16–1.26)	(0.95–1.01)	(1.25–1.35)	(0.91–0.96)	(1.18–1.28)	(0.98–1.04)
VIF	2.05	1.03	1.69	1.06								
Sex, Region	1.31***	1.65***	1.23***	1.48***	1.11***	1.19***	1.09***	1.23***	1.20***	1.41***	1.14***	1.31***
	(1.21–1.42)	(1.57–1.74)	(1.16–1.31)	(1.42–1.54)	(1.06–1.15)	(1.16–1.23)	(1.04–1.13)	(1.19–1.26)	(1.15–1.26)	(1.37–1.46)	(1.09–1.19)	(1.27–1.34)
VIF	2.56	1.24	2.45	1.15								
Education, Region	1.26***	0.98	1.22***	1.09***	1.15***	0.98*	1.08***	0.96**	1.22***	0.97*	1.11***	1.00
	(1.18–1.35)	(0.94–1.02)	(1.15–1.30)	(1.05–1.13)	(1.11–1.19)	(0.95–1.00)	(1.04–1.12)	(0.94–0.99)	(1.17–1.28)	(0.94–1.00)	(1.07–1.16)	(0.97–1.03)
VIF	2.04	1.12	1.88	1.16								
Sex, Region, Education	1.25***	0.94***	1.21***	1.09***	1.15***	0.96**	1.08***	0.97**	1.22***	0.95***	1.11***	1.01
	(1.17–1.34)	(0.91–0.98)	(1.14–1.29)	(1.05–1.13)	(1.11–1.19)	(0.94–0.99)	(1.04–1.12)	(0.94–1.00)	(1.17–1.27)	(0.92–0.97)	(1.07–1.16)	(0.98–1.03)
VIF	2.09	1.12	1.95	1.15								
Sex, Region, Age	1.34***	1.65***	1.32***	1.52***	1.17***	1.23***	1.18***	1.28***	1.22***	1.41***	1.23***	1.36***
	(1.25–1.44)	(1.57–1.73)	(1.26–1.39)	(1.47–1.58)	(1.12–1.21)	(1.19–1.26)	(1.13–1.22)	(1.25–1.31)	(1.17–1.28)	(1.37–1.46)	(1.18–1.27)	(1.32–1.40)
VIF	2.35	1.23	2.21	1.13								
Sex, Age, Education	1.48***	1.46***	1.37	1.57***	1.14**	1.10**	1.06	1.03	1.22***	1.26***	1.18*	1.15**
	(1.16–1.88)	(1.21–1.76)	(0.86–2.19)	(1.20–2.05)	(1.02–1.27)	(1.01–1.20)	(0.92–1.23)	(0.92–1.15)	(1.06–1.40)	(1.13–1.40)	(1.00–1.40)	(1.01–1.32)
VIF	2.05	1.13	2.10	1.19								
Region, Age, Education	1.33***	0.99	1.36***	1.13***	1.19***	1.00	1.18***	1.01	1.24***	0.98	1.19***	1.02
	(1.26–1.40)	(0.95–1.03)	(1.29–1.43)	(1.09–1.17)	(1.15–1.23)	(0.98–1.03)	(1.14–1.23)	(0.98–1.04)	(1.20–1.29)	(0.95–1.01)	(1.14–1.23)	(0.99–1.05)
VIF	1.74	1.07	1.61	1.11								

(*continued on next page*)

Table 3 (*continued*)

