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To cite this article: Anderson Sousa Martins-da-Silva, Julio Torales, Ruth Francielle Vieira Becker, Helena F. Moura, Marcela Waisman Campos, Thiago M. Fidalgo, Antonio Ventriglio & João Mauricio Castaldelli-Maia (2022) Tobacco growing and tobacco use, International Review of Psychiatry, 34:1, 51-58, DOI: [10.1080/09540261.2022.2034602](https://doi.org/10.1080/09540261.2022.2034602)

To link to this article: <https://doi.org/10.1080/09540261.2022.2034602>



Published online: 17 Feb 2022.



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REVIEW ARTICLE



Tobacco growing and tobacco use

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ABSTRACT

Tobacco use is associated with an annual global economic cost of two trillion dollars and mortality of half of its regular users. Tobacco leaf cultivation is the starting point of the tobacco cycle. Tobacco farming employs millions of small-scale tobacco farmers around the globe, most of whom are out growers who rely on the tobacco industry. This paper aims to map the regions of greatest tobacco production globally (i.e., the US, Brazil, China, Indonesia, India, and Zambia) and tobacco use rates in these locations. Smoking rates were higher in those areas, except for India, where important population subgroups reported an upward trend for tobacco smoking. In general, there was a relationship between tobacco farming and tobacco smoking. Tobacco farming may lead to a higher risk of tobacco use and lower adherence to tobacco control policies. Therefore, promoting viable alternative livelihoods for tobacco farmers must have dual benefits. Additionally, specific health prevention policies might be necessary for those populations reporting higher tobacco use and lower perception of tobacco-related health risks.

ARTICLE HISTORY

Received 17 January 2022
Accepted 24 January 2022

KEYWORDS

Tobacco; tobacco use; tobacco industry; tobacco use disorder; tobacco growing

Introduction

Tobacco is reported to have originated in Latin America (Drope et al., 2018) and rapidly spread worldwide after its discovery. It has been reported that the early caravel sailors were smokers. Tobacco became a trade commodity across the centuries as the practice of smoking spread across Europe (Araújo, 2012; José et al., 2017).

Tobacco social use is associated with an annual global economic cost of two trillion dollars and mortality of half of its regular users. Tobacco leaf cultivation is the starting point of the tobacco cycle; tobacco farming employs millions of small-scale tobacco farmers around the world, most of whom are out growers who rely on the tobacco industry (Almeida et al., 2012; Hu et al., 2016). The tobacco leaf is used to make various products, including cigarettes, marketed to potential customers (Almeida et al., 2012).

In the last three decades, China has led tobacco growing and production (Hu et al., 2016). Additionally, there has been a decrease in the growth in the high-Human Development Index (HDI) countries and an increase elsewhere (Hu et al., 2016). The contrast might partially explain these data to tobacco-control strategies in low-HDI countries since their governments and agribusiness sector claim this control may affect the livelihoods of smallholder tobacco farmers. Recent data suggest that tobacco farming is not prosperous for smallholder farmers who pay taxes, dedicate hundreds of hours to agriculture, and receive meagre prices for their leaf (Almeida et al., 2012; Zajonz et al., 2017).

It has been estimated that 942 million men and 175 million women aged ≥ 15 smoke in the world. However, there are some gender differences in the global distribution since three-quarters of male daily-smokers live in countries with a medium- or high-

HDI. In contrast, half of the female daily-smokers live in very high-HDI countries (Drope et al., 2018).

As mentioned above, there has been a decreasing trend in smoking prevalence in most high-HDI countries, as well as an increase in many medium- or low-HDI countries. This increase might be partially explained by an increase in affordability of cigarettes, reflecting income growth and tobacco marketing development (Drope et al., 2018). Tobacco marketing is widespread and may be responsible for the recent increase in smoking among youth females (more than adult women or youth males) in several low- and high-HDI countries (Drope et al., 2018; Soneji et al., 2017).

While smoking prevalence in the US shows a steady decline, smokeless tobacco consumption has been steadily growing (Maxwell, 2011). Sales of moist snuff products, especially pouched and flavored, have increased by 50% (Delnevo et al., 2014; Federal Trade Commission, 2011). In 2012, four of the five major tobacco-growing states in the US reported a smoking prevalence above the national average (Centers for Disease Control and Prevention, 2012). The reason for tobacco-growing prevalence may be that some states report lower tobacco taxes and less stringent clean-indoor-air laws and tobacco policies (Americans for Nonsmokers' Rights, 2013; Fallin & Glantz, 2015).

