Original Article

The Relationship Between Gender and Women's Tobacco Use: An Ecological Analysis with Country-level Data

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Abstract

OBJECTIVE: Health and well-being are profoundly influenced by gender and its dimensions. This study explores the intricate relationship between gender roles and tobacco use.

MATERIAL AND METHODS: The study investigates correlations between the Gender Development Index (GDI), the Global Gender Gap Index (GGGI), and its sub-indicators—critical markers of gender equality—and tobacco prevalence and tobacco-related mortality. Statistical analyses, conducted using the Statistical Package for Social Science and Microsoft Excel, involve Spearman correlation analysis for continuous numerical data and the Kruskal-Wallis H test for differences between means.

RESULTS: As per the GDI, a decrease in gender inequality correlates with an increase in tobacco prevalence among women. The highest prevalence of tobacco use in women is found in countries within GDI group 1, with the lowest observed in group 5, characterized by pronounced gender inequality. A moderate positive correlation is identified between the prevalence of tobacco use in women and the GDI, GGGI, and the education sub-component of GGGI. Similarly, a moderate positive relationship is observed between tobacco-related mortality in women and the education subcomponent of GGGI. Education exhibits the highest correlation with both tobacco prevalence and tobacco-related mortality in women.

CONCLUSION: The increased prevalence of tobacco use among women in countries with high education and socioeconomic status suggests the early stages of the tobacco epidemic. Smoking cessation remains a persistent challenge, especially for women. The study emphasizes the imperative for tailored gender-specific policies, highlighting the integration of gender considerations into health promotion and public health initiatives.

KEYWORDS: Tobacco use, gender equity, health policy

INTRODUCTION

Tobacco use, prevalent both in our country and worldwide, stands as the leading preventable behavioral factor contributing to mortality. Smoking causes substantial health issues for both genders; however, women exhibit a heightened susceptibility to numerous diseases associated with smoking.[1,2]

Although tobacco use is currently more prevalent among men, there is a narrowing gender gap. While tobacco use among women is generally on the decline, the rate of decrease is considerably slower than among men and is even increasing in some regions. According to the Lopez Curve, depicting the four stages of the tobacco epidemic, women's tobacco use emerged later than that of men. A noticeable gap of 30-40 years is observed when assessing the highest tobacco use and mortality rates related to tobacco with women lagging behind. As women's tobacco use began later, the anticipated rise in female deaths is expected to occur later than males. This underscores the concerning reality for public health regarding the projected increases in female smoking prevalence.[1,3,4]

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Gender is a pivotal factor influencing health outcomes, demanding due consideration in tobacco control initiatives. It shapes susceptibility to various health conditions and access to healthcare throughout individuals' lives. Existing literature reveals a connection between gender roles and health behaviors, notably in terms of tobacco use. The empowerment of women has coincided with heightened industry activities targeting this demographic, resulting in an increase in smoking prevalence among women. Concepts such as "freedom," "economic independence," "equality with men," and "strength equal to men" have been emphasized, contributing to the rise in women's initiation of smoking.[1,5,6]

As women assumed more prominent roles in society, they became the primary focus of the tobacco industry. For instance, in 1968, Philip Morris tapped into the burgeoning women's movement with messages of 'freedom, independence, and power' through the introduction of 'Virginia Slims' cigarettes. This marked the first instance of a cigarette marketed exclusively for women, featuring a 'taller, slimmer, and more feminine' design. Concurrently, there was a rapid increase in smoking initiation among young girls aged 14-17, and 'Virginia Slims' emerged as one of the most popular brands among women.[7,8] To address women's concerns about smoking-related health risks, the tobacco industry has introduced nicotine-reduced, thin, filtered, and flavored cigarettes. These cigarettes are specially packaged in colorful and pictorial designs aimed at women. Over the years, the tobacco industry has actively supported women's organizations, ethnic minority groups with broad societal impact, sponsored sports organizations, and provided gift vouchers and tickets for events like concerts. Throughout these activities and advertisements, the image of thin, beautiful women is prominently featured, associating tobacco use with the independence and success of the modern, strong woman. This narrative has also found support in films, television programs, and plays. As access to traditional advertising has become increasingly restricted, there has been a shift toward product placement in art and cinema, as well as increased exposure through online advertising and promotion on social media. This evolution makes it more challenging to counteract the influence of advertising in tobacco control efforts.[1,6]