Outcomes:	Self-Rated Health (SRH)				Chronic Illness				Physical Restraint			
	(1: Bad. 0: Good)				(1: Yes. 0: No)				(1: Yes. 0: No)			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
Relative Deprivation of Education												
All	1.29***	1.90***	1.08	1.69***	1.50***	1.42***	1.16***	1.42***	1.45***	1.75***	1.09**	1.46***
	(1.13–1.48)	(1.81–2.00)	(0.97–1.20)	(1.64–1.75)	(1.37–1.66)	(1.37–1.48)	(1.09–1.24)	(1.38–1.46)	(1.31–1.61)	(1.68–1.82)	(1.02–1.17)	(1.43–1.50)
VIF	6.93	1.11	7.55	1.24								
Age Group	1.05	1.75***	0.69***	1.55***	1.06	1.32***	0.77***	1.29***	1.08*	1.59***	0.78***	1.35***
	(0.93–1.18)	(1.67–1.84)	(0.63–0.75)	(1.49–1.60)	(0.99–1.14)	(1.27–1.36)	(0.72–0.81)	(1.25–1.32)	(1.00–1.17)	(1.53–1.65)	(0.74–0.83)	(1.32–1.39)
VIF	3.09	1.07	3.56	1.21								
Sex	1.26***	1.68***	1.07	1.73***	1.43***	1.31***	1.15***	1.45***	1.39***	1.55***	1.08**	1.49***
	(1.11–1.43)	(1.62–1.75)	(0.97–1.19)	(1.67–1.79)	(1.31–1.56)	(1.28–1.35)	(1.08–1.22)	(1.41–1.49)	(1.27–1.52)	(1.51–1.60)	(1.02–1.16)	(1.45–1.53)
VIF	8.90	1.11	5.87	1.24								
Region	1.26***	1.85***	1.06	1.62***	1.48***	1.39***	1.18***	1.38***	1.41***	1.69***	1.09***	1.42***
	(1.11–1.43)	(1.76–1.94)	(0.97–1.17)	(1.57–1.67)	(1.35–1.62)	(1.34–1.44)	(1.11–1.25)	(1.35–1.42)	(1.28–1.55)	(1.63–1.76)	(1.03–1.17)	(1.39–1.46)
VIF	6.65	1.07	6.65	1.10								
Sex, Age Group	1.05	1.62***	0.70***	1.54***	1.10***	1.27***	0.77***	1.27***	1.10**	1.49***	0.79***	1.35***
	(0.93–1.17)	(1.56–1.69)	(0.65–0.76)	(1.49–1.60)	(1.03–1.18)	(1.23–1.31)	(0.73–0.81)	(1.24–1.31)	(1.02–1.19)	(1.44–1.54)	(0.74–0.83)	(1.31–1.39)
VIF	4.66	1.07	2.63	1.21								
Age, Region	1.06	1.70***	0.73***	1.48***	1.06*	1.29***	0.81***	1.26***	1.08**	1.54***	0.82***	1.32***
	(0.96–1.18)	(1.63–1.79)	(0.67–0.79)	(1.44–1.53)	(0.99–1.14)	(1.24–1.33)	(0.77–0.85)	(1.23–1.29)	(1.01–1.16)	(1.49–1.60)	(0.78–0.87)	(1.29–1.35)
VIF	2.85	1.03	2.93	1.04								
Sex, Region	1.24***	1.63***	1.06	1.65***	1.42***	1.29***	1.16***	1.41***	1.37***	1.50***	1.08***	1.44***
	(1.11–1.39)	(1.57–1.69)	(0.97–1.15)	(1.59–1.70)	(1.31–1.54)	(1.25–1.32)	(1.10–1.23)	(1.37–1.45)	(1.26–1.49)	(1.46–1.55)	(1.02–1.15)	(1.40–1.48)
VIF	8.53	1.06	4.69	1.09								
Region, Sex, Age	1.09*	1.62***	0.75***	1.49***	1.12***	1.27***	0.80***	1.26***	1.13***	1.48***	0.82***	1.32***
	(0.99–1.21)	(1.57–1.69)	(0.70–0.81)	(1.44–1.55)	(1.05–1.20)	(1.24–1.31)	(0.76–0.84)	(1.23–1.29)	(1.06–1.21)	(1.44–1.52)	(0.78–0.86)	(1.29–1.36)
VIF	4.21	1.03	4.24	1.02								
Education Controlled	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Income Controlled	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Sample size	40,995	40,995	46,796	46,796	40,995	40,995	46,796	46,796	40,995	40,995	46,796	46,796

