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Socio-demographic inequalities in cigarette smoking in Indonesia, 2007 to 2014

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ABSTRACT

The prevalence of smoking in Indonesia is one of the highest in the world. Since 2007, some tobacco control policies have been implemented by the Indonesian government. However, evidence on the effectiveness of such policies at reducing tobacco use in Indonesia is scarcely available. Using both cross-sectional and longitudinal analysis of individual and household data from two waves of the Indonesia Family Life Survey (IFLS), this study explored changes in smoking patterns among Indonesian adults between 2007 and 2014 controlling for socio-demographic factors. Overall, there was no statistically significant change in the prevalence of smoking between 2007 and 2014. However, cigarettes became more affordable. Smokers in 2014 consumed more cigarettes (β: 0.95; 0.73, 1.17) and spent more money on cigarettes (β: IDR 2775; IDR 1124, IDR 4426) compared to those in 2007. Males, individuals < 55 years old and those with lower levels of education had a higher likelihood of being smokers in 2014. Respondents with lower education levels and those under 26 years of age had higher odds of initiating smoking during the study period. Similarly, smoking cessation between 2007 and 2014 was more likely among respondents with higher levels of education and aged above 40 years. In conclusion, the implementation of tobacco control measures does not appear to have had a positive impact on smoking behaviours among adults in Indonesia between 2007 and 2014. Instead, cigarette consumption increased differentially across socio-demographic groups. Hence, tailored tobacco control interventions targeting the most socially disadvantaged population may be necessary in Indonesia.

1. Introduction

Indonesia is the fourth most populous country in the world with 260 million inhabitants. More than 25% of these are smokers (Reitsma et al., 2017), making Indonesia the second largest global cigarette market (WHO, 2012; Gibson, 2017). As a result, Indonesia has attracted powerful transnational tobacco companies (Hurt et al., 2012). Aggressive marketing by the these companies, along with relatively cheap cigarette prices, and poor commitments to control cigarette consumption will likely lead Indonesia to have one of the largest populations of smokers in the world over the next decades (Southeast Asia Tobacco Control Alliance and Southeast Asia Tobacco Control Alliance, 2016).

Cigarette prices are relatively cheap, however cigarette costs account for a large proportion of household expenditure in Indonesia, particularly among the poor (Ahsan and Wiyono, 2012). Smoking has been shown to have negative health impacts for this vulnerable population group. For example, paternal smoking among poor families in Indonesia has been linked to less expenditure on nutrient rich foods, such as fruit and vegetables, child malnutrition and increased rates of under-five mortality (Semba et al., 2008). The prevalence of smoking is generally higher among people with lower levels of education (Thakur et al., 2013; Sreeramareddy et al., 2014). In addition, smokers with lower levels of education are less likely to use smoking cessation services, which may perpetuate their tobacco addiction (Zhu et al., 2010).

Despite the known health consequences of smoking, Indonesia is one of just fifteen countries that are not parties to the World Health Organisation's (WHO) Framework Convention on Tobacco Control (FCTC) (Organization World Health, 2015). However, under the recommendation of the WHO MPOWER tobacco control initiative, national and sub-national regulations were introduced by the Indonesian government. Tobacco products became legally defined by the Indonesian Government as excise items in 2007 (Excise Tax Law No. 39 of

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2007) (Barber and Ahsan, 2009). This was followed by the establishment of a smoke-free policy in 2009 in subnational authorities (Indonesia, 2009; Indonesia TM for H and TM fo HA, 2011). In 2012, mandatory text and graphical warnings on cigarette packaging and partial bans on tobacco advertisement were introduced (Presiden Republik Indonesia, 2012). One year later, general goals of tobacco control monitoring and smoking cessation services were covered in the roadmap of tobacco control for health and safety in Indonesia (Ministry of Health Indonesia, 2013). Lastly, in 2014 some local governments implemented smoke-free areas in their regions (World Health Organization, 2015a).

However, monitoring of these tobacco control policies has been poor. Few studies have examined smoking trends over time, which may reflect the impact of the legislated policies (WHO, 2012; Arrazola et al., 2017; Lian et al., 2016). This study aims to assess smoking trends since the introduction of tobacco policies over a seven-year period (between 2007 and 2014). It also aims to explore the association of individual socio-demographic factors with changes in smoking patterns.