Main Points

- As the Gender Development Index, the Global Gender Gap Index, and their sub-components, education and women's political participation increase, tobacco product usage in women also appears to increase.
- Education is the parameter that shows the highest correlation with tobacco usage frequency and tobacco-related mortality in women.
- In countries with low gender inequality, tobacco usage and tobacco-related mortality are higher among women.
- The high prevalence of tobacco usage among women in countries with high education and socio-economic status indicates that the tobacco epidemic is in its early stages for women.
- Public health interventions and campaigns promoting health should consider gender-specific policies to address tobacco usage among women.

It is important to understand the gender-based reasons for smoking and to take into account gender roles in developing intervention plans, aiming to create women-specific and women-centered approaches.[9,10] Gender inequality indicators are important parameters because they encompass most of the welfare indicators and illustrate the role of women in society. However, there is no gold standard criterion for evaluating gender inequality.[11] In our study, we examined the relationships between the Gender Development Index (GDI) and the Global Gender Gap Index (GGGI), which are indicators of gender equality, along with the subheadings of the GGGI related to the economy, education, health, and politics, as well as the frequency of tobacco use and tobacco-related mortality.

MATERIAL AND METHODS

Data Sources and Data Collection

In the data collection phase, the most recent versions of the examined reports have been included. Information regarding the data obtained from the reports is presented below. Data from 144 countries in the GGGI and 147 countries in the GDI, along with data on the frequency of tobacco use and tobacco-related mortality, have been evaluated (Supplementary Table 1). The research ethics committee approval was received from Hacettepe University Non-interventional Clinical Research Ethics Committee (approval number: 2021/19-12, date: 16.11.2021). The study used publicly available country data, but did not use individual data. Therefore, informed consent was not required.

Dependent Variables

Tobacco use frequency: Data on total tobacco use frequency (current smoking) and gender-specific tobacco use frequency were obtained using the World Health Organization (WHO) Global Tobacco Epidemic 2021 Report attachments.[12] In the research, "current smoker" refers to individuals who have used more than 100 tobacco products in their lifetime and have used them in the last 28 days.

Tobacco-related mortality data: Obtained through the Tobacco Atlas, a resource sponsored by the American Cancer Society that conducts tobacco control studies to provide effective solutions in combating tobacco and explores the harmful aspects, nature, and impact of tobacco.[13]

Gender-specific tobacco use frequency rate (GSR): Calculated by researchers by dividing the frequency of tobacco use among women by the frequency of tobacco use among men.

Gender-specific tobacco-related mortality rate (GMR): Calculated by researchers by dividing the mortality related to tobacco use among women by the mortality related to tobacco use among men.

Independent Variables

Gender Development Index: The GDI found in the United Nations Development Programme's Human Development Report is not specifically a measure of gender inequality but rather an evaluation of the Human Development Index's components—life expectancy, education, and income—based

on gender. Countries are categorized into five groups according to their GDI levels. As the GDI value increases, inequality between genders decreases. GDI assesses gender inequality with the parameters listed below:[11,14]

- Gender-specific life expectancy at birth,

- Expected years of schooling,

- Average years of education for females and males aged 25 and above,

- Gender-specific estimated earned income.

Global Gender Gap Index: The study utilizes the GGGI from the Global Gender Gap Report. This index, designed by the World Economic Forum, is a four-dimensional measure to assess gender equality. The GGGI is constructed by examining data on education, political empowerment, economic gains, and opportunity equality. As the index value increases, gender inequality decreases. The indicators include the following dimensions:

- Economic gains and opportunity equality: Assessed through factors such as salary, high-skilled employment, duration of maternity leave, percentage of women in managerial positions, government-provided child support, wage equality between men and women, levels of male and female unemployment, economic activities, and equal pay for equal work.

- Education: Evaluated through literacy rates, enrollment rates for primary, secondary, and tertiary education, average years of education, and access to basic and advanced education, with a gender-specific perspective.

- Political empowerment: Assessed based on the representation of women in decision-making structures, including the number of female ministers, the percentage of women in parliament, the number of women in high-status legislative and administrative positions, and the number of years a woman has served as the head of state.