Notes: The table reports point and interval estimates for odds ratios for RD for each outcome variable and each reference group, separately. The top and bottom panels report estimates from regressions when RD is defined based on income and education, respectively. For each outcome measure and reference group, a set of two regression results are shown (first, with the whole set of control variables; and second, when both income and education are excluded). The variance inflation factors (VIF) of the RD variable are invariant to different outcome variables; therefore, they are reported only for the first outcome variable. The control variables (besides RD, education, and income) in all regressions are dummy variables for survey year and region, dummy variables for age group, employment status, sex, and marital status of the individual.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 4
Estimated odds ratios and 95% confidence intervals (HRS results, Part 1).
Source: Authors' calculations based on data from the Health Research Survey. Data for chronic illnesses are from years 2010 and 2012.

Outcomes:	Self-Rated Health (SRH)				Chronic Illness				Bodily Pain			
	(1: Bad. 0: Good)				(1: Yes. 0: No)				(1: Yes. 0: No)			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
Relative Deprivation of Income												
All	1.14	1.54***	1.32***	1.49***	0.99	1.06**	1.05	1.17***	1.20***	1.34***	1.11**	1.22***
	(0.91–1.42)	(1.38–1.72)	(1.14–1.53)	(1.38–1.62)	(0.89–1.10)	(1.01–1.12)	(0.97–1.14)	(1.12–1.23)	(1.07–1.34)	(1.25–1.43)	(1.01–1.22)	(1.16–1.29)
VIF	3.55	1.15	3.37	1.20								
Age Group	1.06	1.47***	1.31***	1.46***	0.98	1.06**	1.02	1.16***	1.15**	1.31***	1.12**	1.22***
	(0.86–1.30)	(1.33–1.63)	(1.14–1.50)	(1.36–1.58)	(0.89–1.09)	(1.00–1.11)	(0.95–1.11)	(1.10–1.21)	(1.03–1.29)	(1.23–1.40)	(1.02–1.22)	(1.16–1.28)
VIF	2.96	1.13	2.76	1.15								
Sex	1.15	1.54***	1.32***	1.50***	1.00	1.06**	1.05	1.17***	1.20***	1.34***	1.11**	1.22***
	(0.92–1.43)	(1.38–1.72)	(1.14–1.52)	(1.38–1.62)	(0.90–1.11)	(1.01–1.12)	(0.97–1.14)	(1.12–1.23)	(1.07–1.35)	(1.25–1.43)	(1.01–1.21)	(1.16–1.29)
VIF	3.51	1.15	3.34	1.20								
Education	1.13	1.00	1.22**	1.15***	0.96	0.96	0.98	0.99	1.11**	0.99	1.07	1.05*
	(0.94–1.36)	(0.91–1.10)	(1.05–1.43)	(1.05–1.25)	(0.89–1.04)	(0.92–1.01)	(0.91–1.06)	(0.94–1.05)	(1.00–1.23)	(0.93–1.05)	(0.98–1.17)	(0.99–1.12)
VIF	2.28	1.14	2.04	1.19								
Region	1.06	1.48***	1.34***	1.49***	0.99	1.06**	1.05	1.17***	1.16***	1.31***	1.09*	1.21***
	(0.87–1.30)	(1.33–1.65)	(1.17–1.54)	(1.38–1.62)	(0.90–1.09)	(1.00–1.12)	(0.97–1.13)	(1.11–1.22)	(1.04–1.29)	(1.23–1.40)	(1.00–1.19)	(1.15–1.27)
VIF	2.86	1.13	2.73	1.16								