This paper aims to map the regions of greatest tobacco production throughout the globe (i.e., China, Brazil, India, US, Indonesia, and Zambia, in this order) and social smoking rates in these locations, data from these regions are available in Table 1.

Brazil

Brazil is the second leading tobacco-producing country worldwide. Especially in southern Brazil, more than 220,000 families are directly involved in tobacco cultivation (Instituto Brasileiro de Geografia e Estatística – IBGE, 2014).

The main tobacco varieties produced in the country are Virginia > Burley > common tobacco. In 2014, according to the Brazilian Institute of Geography and Statistics (IBGE, 2014), 719 Brazilian municipalities reported tobacco-growing areas, 90% of which were in the South (97% of national production generating an annual gross revenue of U\$94.6 million). The State of Rio Grande do Sul stands out as the largest tobacco producer, comprising 51% of the total cultivation (Sindicato Interestadual da Indústria do Tabaco SINDITABACO, 2022).

Brazilian tobacco is usually produced in small properties owned by family farmers with an average of 16 hectares: tobacco cultivation covers 17.6% of total properties, around 2.8 hectares per property, representing 51.4% of their income (Associação dos Fumicultores do Brasil, 2022).

In the 2014/2015 harvest, more than 85% of Brazilian tobacco was exported, representing 514,000 exported tons and a total value of US\$2,151 billion. When compared to the previous harvest, there was an increase of +41 tons exported but a reduction of US\$309 million in the revenue (Sindicato Interestadual da Indústria do Tabaco SINDITABACO, 2022). The decreased value of tobacco leaf stems has been due to the increase of tobacco production in African countries with cheaper labour costs than Brazil and tariff advantages. In Brazil, taxes represent 50.9% of the cost (Almeida et al., 2012). As a result, Brazil stands out in the international market as the leader in exports and the second-largest tobacco producer globally, comprising 11.4% of world production. Chinese production leads the ranking, covering 36.8% of world production, even if China allocates its cultivation largely for domestic consumption (Associação dos Fumicultores do Brasil, 2022).

As shown, Brazil largely exported tobacco in 2015, reaching 1.14% of Brazilian exports and 85% of the national production (Associação dos Fumicultores do Brasil, 2022). Destination regions include the

Table 1. Data from the largest global producers (Brasil. Ministério da Saúde, 2014; Drope et al. 2018; Hu et al., 2016).

	Brazil	US	China	India	Indonesia	Zambia
Smoking Prevalence, Male	18.8%	14.4%	52.1%	17.3%	66.6%	16%
Smoking Prevalence, Female	11.6%	11.7%	2.7%	1.4%	2.1%	2.5%
Deaths, Male	12.36%	19.27%	24.89%	12.95%	21.37%	6.56%
Deaths, Female	10.51%	16.21%	12.75%	5.28%	7.02%	3.57%
Smokeless Tobacco Use	0.3%	2.2%	0.5%	17.8%	4.3%	0.5%
Agricultural land devoted to tobacco cultivation	0.15%	0.04%	3.57%	0.24%	0.37%	0.28%
Growing (metric tons)	862,396	397,535	2,995,400	720,725	196,300	112,049
Cigarettes Production (billion)	53.21	270.24	2,355.4	82.12	342	n/a
AD Ban Compliance	High	n/a	High	Moderate	n/a	n/a

AD, Tobacco Advertisement.

Table 2. Smoking prevalences (Barros et al., 2011; Centers for Disease Control & Prevention Content source, 2022; Hu et al., 2016; Nyirenda et al., 2019; Observatório da Política Nacional de Controle do Tabaco, 2016; U.S. Department of Agriculture, 2019).

	Smoking prevalence
Brazil	10.5%
Southern Region	17.4%
US	14%
Kentucky	23.6%
North Carolina	18.5%
China	27.7%
Yunnan	33.7%
Zambia	8.1% ^a / 10.7% ^b
Eastern	13%

^aurban area; ^brural area.

European Union (43%), followed by the Far East (25%), North America (11%), Eastern Europe (8%), Africa/Middle East (7%), and Latin America (6%), with a ranking order: US, Belgium, China, Russia, Netherlands, and Germany (Sindicato Interestadual da Indústria do Tabaco SINDITABACO, 2022).