- Health and survival: Evaluated through gender-specific life expectancy, the effectiveness of government efforts to reduce poverty and inequality, adolescent fertility rate, the percentage of births attended by educated health personnel, and maternal and infant mortality rates.[15]

Statistical Analysis

For data entry and analysis in the study, the Statistical Package for the Social Sciences 24.0 and Microsoft Excel were used. A map was created using Microsoft Excel to visualize gender-specific tobacco use frequency based on the GGGI of countries.

In the analyses, descriptive statistics such as percentage, mean, standard deviation, median, quartiles, minimum-maximum values, were used or reported. The relationships between continuous numerical data were evaluated using the Spearman correlation test. According to the correlation coefficient (r), relationships were considered negligibly weak between 0-0.19, weak between 0.20-0.39, moderate between 0.40-0.69, strong between 0.70-0.89, and very strong between 0.90-1.00.[16] To

assess differences between means, the non-parametric Kruskal-Wallis H test was employed. In cases where the results were significant in the Kruskal-Wallis H test, pairwise comparisons were conducted using the Mann-Whitney U test to identify which groups differed. The significance level in the study was set at $P < 0.05$.

RESULTS

The frequency of tobacco product use is an average of 28.6±13.2% in males and 9.3±9.9% in females, with median values of 26.7% and 4.8%, respectively. The GSR has a mean value of 0.3±0.3, indicating that for every 1 woman, approximately 3.3 men use tobacco products. Tobacco-related mortality is 14.9±7.3% for males and 7.1±4.6% for females, with median values of 15.6% and 6.3%, respectively. The GMR has a mean value of 0.5±0.3, signifying that for every 5 females, 10 males die due to tobacco use.

According to the GDI, as gender inequality decreases, the frequency of tobacco use among women increases. Women's tobacco use frequency is higher in countries belonging to group 1 compared to other groups. It is the lowest in the countries in group 5 where gender inequality is most pronounced, and the difference between groups is statistically significant ($P < 0.001$, Table 1).

According to the GDI, in evaluating the frequency of tobacco use among men, it is observed that countries in group 5 have a lower frequency of tobacco use compared to other groups, and the difference between groups is statistically significant ($P = 0.030$, Table 1).

In Figure 1, the GGGI ranges from red to green, with the index value increasing as gender inequality decreases. The size of the circles in the visualization represents the frequency of tobacco use, with larger circles indicating higher tobacco use frequency. In European countries where the GGGI is high, the frequency of tobacco use is higher among women, while a similar pattern is not observed in men. In Europe and America, countries with higher GGGI, indicating less gender inequality, have a higher rate of tobacco use by gender compared to other countries (Figure 1).

In countries belonging to group 1, where gender inequality is the least pronounced, 10 men smoke for every 4 women, while in group 2, approximately 10 men smoke for every 3 women. In groups 3, 4, and 5, approximately 10 men smoke for every 1 woman. It is observed that women in countries belonging to group 1 and group 2 use more tobacco compared to those in other groups, and the difference between groups is statistically significant ($P < 0.001$, Table 1). According to the GDI, in group 5 countries, tobacco-related mortality is the lowest for both genders, and the difference between groups has been found to be statistically significant ($P < 0.001$, Table 2).

When evaluating the rate of tobacco-related mortality according to gender, there is no statistically significant difference between groups ($P = 0.401$, Table 2).

There is a moderately positive relationship between the frequency of tobacco use in women and the GDI (r=0.439; $P < 0.001$,

Table 1. Assessment of tobacco use frequency according to GDI

| GDI group**** | Tobacco use prevalence in women | | | P value |
	Median	Q1-Q3	Min-max	
1	10.6	4.0-20.1	0.4-39.3	
2	6.5	2.6-20.4	0.3-35.8	
3	2.8	1.0-6.0	0.1-29.6	P < 0.001*
4	2.2	0.7-5.3	0.3-19.0	
5	1.6	0.6-2.7	0.1-28.2	
GDI group	Tobacco use prevalence in men			P value
	Median	Q1-Q3	Min-max	
1	30.0	17.1-40.4	8.4-56.9	
2	25.3	18.7-33.3	12.8-51.4	
3	26.7	18.7-44.5	15.1-72.6	0.030**
4	32.6	16.9-44.3	5.1-45.8	
5	19.2	13.3-26.6	6.4-57.1	
GDI group	GSR			P value
	Median	Q1-Q3	Min-max	
1	0.4	0.1-0.8	0-0.9	
2	0.3	0.1-0.8	0-1.1	
3	0.1	0.1-0.2	0-0.7	P < 0.001***
4	0.1	0.1-0.2	0-0.4	
5	0.1	0-0.2	0-0.7	