Sex, Education	1.13	0.99	1.20**	1.13***	0.96	0.96	0.98	0.99	1.11**	0.98	1.07	1.05*
	(0.94–1.37)	(0.89–1.09)	(1.04–1.40)	(1.04–1.22)	(0.89–1.04)	(0.91–1.01)	(0.91–1.05)	(0.94–1.05)	(1.00–1.24)	(0.92–1.04)	(0.98–1.16)	(0.99–1.11)
VIF	2.21	1.13	2.04	1.19								
Sex, Age	1.11	1.52***	1.28***	1.45***	0.98	1.06*	1.03	1.16***	1.20***	1.35***	1.13***	1.22***
	(0.90–1.36)	(1.36–1.69)	(1.12–1.46)	(1.34–1.56)	(0.88–1.09)	(1.00–1.12)	(0.96–1.11)	(1.10–1.21)	(1.07–1.35)	(1.26–1.44)	(1.04–1.23)	(1.16–1.28)
VIF	3.06	1.17	2.50	1.15								
Age, Region	1.07	1.50***	1.39***	1.53***	0.99	1.06**	1.05	1.17***	1.10*	1.30***	1.10**	1.22***
	(0.88–1.31)	(1.34–1.67)	(1.22–1.58)	(1.41–1.67)	(0.90–1.09)	(1.00–1.12)	(0.97–1.14)	(1.11–1.23)	(0.99–1.23)	(1.22–1.39)	(1.01–1.20)	(1.16–1.29)
VIF	2.27	1.09	2.16	1.09								
Age, Education	1.11	0.97	1.19**	1.10**	0.95	0.95*	0.97	0.97	1.06	0.96	1.09**	1.05
	(0.94–1.32)	(0.89–1.06)	(1.03–1.38)	(1.02–1.19)	(0.88–1.02)	(0.91–1.00)	(0.90–1.04)	(0.92–1.03)	(0.96–1.17)	(0.91–1.01)	(1.00–1.18)	(0.99–1.11)
VIF	2.03	1.05	1.70	1.05								
Sex, Region	1.05	1.47***	1.34***	1.50***	0.98	1.05*	1.06	1.17***	1.13**	1.30***	1.09*	1.22***
	(0.86–1.28)	(1.32–1.64)	(1.16–1.54)	(1.39–1.63)	(0.90–1.08)	(1.00–1.11)	(0.98–1.15)	(1.12–1.23)	(1.02–1.26)	(1.22–1.39)	(1.00–1.20)	(1.15–1.28)
VIF	2.59	1.08	2.74	1.20								
Education, Region	1.09	1.29***	1.26***	1.37***	0.98	1.02	1.03	1.11***	1.12**	1.19***	1.06	1.15***
	(0.92–1.29)	(1.16–1.44)	(1.12–1.41)	(1.27–1.49)	(0.91–1.06)	(0.96–1.08)	(0.97–1.11)	(1.06–1.17)	(1.02–1.23)	(1.11–1.27)	(0.98–1.14)	(1.09–1.21)
VIF	1.91	1.10	1.99	1.13								
Sex, Region, Education	1.16*	1.01	1.13**	1.17***	0.94*	0.95**	1.00	1.01	0.94*	0.95**	1.03	1.05*
	(0.99–1.35)	(0.91–1.11)	(1.00–1.28)	(1.08–1.27)	(0.87–1.01)	(0.90–1.00)	(0.93–1.07)	(0.96–1.07)	(0.87–1.01)	(0.90–1.00)	(0.95–1.11)	(0.99–1.12)
VIF	1.81	1.08	1.84	1.19								
Sex, Region, Age	1.12	1.50***	1.07	1.03	1.17*	1.09***	1.08	0.97	1.17*	1.09***	1.06	1.03
	(0.83–1.51)	(1.36–1.66)	(0.97–1.18)	(0.97–1.10)	(0.99–1.38)	(1.03–1.15)	(0.93–1.25)	(0.92–1.02)	(0.99–1.38)	(1.03–1.15)	(0.99–1.13)	(0.98–1.08)
VIF	5.32	1.03	1.64	1.04								
Sex, Age, Education	1.12	0.98	1.32***	1.48***	0.95	0.96	0.97	1.17***	0.95	0.96	1.05	1.22***
	(0.97–1.30)	(0.89–1.08)	(1.07–1.63)	(1.37–1.60)	(0.88–1.03)	(0.91–1.01)	(0.91–1.04)	(1.11–1.23)	(0.88–1.03)	(0.91–1.01)	(0.91–1.22)	(1.15–1.28)
VIF	2.02	1.08	4.18	1.05								
Region, Age, Education	1.12	1.01	1.13**	1.14***	0.99	0.97	0.98	0.99	0.95	0.96	1.04	1.05
	(0.97–1.29)	(0.92–1.10)	(1.00–1.28)	(1.05–1.24)	(0.91–1.08)	(0.92–1.03)	(0.91–1.05)	(0.93–1.05)	(0.89–1.02)	(0.91–1.01)	(0.96–1.13)	(0.98–1.11)
VIF	1.65	1.03	1.52	1.05								