2. Methods

2.1. Data source

This study involved secondary analysis of the Indonesia Family Life Survey (IFLS) waves 4 (IFLS 4) and 5 (IFLS 5) which were fielded in 2007–2008 and 2014–2015, respectively. The IFLS is the only large-scale longitudinal socioeconomic and health survey in Indonesia collecting individual, household, and community data. Participants were recruited using a multistage stratified sampling method and are representative of approximately 83% of the Indonesian population living in 13 out of the 27 provinces in 1993 – the first time IFLS was conducted (RAND, 2017). Sampling and survey methods have been discussed in detail elsewhere (Strauss et al., 2016). For the purpose of this study, individual (adults aged 15 years and older) and household data from IFLS 4 and IFLS 5 were included. In total 44,103 individuals from 13,535 households were interviewed in IFLS 4, and 50,148 individuals from 16,204 households in IFLS 5 (including approximately 91.4% of IFLS 4 respondents) (Strauss et al., 2016). This study was concerned with individual and household data for a subset of the IFLS sample who were asked about their tobacco use: 30,812 individuals from 7069 households in IFLS 4 and 36,339 individuals from 8286 households in IFLS 5. The final sample size, after excluding respondents with missing values, was 29,345 individuals from 6733 households in 2007, and 34,609 individuals from 7895 households in 2014. Excluded respondents were similar to the final sample with respect to socio-demographic characteristics. The longitudinal sample contained data on 22,765 respondents who were surveyed in both IFLS 4 and IFLS 5.

The World Bank national accounts data files were also used to source information on the Gross Domestic Product (GDP) per capita and annual inflation rate in Indonesia for 2007 and 2014 (The World Bank, 2017).

2.2. Measures

2.2.1. Smoking status

In this paper, “smoking” refers to manufactured cigarette smoking. Respondents who reported that they had never used any tobacco products or never smoked manufactured cigarettes/cigars were categorised as “never smokers”. Those who reported having ever smoked manufactured cigarettes/cigars were asked: “Do you still have the habit, or have you totally quit?” with the two responses categorised as: “current smoker” and “former smoker” respectively.

2.2.2. Type of cigarette

Current smokers were categorised into groups based on the type of cigarette(s) they usually smoked (Filtered, Unfiltered, Filtered cloves, and Unfiltered cloves). Respondents were included in more than one sub-groups if they smoked more than one type of cigarettes at the time of the survey.

2.2.3. Number of cigarettes

Current smokers' cigarette consumption was obtained by asking “In one day about how many cigarettes do you consume now?” Responses were categorised into five groups: < 5, 5–9, 10–14, 15–24, > 24 sticks per day.

2.2.4. Cigarette spending

Information on weekly cigarette expenditure was obtained by asking current smokers “How much do you spend each week on these products?”. Information on monthly household cigarette expenditure was also obtained from “smoking households” (households where one or more members were current cigarette smokers). To allow comparison between the two waves, all cigarette spending estimates in 2007 were adjusted for inflation.

2.2.5. Cigarette affordability

Cigarette affordability, also known as the Relative Income Price (RIP), was estimated by taking the share (percentage) of Indonesia's GDP per capita required to purchase 100 packs of the most sold brand of cigarettes at the time of the study (2007 and 2014). Information on cigarette prices in 2007 and 2014 were drawn from the WHO Report on the Global Tobacco Epidemic in 2015 as the price of the most sold brand at the time of the study (World Health Organization, 2015a). Prices in the local currency (Indonesian Rupiah, IDR) and conversion to purchasing power parity (PPP) USD are presented.

2.2.6. Changes in smoking status

For the longitudinal analysis, changes in smoking status were explored using two variables: smoking cessation and smoking initiation. The smoking cessation variable was dichotomous – “yes” represents smokers from 2007 who quit smoking by 2014 and “no” represents smokers from 2007 who remained smokers in 2014. In the smoking initiation variable, “yes” represents non-current cigarette smokers in 2007 who started smoking by 2014.

2.2.7. Socio-demographic characteristics

Socio-demographic data included age (15–24; 25–34; 35–44; 45–54; ≥55), gender (male; female), marital status (married; unmarried; divorced/separated), highest level of education attained (not attended school; elementary school; high school; college/university; others: disabled, kindergarten, Islamic school), area of residence (urban; rural), employment status (employed; non-employed; attending school; housekeeping), and change of employment status between waves (no change; stopped working; started working).

2.3. Statistical analysis

2.3.1. Cross-sectional analysis

Descriptive analysis was conducted to explore the socio-demographic characteristics of the study population and smoking prevalence estimates across measures. Cross-sectional weights were applied. Changes in cigarette affordability were assessed by calculating Relative Income Price (RIP) for both 2007 and 2014. A multilevel logistic regression model, allowing for clustering of observations at the provincial level was fitted to examine the association between smoking status and time (survey year included as a categorical variable), age, gender, marital status, educational level, employment status, and area of residence. Multilevel linear regression models with the same independent variables were also fitted for the outcomes cigarette consumption and spending.