*The difference is due to groups 1 and 3, groups 1 and 4, groups 1 and 5, and groups 2 and 5.
**The difference is due to the contrast between groups 1 and 5.
***The difference is attributed to groups 1 and 3, groups 1 and 4, groups 1 and 5, and groups 2 and 5.
****The number of countries in group 1 according to the GDI is 56, in group 2 it is 32, in group 3 it is 19, in group 4 it is 9, and in group 5 it is 31.
GDI: Gender Development Index, GSR: gender-specific tobacco use frequency rate, Min-max: minimum-maximum

Table 3). In men, a weak positive relationship is observed between the frequency of tobacco use and the GDI (r=0.187; $P = 0.023$, Table 3).

In women, there is a moderately positive relationship between the frequency of tobacco use and the GDI (r=0.439, $P < 0.001$) and the GGGI (r=0.512, $P < 0.001$); a weak positive relationship with the economic component of GGGI (r=0.241, $P = 0.004$); a moderately positive relationship with the education component of GGGI (r=0.580, $P < 0.001$); and a weak positive relationship with the political component of GGGI (r=0.350, $P < 0.001$). As the GDI and GGGI indices increase, gender inequality decreases, and the frequency of tobacco use increases among women. The highest correlation is found with the GGGI subheading of education. There is no correlation between the health subcomponent of GGGI and tobacco use in women (Table 3).

For the rate of tobacco use by gender, there is a moderately positive relationship with the GDI (r=0.421, $P < 0.001$), a moderately positive relationship with the GGGI (r=0.591, $P < 0.001$), a weak positive relationship with the economic component of GGGI (r=0.286, $P = 0.001$), a moderately positive relationship with the education component of GGGI

(r=0.577, $P < 0.001$), and a moderately positive relationship with the political component of GGGI (r=0.468, $P < 0.001$). The variables showing the highest correlation with the rate of tobacco use by gender are the GGGI and its subcomponent, education (Table 3).

There is a weak positive relationship between tobacco-related mortality and the GDI for both women (r=0.290, $P < 0.001$) and men (r=0.349, $P < 0.001$) (Table 3).

For women, there is a weak positive relationship between tobacco-related mortality and the GGGI (r=0.265, $P < 0.001$), a moderate positive relationship with the education component of GGGI (r=0.459, $P < 0.001$), and a very weak positive relationship with the political component (r=0.177, $P = 0.034$). The subcomponent with the highest correlation is education. As education increases, tobacco use increases in women (Table 3). There is a positive low-level statistically significant relationship between the political subcomponent of GGGI and tobacco-related mortality rates by gender (r=0.164, $P = 0.049$, Table 3).

DISCUSSION

Tobacco use frequency and tobacco-related mortality are higher in men than in women. On average, 10 men smoke for every 3

Table 2. Evaluation of tobacco-related mortality according to the GDI

GDI group***	Mortality related to tobacco in women			P value
	Median	Q1-Q3	Min-max	
1	7.6	4.9-11.1	1.0-20.8	
2	8.1	4.0-10.4	1.6-22.4	
3	6.0	2.5-11.0	1.6-14.1	P < 0.001*
4	7.6	2.9-8.7	1.2-9.7	
5	2.7	1.9-6.1	0.5-15.8	
GDI group	Mortality related to tobacco in men			P value
	Median	Q1-Q3	Min-max	
1	18.9	11.4-22.3	3.8-29.2	
2	15.1	9.1-21.4	4.7-29.1	
3	13.0	6.1-21.4	3.9-29.8	P < 0.001**
4	20.0	6.7-25.2	4.0-26.1	
5	6.4	5.0-13.0	1.8-23.1	
GDI group	GMR			P value
	Median	Q1-Q3	Min-max	
1	0.4	0.3-0.6	0-2.4	
2	0.5	0.4-0.7	0.2-1.26.1	
3	0.4	0.4-0.6	0.3-0.9	0.401
4	0.4	0.3-0.5	0.3-0.6	
5	0.4	0.3-0.5	0.3-0.8	