In contrast to its production, the national prevalence of tobacco smoking has been declining due to stricter legislation and anti-smoking campaigns. In 1989, 34.8% of the adult Brazilian population were smokers (Brasil. Ministério da Saúde, 2014). In 2016, a prevalence of approximately 10.5% was observed with a continuing downward trend in the last decades: this downward trend has been attributed to the national regulatory and preventive actions with a possible lower mortality rate in the next three to four decades (Almeida et al., 2012; Malta et al., 2013; Monteiro et al., 2007; Observatório da Política Nacional de Controle do Tabaco. *Prevalência de tabagismo*, 2016). The southern region is the country's largest producer, with the highest prevalence of smoking (17.4%) and 45.1% of smokers aged between 40 and 59 years old, and 24% with the lowest per capita income (Barros et al., 2011; Table 2).

United States of America

US tobacco production decreased from nearly 180,000 tobacco-growing farms in 1980 to about 10,000 in 2012. Yet, despite this evidence, the US continues to be one of the largest producers in the world (U.S. Department of Agriculture, 2012), only after China, India, and Brazil (Eriksen et al., 2022).

In 2018, North Carolina and Kentucky accounted for more than 70% of national tobacco cultivation, more than 373 million pounds harvested (U.S. Department of Agriculture, 2019). In 2019, 14.0% of all adults (34.1 million people) were currently smoking cigarettes in the US (Centers for Disease Control

and Prevention Content source, 2022). However, in Kentucky and North Carolina, this prevalence reached 23.6% and 18.5% of adults, respectively, in the same year (U.S. Department of Agriculture, 2019). In 2020, 23.6% of high school students reported current use of tobacco products, only 4.6% cigarettes. A similar prevalence of tobacco products was observed in Kentucky and North Carolina (29.7% and 36.5%, respectively), with a tobacco smoking prevalence of 8.3% in North Carolina and 8.9% in Kentucky (Gentzke et al., 2020; Wang et al., 2019).

China

China produces around 2.66 million tons of tobacco leaf per year, one-third of the world's production (Parascandola & Xiao, 2019). However, the State Tobacco Monopoly Administration (STMA) determines China's tobacco leaf production quota. The Chinese Ministry of Agriculture has no jurisdiction over the production, pricing, or marketing of tobacco leaf (Parascandola & Xiao, 2019; Wang, 2006).

China reports over 350 million smokers, with one million premature, smoke-related deaths per year (Liu et al., 1998; Yang, 2004). Also, the country is facing an unprecedented epidemic of lung cancer, with 733,000 new cases and 610,000 deaths annually (Parascandola & Xiao, 2019). Lung cancer is the most diagnosed form among smokers, with 17% of total cancer incidence and 21.7% of total cancer mortality (Parascandola & Xiao, 2019).

Tobacco growing contributes to 1–2% of the Chinese agricultural provincial economy, except in Yunnan, Guizhou, and Sichuan provinces (even if the province of Yunnan was responsible for 62% of all the tobacco growing) (Cai et al., 2012; Hu et al., 2016). In 2015, the general smoking prevalence in China was 27.7%, 52.1% among men, and 2.7% among women, while in Yunnan, the prevalence rates of tobacco use were 68.5% among men and 1.3% among women (Hu et al., 2016). In particular, Cai et al. (2012) reported that tobacco farmers had higher prevalence rates of current smoking, nicotine dependence, and second-hand smoking exposure than participants not engaged in tobacco farming ($p < 0.01$).

India

India is the third-largest producer and exporter of tobacco in the world after China and Brazil. Tobacco growing in India accounts for 10% of the total cultivated area and 9% of the total production (Singh &

Ladusingh, 2014). Different types of tobacco are produced in the country: Flue-cured Virginia, Bidi, Hookah, Chewing, Cigar-wrapper, Cheroot, Burley, Oriental Lanka, Pikka, Natu, Motihari, and Jati. Annually, tobacco contributes 4% of national agricultural exports in foreign exchanges (Central Tobacco Research Institute Rajahmundry, 2015). Also, India shows low costs of production, and average farm and export prices. It has been reported that the prevalence of traditional smoking, smokeless, and dual-use (use of both smoking and smokeless tobacco products) of tobacco use is high across the country (Central Tobacco Research Institute Rajahmundry, 2015; Singh & Ladusingh, 2014). Beyond cigarettes, beedis (tobacco wrapped in dried leaves of specific trees) is commonly smoked largely in the rural areas as well as several types of smokeless tobacco are available, including chewing paan (a mixture of lime, areca nut pieces, tobacco, and spices wrapped in betel leaf), chewing gutkha or pan masala (scented tobacco powdered with lime and areca nut), and mishri (a kind of toothpaste used for rubbing on gums) (Central Tobacco Research Institute Rajahmundry, 2015; Rani et al., 2003).