2.3.2. Longitudinal analysis

Longitudinal analysis was undertaken to assess changes in smoking status among the subset of IFLS 4 who were followed up in IFLS 5. Appropriate longitudinal person weights were applied to obtain estimates accounting for the sample design effects and attrition between IFLS 4 and ILFS 5 (Strauss et al., 2016). Multiple logistic regression analyses were performed to identify the sociodemographic factors associated with smoking cessation and smoking initiation occurred between 2007 and 2014. A random effects model, indicated as the most appropriate by the Hausman test, was used in the regression analyses to adjust for unobserved variables at the level of the individual. Independent variables included age, gender, marital status, educational level, employment status, and area of residence, and change in employment between the two waves.

Regression results are presented as adjusted Odds Ratios (OR) or linear coefficients (β) with 95% Confidence Intervals (95% CI) as appropriate. All analyses were conducted using STATA version 13.1.

3. Results

3.1. Cross-sectional analysis

3.1.1. Trends in cigarette consumption

Table 1 presents an overview of cigarette consumption among Indonesian adults in 2007 (N = 29,345) and 2014 (N = 34,609). Supplementary Table 1 presents the overall sample characteristics. There was no evidence of decline in the prevalence of current smoking between 2007 and 2014 (30.8% vs 31.9%). A higher proportion of respondents reported smoking 15 or more cigarettes per day in 2014, compared to 2007. Filtered cloves became the most popular cigarette type in 2014, used by almost half (48.4%) of the smokers and surpassing unfiltered cloves, which was the most popular in 2007.

3.1.2. Cigarette spending and affordability

Adjusting for inflation, smokers in 2007 spent a median of IDR 55,700 (USD 4.28) per week on cigarettes. In 2014, this figure increased by 13.1% to IDR 63,000 (USD 4.85). The price of cigarettes also increased between 2007 and 2014. For, example, the most sold cigarette brand in both waves, was 9.1% more expensive in 2014 (pack of 20-cigarettes increased from USD 2.30 in 2007 to USD 2.51 in 2014). However, cigarette smoking became more affordable; the price of 100 packs of cigarettes in 2014 represented 1.65% of the Indonesian GDP per capita - 0.32% lower than the RIP in 2007. Smoking households spent 9.4% (6.9%, 11.9%) of their monthly expenditure on cigarettes in 2014, compared to 10.6% (7.9%, 13.3%) in 2007 (Fig. 1).

Table 1
Cigarette consumption characteristics among Indonesians aged 15 and older, IFLS, 2007 and 2014.

	Year 2007 (N = 29,345)		Year 2014 (N = 34,609)	
	%[a]	95% CI	%[a]	95% CI
Cigarette smoking status[b]				
Current smoker	30.8	30.2 to 31.4	31.9	31.3 to 32.4
Former smoker	2.5	2.3 to 2.7	4.7	4.4 to 4.9
Never smoked	66.7	66.1 to 67.3	63.5	62.9 to 64.0
Type of cigarette[c]				
Filtered	14.1	13.3 to 14.8	25.5	24.6 to 26.4
Unfiltered	1.3	1.0 to 1.5	1.0	0.8 to 1.2
Filtered cloves	40.7	39.6 to 41.9	48.4	47.4 to 49.5
Unfiltered cloves	43.7	42.5 to 44.9	24.6	23.6 to 25.5
Cigar	0.2	0.1 to 0.3	0.4	0.3 to 0.6
Number of cigarettes (sticks/day)[c]				
< 5	16.7	15.8 to 17.6	14.6	13.9 to 15.4
5–9	24.1	23.1 to 25.0	22.2	21.3 to 23.1
10–14	39.5	38.3 to 40.6	35.0	34.0 to 36.0
15–24	16.8	16.0 to 17.6	23.5	22.6 to 24.4
> 24	3.0	2.7 to 3.4	4.6	4.2 to 5.1

Abbreviation: IFLS, Indonesia Family Life Survey; CI, Confidence Interval; SD, Standard Deviation.

[a] Percentage was reported as weighted relative frequency.

[b] Among smokers and non-smokers. Total respondents in year 2007 = 29,345; 2014 = 34,609.

[c] Among current manufactured cigarette smokers. Total respondents in year 2007 = 8945; 2014 = 10,730.