(*continued on next page*)

Table 4 (*continued*)

Outcomes:	Self-Rated Health (SRH)				Chronic Illness				Bodily Pain			
	(1: Bad. 0: Good)				(1: Yes. 0: No)				(1: Yes. 0: No)			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
Relative Deprivation of Education												
All	1.27	1.65***	0.95	1.48***	0.90	1.08**	0.88**	1.14***	1.14	1.42***	1.07	1.21***
	(0.94–1.71)	(1.49–1.84)	(0.78–1.16)	(1.39–1.58)	(0.76–1.07)	(1.02–1.15)	(0.78–0.98)	(1.09–1.20)	(0.93–1.39)	(1.33–1.53)	(0.95–1.20)	(1.16–1.27)
VIF	6.32	1.33	6.32	1.33								
Age Group	1.26*	1.66***	0.96	1.47***	1.00	1.09***	0.88**	1.13***	0.99	1.37***	0.99	1.19***
	(0.97–1.64)	(1.49–1.84)	(0.80–1.14)	(1.38–1.57)	(0.87–1.15)	(1.03–1.16)	(0.80–0.98)	(1.08–1.18)	(0.83–1.18)	(1.28–1.47)	(0.89–1.09)	(1.14–1.24)
VIF	5.79	1.20	5.79	1.20								
Sex	1.26	1.53***	0.96	1.50***	0.92	1.07***	0.88**	1.15***	1.13	1.34***	1.07	1.22***
	(0.95–1.66)	(1.40–1.67)	(0.79–1.15)	(1.40–1.61)	(0.79–1.08)	(1.02–1.12)	(0.79–0.98)	(1.09–1.20)	(0.94–1.36)	(1.26–1.42)	(0.96–1.19)	(1.16–1.28)
VIF	5.76	1.33	5.76	1.33								
Region	1.21	1.65***	0.95	1.46***	0.92	1.08**	0.87**	1.14***	1.18	1.43***	1.08	1.21***
	(0.90–1.63)	(1.48–1.83)	(0.79–1.14)	(1.37–1.55)	(0.78–1.10)	(1.02–1.15)	(0.78–0.98)	(1.09–1.19)	(0.96–1.44)	(1.33–1.54)	(0.96–1.20)	(1.15–1.26)
VIF	5.00	1.21	5.00	1.21								
Sex, Age Group	1.14**	1.36***	1.02	1.38***	0.97	1.04	0.94**	1.08***	1.02	1.22***	0.99	1.14***
	(1.01–1.28)	(1.27–1.45)	(0.92–1.13)	(1.30–1.47)	(0.90–1.04)	(0.99–1.09)	(0.88–1.00)	(1.04–1.13)	(0.94–1.11)	(1.15–1.28)	(0.93–1.05)	(1.09–1.19)
VIF	2.15	1.18	2.15	1.18								
Age, Region	1.24*	1.67***	0.94	1.45***	1.03	1.10***	0.90**	1.13***	1.01	1.38***	0.99	1.18***
	(0.96–1.59)	(1.50–1.86)	(0.80–1.11)	(1.37–1.55)	(0.90–1.18)	(1.03–1.17)	(0.82–0.99)	(1.09–1.18)	(0.86–1.20)	(1.28–1.48)	(0.90–1.09)	(1.13–1.24)
VIF	3.98	1.07	3.98	1.07								
Sex, Region	1.15	1.51***	0.94	1.48***	0.92	1.07**	0.89**	1.15***	1.14	1.34***	1.07	1.22***
	(0.88–1.52)	(1.38–1.66)	(0.79–1.12)	(1.39–1.59)	(0.79–1.07)	(1.01–1.12)	(0.80–0.99)	(1.09–1.20)	(0.96–1.36)	(1.26–1.42)	(0.96–1.19)	(1.16–1.28)
VIF	4.36	1.22	4.36	1.22								
Region, Sex, Age	1.19	1.53***	0.97	1.49***	1.03	1.31***	0.94	1.15***	1.00	1.08***	1.00	1.20***
	(0.95–1.49)	(1.40–1.67)	(0.83–1.13)	(1.39–1.60)	(0.89–1.19)	(1.24–1.39)	(0.86–1.03)	(1.09–1.20)	(0.88–1.12)	(1.02–1.13)	(0.91–1.10)	(1.14–1.25)
VIF	4.21	1.23	3.10	1.07								
Education Controlled	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Income Controlled	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Sample size	19,296	19,296	23,204	23,204	13,201	13,201	15,991	15,991	19,287	19,287	23,193	23,193