*The difference stems from group 1 and 5, group 2 and 5, group 3 and 5, group 4 and 5.
**The difference arises from group 1 and 5, group 2 and 5, group 4 and 5.
***The number of countries in group 1 according to the GDI is 56, in group 2 it is 32, in group 3 it is 19, in group 4 it is 9, and in group 5 it is 31.
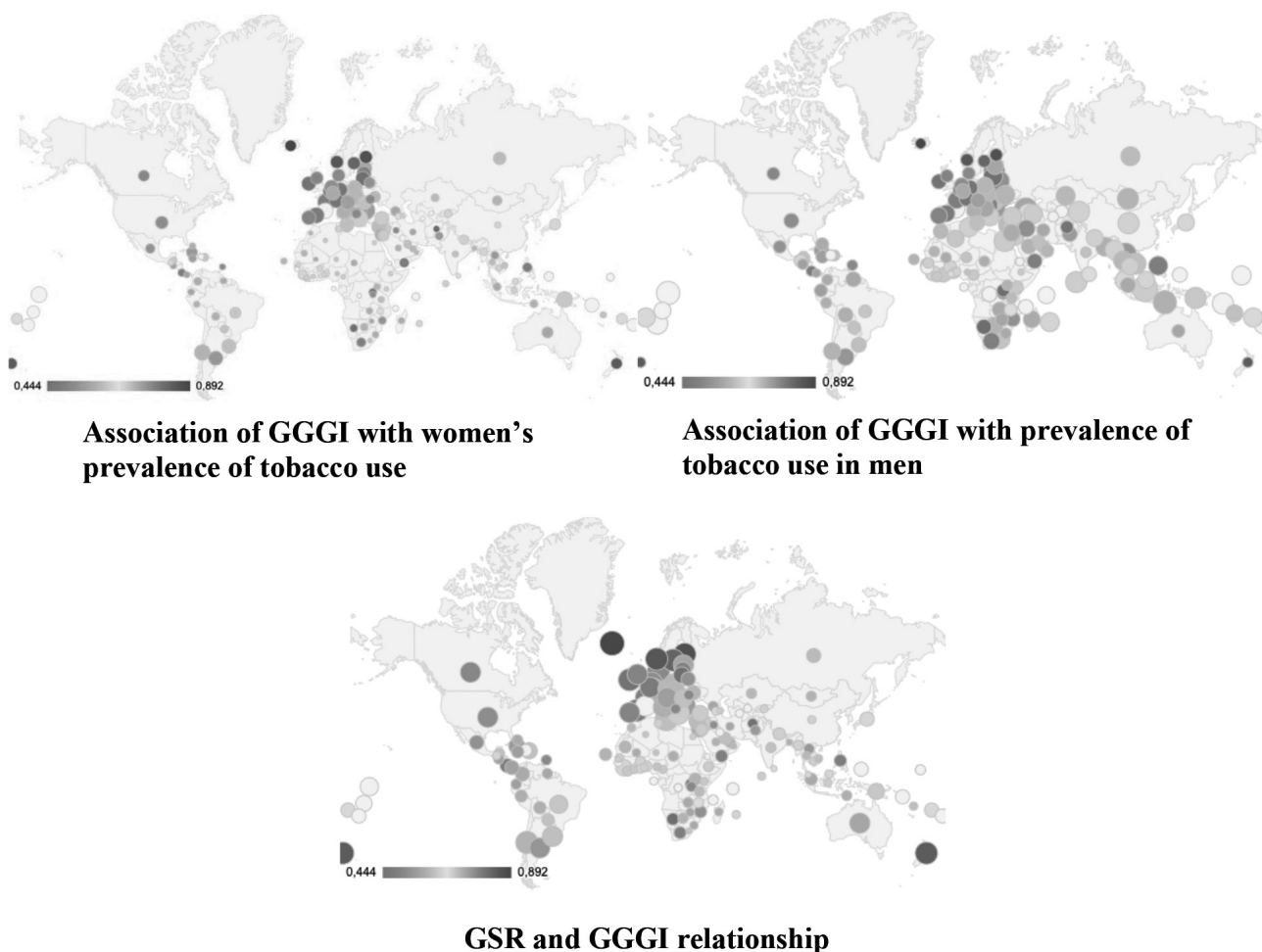GDI: Gender Development Index, GMR: gender-specific tobacco-related mortality rate, Min-max: minimum-maximum