The national prevalence of tobacco use has been estimated at around 29% among people aged ≥ 15 years old, with an increasing trend since more than two-thirds of Indian states report a high rate of smokeless tobacco use among both males and females (Rai & Bramhankar, 2021). The Northeast region reports the highest prevalence of smokeless tobacco and dual tobacco use. For example, Mizoram reports a prevalence of tobacco use of 72.9% for males and 61.6% for females (Sinha et al., 2003). Ladusingh et al. (2017) reported that tobacco use is socially acceptable as an integral part of their culture, especially among youths. States such as Andhra Pradesh, Gujarat, Uttar Pradesh, and Karnataka are the key states covering more than 80% of the tobacco-growing in the country (Singh & Ladusingh, 2014). Only Gujarat and Uttar Pradesh report a prevalence of any tobacco use higher than the national prevalence, with 41.1% and 44.1% for males and 8.7% and 8.4% for females, respectively (Rai & Bramhankar, 2021) (Table 3).

Indonesia

Indonesia produces 2.3% of the world's tobacco leaf supply (Republic of Indonesia Ministry of Health, 2004). Tobacco farming activities are concentrated in East Java (33.3%), West Nusa Tenggara (31.2%), and

Table 3. Tobacco use rates in India and Indonesia (Achadi et al., 2005; Center for Indonesia's Strategic Development Initiatives, 2021; Rai & Bramhankar, 2021).

	Male prevalence	Female prevalence
India	38%	8.9%
Gujarat	41.1%	8.7%
Andhra Pradesh	22.6%	3.8%
Uttar Pradesh	44.1%	8.4%
Karnataka	27.1%	8.5%
Indonesia	64.5%	1–3%
West Nusa Tenggara	70%	0.6%
East Java	62%	0.8%
Central Java	NA	NA

NA, Not available.

Central Java (20.3%) (Global Agricultural Information Network, 2000). In total, 88% of Indonesian smokers prefer kreteks over regular cigarettes. Kreteks include 30–40% of cloves containing eugenol, which is used as a local anaesthetic in dentistry (University of California & Los Angeles Biomedical Library, 2022). Because the rods of the clove are firmly packed, eugenol is suitable for deeper inhalation, resulting in slower smoking and more puffs (Malson et al., 2003). While kreteks may be perceived as less harmful to health, they contain more nicotine per stick than cigarettes sold in the US (Rahman, 2004).

In 2019, prevalence in Indonesian adult ever-smoking was 32.8%, according to *Survei Sosial Ekonomi Nasional*, an Indonesian Socio-economic Survey (SUSENAS) (Center for Indonesia's Strategic Development Initiatives, 2021). However, the same survey observed an increase from 7.2 to 9.1% in the prevalence of smoking adolescents aged 10–18 years old (Center for Indonesia's Strategic Development Initiatives, 2021). Fifteen out of 34 Indonesian provinces record higher incidence than the national average (Center for Indonesia's Strategic Development Initiatives, 2021), West Java and West Nusa Tenggara, two of the three largest tobacco-growing provinces, are among them. West Java records an incidence of 36.6% and West Nusa Tenggara a smoking prevalence among men over 70% (Achadi et al., 2005; Center for Indonesia's Strategic Development Initiatives, 2021).

Zambia

In 2019, the Ministry of Health of Zambia had estimated a prevalence of tobacco use of 24% in men and 7.8% in women (Global Tobacco Industry Interference Index, 2020). The World Health Organization (WHO) predicts an additional 300,000 tobacco users by 2025 (World Health Organization (WHO), 2015). Tobacco is an important part of Zambian agriculture. Between 1996 and 2016, there

was an increase of 2000% of the land devoted to tobacco harvesting and an 800% increase in export (Food & Agriculture Organization of the United Nations (FAOSTAT), 2019).