Notes: See notes to Table 3.

Table 5
Estimated odds ratios and 95% confidence intervals (HRS results. Part 2: Smoking-related outcomes).
Source: Authors' calculations based on data from the Health Research Survey.

Outcomes:	Smoking status				Cigarettes smoked			
	(1: Yes. 0: No)				(Categorical)			
	MEN		WOMEN		MEN		WOMEN	
Relative Deprivation of Income								
All	0.99	1.12***	0.96	0.78***	1.02	1.15***	0.95	0.77***
	(0.91–1.08)	(1.07–1.17)	(0.87–1.07)	(0.74–0.83)	(0.94–1.10)	(1.10–1.21)	(0.85–1.06)	(0.72–0.82)
VIF	3.55	1.15	3.37	1.20				
Age Group	0.97	1.11***	0.82***	0.74***	0.98	1.13***	0.81***	0.72***
	(0.89–1.05)	(1.06–1.16)	(0.74–0.91)	(0.70–0.78)	(0.91–1.06)	(1.08–1.19)	(0.72–0.91)	(0.68–0.77)
VIF	2.96	1.13	2.76	1.15				
Sex	0.99	1.12***	0.96	0.78***	1.02	1.15***	0.95	0.77***
	(0.91–1.08)	(1.07–1.17)	(0.87–1.07)	(0.74–0.83)	(0.94–1.10)	(1.10–1.21)	(0.85–1.06)	(0.72–0.82)
VIF	3.51	1.15	3.34	1.20				
Education	0.95	0.90***	0.75***	0.91***	0.98	0.90***	0.76***	0.91**
	(0.88–1.02)	(0.86–0.94)	(0.68–0.83)	(0.85–0.97)	(0.91–1.05)	(0.86–0.94)	(0.68–0.85)	(0.85–0.98)
VIF	2.28	1.14	2.04	1.19				
Region	0.97	1.10***	0.96	0.80***	1.00	1.13***	0.96	0.79***
	(0.90–1.05)	(1.05–1.15)	(0.87–1.05)	(0.75–0.84)	(0.93–1.08)	(1.08–1.18)	(0.87–1.07)	(0.74–0.83)
VIF	2.86	1.13	2.73	1.16				
Sex, Education	0.95	0.89***	0.78***	0.93**	0.98	0.89***	0.79***	0.93**
	(0.88–1.02)	(0.85–0.93)	(0.71–0.86)	(0.87–0.99)	(0.91–1.05)	(0.85–0.93)	(0.71–0.88)	(0.87–1.00)
VIF	2.21	1.13	2.04	1.19				
Sex, Age	0.94	1.10***	0.83***	0.74***	0.95	1.13***	0.81***	0.72***
	(0.86–1.02)	(1.05–1.16)	(0.74–0.91)	(0.70–0.78)	(0.87–1.03)	(1.07–1.18)	(0.73–0.91)	(0.67–0.77)
VIF	3.06	1.17	2.50	1.15				
Age, Region	0.97	1.10***	0.89**	0.77***	0.99	1.13***	0.89**	0.75***
	(0.90–1.04)	(1.05–1.16)	(0.81–0.98)	(0.72–0.81)	(0.92–1.06)	(1.08–1.18)	(0.80–0.99)	(0.71–0.80)
VIF	2.27	1.09	2.16	1.09				
Age, Education	0.97	0.90***	0.72***	0.92**	0.98	0.89***	0.73***	0.92**