Table 3. Correlation analysis of tobacco use frequency and tobacco-related mortality with GDI, GGGI and GGGI subcomponents

Indicators	Tobacco use prevalence in women		Tobacco use prevalence in men		GSR	
	Correlation coefficient	P value	Correlation coefficient	P value	Correlation coefficient	P value
GDI	0.439	<0.001	0.187	0.023	0.421	<0.001
GGGI	0.512	<0.001	-0.034	0.688	0.591	<0.001
GGGI - Economy	0.241	0.004	-0.016	0.851	0.286	0.001
GGGI - Education	0.580	<0.001	0.210	0.012	0.577	<0.001
GGGI - Health	0.061	0.466	0.035	0.676	0.012	0.885
GGGI - Politics	0.350	<0.001	-0.160	0.055	0.468	<0.001
Indicators	Mortality related to tobacco in women		Mortality related to tobacco in men		GMR	
	Correlation coefficient	P value	Correlation coefficient	P value	Correlation coefficient	P value
CDGE	0.290	<0.001	0.349	<0.001	0.005	0.954
GGGI	0.265	0.001	0.209	0.012	0.154	0.065
GGGI - Economy	0.111	0.186	0.128	0.125	-0.007	0.935
GGGI - Education	0.459	<0.001	0.451	<0.001	0.144	0.085
GGGI - Health	-0.177	0.034	-0.075	0.373	-0.110	0.188
GGGI - Politics	0.177	0.034	0.076	0.362	0.164	0.049

GGGI: Global Gender Gap Index, GDI: Gender Development Index, GMR: gender-specific tobacco-related mortality rate, GSR: gender-specific tobacco use frequency rate

Association of GGGI with women's prevalence of tobacco use

Association of GGGI with prevalence of tobacco use in men

GSR and GGGI relationship

Figure 1. Tobacco use prevalence in relation to the GGGI

GGGI: Global Gender Gap Index, GSR: gender-specific tobacco use frequency rate

women, while 10 men lose their lives due to smoking for every 5 women. According to the WHO, the prevalence of tobacco use is 22.3% overall, with 36.7% in men and 7.8% in women among adults aged 30 and older. Tobacco is attributable to 12% of all deaths among adults aged 30 and older, corresponding to 7% for women and 16% for men.[1,2,17]

In our study, countries with a high GDI observe, tobacco use is higher among women. In GDI group 1 countries, four women smoke for every 10 men, while in group 5 countries, one woman smokes for every 10 men (Table 1). According to the GGGI, women living in countries with more gender equality, higher educational levels, better economic conditions, and greater female political participation generally exhibit higher tobacco use. In men, tobacco use shows a low correlation with the education subcomponent of both GDI and GGGI, while in women, it demonstrates a moderate correlation (Tables 1, 3). Highly educated young women with a high socioeconomic status are the initial group of women who start smoking.[3] At the beginning of the 20th century, consistent and powerful gender-based messages and advertisements by the tobacco industry led to the widespread adoption of smoking among women in middle and high-income countries. Consequently, tobacco product usage increased primarily among women in Western societies. While

global male smoking rates have peaked, it is anticipated that female usage, particularly in low and middle-income countries, will rise in the 21st century as the tobacco industry continues to create markets, especially in these regions.[9] An analysis of the relationship between educational status and smoking was conducted in a study encompassing 12 European countries, including Denmark, Germany, the Netherlands, Switzerland, Portugal, Spain, and Italy. In most countries, smoking prevalence was found to be higher among individuals with lower educational levels. However, in Northern European countries such as the United Kingdom, Norway, and Sweden, higher-educated women exhibited a higher prevalence of smoking.[18]