In 2018, the British American Tobacco Zambia and Roland Imperial Tobacco opened cigarette-manufacturing facilities to produce 20 million cigarettes daily (Roland Imperial Tobacco Company LTD Roland Imperial Tobacco: Company Profile, 2018). This increase in manufacturing capacity made cigarettes more affordable in Zambia since the prices nearly halved (Research Unit on the Economics of Excisable Products, 2022). Additionally, even with WHO recommending a 75% tax share for cigarettes, in Zambia, the tax share is 37% (Stoklosa et al., 2019).

Nyirenda et al. (2019) demonstrated in a cross-sectional study (2013–2014) that 8.2% of Zambians in urban areas used tobacco (8.1% cigarettes and 0.1% pipes) and 11% in rural areas (10.7% cigarettes and 0.3% pipes). The prevalence of tobacco in urban areas was 16.7% in males and 0.3% in females, whereas it was 21.8% among males and 0.6% among females in rural areas. Higher prevalence has been recorded in Eastern province with 13% and Luapula with 12.5% (Nyirenda et al., 2019). The Eastern province is the largest tobacco-growing one, responsible for producing 84.7% of Burley and 31.5% of Virginia tobacco in the country (Tembo & Sitko, 2013).

Discussion

This review shows a map of states and provinces reported as the largest tobacco producers with the prevalence rates of smoking (Achadi et al., 2005; Barros et al., 2011; Hu et al., 2016; Nyirenda et al., 2019; Republic of Indonesia Ministry of Health, 2004; Tembo & Sitko, 2013; U.S. Department of Agriculture, 2019). In India, deaths due to non-communicable diseases are increasing, and tobacco use is a key risk factor for the development of various diseases and thus increased mortality (Institute for Health Metrics & Evaluation, 2017; Pandey, 2017). Furthermore, several studies have detected an upward trend for tobacco smoking among Indian youth (John, 2005; Srivastava et al., 2004) different from the US, China, and Brazil.

The US, Brazil, China, and Indonesia have adopted two or more best-practices from MPOWER (acronyms for Monitor tobacco use and prevention policies, Protect people from tobacco smoke, Offer help to quit tobacco use, Warn about the dangers of

tobacco, Enforce bans on tobacco advertising, promotion and sponsorship, Raise taxes on tobacco) measures (World Health Organization, 2021). In contrast, Brazil and Turkey are the only two countries to have adopted all MPOWER measures (Nyirenda et al., 2019). These countries report an improvement of perception-levels of tobacco-related health risks (Kiviniemi & Kozłowski, 2015).

India shows a variety of smoking forms and seems to be an array of smokeless tobacco products; beedis are manufactured in small-scale industries, making monitoring and tobacco control more difficult (Mishra et al., 2012). The earlier optimistic report from 2017 pointing at a 6% decline in smoking among adults (Weiger et al., 2017) has been followed by a 6% increase in smokeless tobacco prevalence in 2018 (Ruhil, 2018). These data indicate that India shows different epidemic trends compared to the US, Brazil, China, and Indonesia.

In Zambia and Africa, tobacco smoking prevalence remains low. However, growing economies and the increased presence of multinational tobacco companies may increase prevalence (Suliankatchi et al., 2019). There are similar prevalence rates in the countries bordering with Zambia: Democratic Republic of Congo (14.1% adults smoking and 9.7% smokeless tobacco), Zimbabwe (20.5% adults smoking and 1% smokeless tobacco), Angola (14.2% adults smoking and 1.4% smokeless tobacco), Mozambique (21.7% adults smoking and 6.9% smokeless tobacco), Tanzania (19.8% adults smoking and 2.5% smokeless tobacco), Malawi (16.7% adults smoking and 0.4% smokeless tobacco) (Drope et al., 2018).

The limitations of this study need to be acknowledged. Often the data are incomplete. This article included ecological data from regions for both growing and tobacco use. In addition, some nuances inside the analysed states or provinces might have been overlooked. Another limitation was the language-based selection since we only included articles in English and Portuguese, and some articles in the native languages might have escaped our notice. Lastly, we only searched the internet, whereas other data sources were not evaluated.

Conclusion


In general, there appears to be a relationship between tobacco farming and tobacco smoking in specific tobacco producing countries. Tobacco farming may lead to a higher risk of tobacco use and lower adherence to tobacco control policies. Therefore, promoting

viable alternative livelihoods for tobacco farmers is likely to have some key benefits. Additionally, specific targeted health promotion policies might be necessary for those populations reporting higher tobacco use and lower perception of tobacco-related health risks.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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