	(0.90–1.04)	(0.86–0.94)	(0.65–0.80)	(0.86–0.98)	(0.92–1.06)	(0.86–0.93)	(0.65–0.81)	(0.85–0.99)
VIF	2.03	1.05	1.70	1.05				
Sex, Region	0.96	1.09***	0.97	0.80***	0.98	1.12***	0.98	0.79***
	(0.89–1.03)	(1.04–1.15)	(0.88–1.07)	(0.75–0.84)	(0.91–1.05)	(1.07–1.17)	(0.88–1.08)	(0.74–0.84)
VIF	2.59	1.08	2.74	1.20				
Education, Region	0.95	0.99	0.85***	0.82***	0.98	1.01	0.84***	0.81***
	(0.89–1.01)	(0.95–1.04)	(0.78–0.92)	(0.77–0.87)	(0.92–1.04)	(0.97–1.06)	(0.76–0.93)	(0.76–0.86)
VIF	1.91	1.10	1.99	1.13				
Sex, Region, Education	0.98	0.89***	0.81***	0.91***	1.01	0.89***	0.82***	0.91**
	(0.93–1.04)	(0.85–0.93)	(0.75–0.88)	(0.86–0.97)	(0.95–1.07)	(0.85–0.93)	(0.76–0.89)	(0.85–0.98)
VIF	1.81	1.08	1.84	1.19				
Sex, Age, Education	0.98	0.88***	1.07	0.83***	1.01	0.88***	1.09	0.82***
	(0.92–1.05)	(0.84–0.92)	(0.91–1.26)	(0.78–0.89)	(0.95–1.08)	(0.84–0.92)	(0.91–1.31)	(0.77–0.88)
VIF	2.02	1.08	1.83	1.18				
Region, Age, Education	1.01	0.91***	0.78***	0.92**	1.04	0.91***	0.78***	0.91**
	(0.95–1.07)	(0.87–0.95)	(0.72–0.85)	(0.85–0.99)	(0.98–1.10)	(0.87–0.95)	(0.71–0.85)	(0.84–0.98)
VIF	1.65	1.03	1.52	1.05				
Sex, Region, Age	1.01	1.08***	0.83***	0.98	1.05	1.10***	0.84***	0.98
	(0.88–1.15)	(1.03–1.13)	(0.77–0.90)	(0.92–1.04)	(0.92–1.20)	(1.05–1.15)	(0.77–0.91)	(0.91–1.05)
VIF	5.32	1.03	1.64	1.04				
Relative Deprivation of Education								
All	0.74***	1.25***	0.47***	0.65***	0.73***	1.30***	0.45***	0.63***
	(0.63–0.88)	(1.18–1.33)	(0.41–0.55)	(0.61–0.69)	(0.61–0.87)	(1.23–1.38)	(0.38–0.54)	(0.59–0.68)
VIF	6.32	1.33	6.32	1.33				
Age Group	0.84***	1.24***	0.70***	0.70***	0.80***	1.27***	0.67***	0.68***
	(0.74–0.96)	(1.17–1.31)	(0.61–0.79)	(0.66–0.74)	(0.70–0.91)	(1.20–1.34)	(0.58–0.77)	(0.64–0.72)
VIF	5.79	1.20	5.79	1.20				
Sex	0.75***	1.20***	0.50***	0.62***	0.73***	1.24***	0.48***	0.60***
	(0.65–0.87)	(1.15–1.26)	(0.43–0.58)	(0.58–0.66)	(0.63–0.86)	(1.19–1.30)	(0.41–0.57)	(0.56–0.65)