During the first stage of the smoking epidemic, the prevalence of smoking is low in both genders. In the second stage, smoking frequency rapidly increases among men, while the increase in women occurs approximately twenty years later. In the third stage, smoking prevalence peaks among men and begins to decline. Following a delay of several decades, it also starts to decline in women. In the fourth stage, smoking prevalence continues to decrease and gradually reaches a stable minimum level. Due to the higher education levels of early adopters, the epidemic starts earlier among those with higher education than among those with lower education. According to the smoking epidemic

model, smoking prevalence increases among highly educated men and women in the early stages of the epidemic, followed by a decrease in smoking among highly educated individuals, while smoking prevalence increases among men and women with lower education.[19] During the smoking epidemic, there is a shift from a positive relationship to a negative relationship between socioeconomic status and smoking prevalence.[18] In the later stages of the epidemic, although smoking prevalence generally decreases among women in high-income countries, it declines unevenly. It is anticipated that women in developed countries who experience social exclusion, poor economic status, a history of violence, psychiatric disorders, and substance use will continue smoking.[20,21]

According to our study's data, in countries with high GDI and GGGI indicating lower gender inequality, higher education levels, and increased education and political participation among women, there is a higher prevalence of tobacco use. This suggests a rising trend in the smoking epidemic among women. The reflection of these parameters may vary in each society, with tobacco use potentially higher among women with low socioeconomic status in developed Western societies that are in the third to fourth stages of the epidemic, while in some societies in the early stages of the epidemic, tobacco use may be higher among women with high socioeconomic status.

In our study, tobacco-related mortality is higher among women in GDI groups 1, 2, and 4, compared to women in other groups, but overall, these mortality rates are still significantly lower than those of men. Additionally, as GDI, GGGI (and its sub-component, education), and women's political participation increase, tobacco-related mortality also increases (Tables 2, 3). When assessed temporally, it is observed that women start smoking after men. In a study evaluating a cohort of individuals aged 50-85 between 1950 and 2015, it was found that since 1980, overall smoking-attributable death rates have generally decreased, with a declining trend in men and an overall increasing trend in women.[22] In a study analyzing data on tobacco-attributed mortality from the WHO covering 63 countries, a decrease in smoking-related deaths was observed in men in most countries. However, among women residing in high-income countries, increases in the impact of tobacco on life expectancy were observed.[23] As education levels increase, tobacco-related mortality unexpectedly also increases in men. However, this counterintuitive trend should be carefully studied for potential confounding factors. In France, since the 1970s, there has been a dramatic increase in the prevalence of smoking among women and a decrease in smoking prevalence among men. However, gender inequality in the burden of tobacco-related diseases has been steadily increasing. Between 2002 and 2014, the incidence and death rates of lung cancer in women increased by approximately 70%, while the incidence of lung cancer in men remained stable, with a 15% decrease in mortality rates.[24] Over the years, the number of men dying from smoking has decreased, while the number of women continues to rise.[4,25]

There are several limitations to this study. The data were collected during the pandemic period, which may have influenced the findings either positively or negatively. Conducting similar studies in the post-pandemic period would be valuable for assessing the impact of the pandemic more clearly. Additionally, cultural norms are an important factor influencing smoking behavior. However, as this study is ecological and does not include country-specific data, the effect of cultural norms on smoking could not be evaluated. Similarly, because country-level data were not analyzed, cross-country comparisons were not made. Future studies, especially those in Türkiye, should include trend analyses by gender and take cultural norms into account to inform the development of gender-specific policies.

CONCLUSION

This study underscores the complex relationship between gender equality, socio-economic factors, and tobacco use, particularly among women. The findings reveal that higher education levels and women's political participation are associated with increased tobacco use and tobacco-related mortality. Countries with less gender inequality show higher prevalence rates among women, suggesting the early stages of a tobacco epidemic in these populations. Education stands out as the strongest correlate of tobacco use and its health consequences, highlighting the dual impact of socio-economic development. As smoking rates among men decline globally, the predicted rise in female smoking, especially in low- and middle-income countries, requires urgent attention. To combat this growing challenge, public health policies must adopt gender-sensitive approaches that account for cultural and demographic differences. Tailored, evidence-based prevention strategies and research with gender-segregated data are essential to effectively address tobacco use and its consequences among women, ensuring equitable and impactful health interventions.

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