VIF	5.76	1.33	5.76	1.33				
Region	0.75***	1.25***	0.49***	0.66***	0.73***	1.30***	0.47***	0.64***
	(0.64–0.88)	(1.18–1.32)	(0.42–0.57)	(0.62–0.70)	(0.62–0.87)	(1.23–1.37)	(0.40–0.56)	(0.61–0.69)
VIF	5.00	1.21	5.00	1.21				
Sex, Age Group	0.89***	1.11***	0.83***	0.70***	0.88***	1.13***	0.80***	0.67***
	(0.84–0.95)	(1.06–1.16)	(0.76–0.90)	(0.65–0.75)	(0.82–0.94)	(1.08–1.18)	(0.73–0.89)	(0.62–0.73)
VIF	2.15	1.18	2.15	1.18				
Age, Region	0.87**	1.24***	0.74***	0.71***	0.84***	1.27***	0.72***	0.70***
	(0.77–0.98)	(1.17–1.31)	(0.66–0.83)	(0.68–0.75)	(0.74–0.95)	(1.20–1.34)	(0.63–0.82)	(0.66–0.74)
VIF	3.98	1.07	3.98	1.07				
Sex, Region	0.75***	1.20***	0.53***	0.63***	0.74***	1.23***	0.52***	0.62***
	(0.65–0.86)	(1.14–1.25)	(0.45–0.61)	(0.59–0.67)	(0.64–0.85)	(1.18–1.29)	(0.44–0.61)	(0.57–0.66)
VIF	4.36	1.22	4.36	1.22				

(continued on next page)

Table 5 (*continued*)

Outcomes:	Smoking status				Cigarettes smoked			
	(1: Yes. 0: No)				(Categorical)			
	MEN		WOMEN		MEN		WOMEN	
Sex, Region, Age	0.85*** (0.76–0.95)	1.19*** (1.14–1.25)	0.82*** (0.73–0.91)	0.70*** (0.66–0.75)	0.82*** (0.73–0.91)	1.22*** (1.16–1.27)	0.80*** (0.70–0.90)	0.69*** (0.64–0.73)
VIF	4.21	1.23	3.10	1.07				
Education Controlled	Yes	No	Yes	No	Yes	No	Yes	No
Income Controlled	Yes	No	Yes	No	Yes	No	Yes	No
Sample size	19,303	19,303	23,213	23,213	18,510	18,510	22,319	22,319

Notes: See notes to Table 3.

not sufficient to keep people away from this unhealthy habit. As the findings indicate, reducing inequalities by increasing educational attainment among women via schooling policies or by improving the economic power of women will not necessarily reduce smoking. Given the well-known adverse effects of smoking on health, it is clear that policy makers need to take into account the newly established result of this study and design additional policies to deal with unhealthy behaviors.

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