3.1.3. Factors associated with smoking status

Table 2 provides an overview of smoking trends between 2007 and 2014, controlling for socio-demographic factors. The odds of being a smoker did not change between 2007 and 2014 (OR: 0.98; 0.93 to 1.03). Being < 40 years of age (OR for < 25 age group: 1.99; 1.78 to 2.21; OR for 26–40 age group: 2.28; 2.10 to 2.48), male gender (OR: 110.00; 99.28 to 121.87), and living in a rural location (OR: 1.12; 1.06 to 1.18) were all positively associated with higher odds of being a smoker. College/university graduates (OR: 0.57; 0.50 to 0.66) and those attending school (OR: 0.25; 0.22 to 0.28) were less likely to be smokers.

3.1.4. Factors associated with cigarette consumption

As shown in Table 2, current smokers in 2014 smoked almost one extra stick of cigarette per day compared to 2007 (β: 0.95; 0.73, 1.17). Male gender (β: 4.09; 3.32 to 4.86), age 26–40 (β: 1.18; 0.78 to 1.58) and age 41–55 (β: 1.61; 1.20 to 2.02), and higher educational status (β: 1.19; 0.51 to 1.88 for high-school graduates and β: 1.89; 1.13 to 2.66 for university graduates) were all associated with higher volume of cigarette consumption. Conversely, smokers who were students (β: −4.29; −5.00, −3.58) and non-employed (β: −1.03; −1.50, −0.56), reported significantly lower consumption compared to employed smokers.

3.1.5. Factors associated with cigarette spending

Table 2 also presents data on cigarette expenditure over the seven-year study period. In 2014, smokers spent more per week on cigarettes (β: IDR 2775; IDR 1124 to IDR 4426). Individuals aged 55 or less (from β: IDR 11,999 to β: IDR 14,593 for age 41–55 and ≤25, respectively) and those with higher levels of education (from β: IDR 7916 to β: IDR 22,783 for elementary and college level, respectively) were more likely to have higher levels of cigarette expenditure. Meanwhile, unemployment was associated with lower cigarette spending (β: IDR -5866, IDR -11,009 to IDR -2875).

3.2. Longitudinal analysis

Table 3 presents the sociodemographic factors associated with changes in smoking patterns between 2007 and 2014.

3.2.1. Sociodemographic factors and changes in smoking status

Smokers who held university degrees were over six times (OR: 6.52; 2.35, 18.12) more likely to quit smoking compared to those who had not attended school. Additionally, smokers who stopped working between 2007 and 2014 were over 26 times (OR: 26.89; 13.06, 55.36) more likely to quit smoking, compared to those who remained in employment. Similarly, those who became employed between 2007 and 2014 were over eight times (OR: 8.88; 4.46, 17.67) more likely to initiate smoking during this period. Factors associated with reduced levels of smoking initiation between 2007 and 2014 included female gender, being over 25 years old at baseline, having completed any level of education and being married. For example, among those who only had an elementary level of education, the odds of smoking initiation between 2007 and 2014 was 91% lower (74%, 97%) compared to those not attending school.

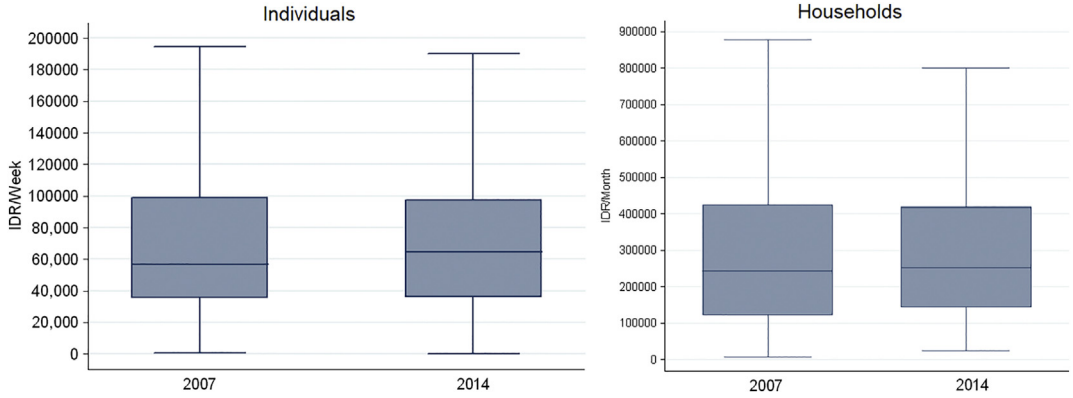

Fig. 1. Distribution (median, interquartile range) of cigarette spending by a) Indonesian smokers aged 15 and above and b) Indonesian smoking households in 2007 and 2014.
IDR, Indonesian Rupiah. 1 USD ≈ 13,000 IDR (late 2014 – early 2015).
Smoking households were defied as households with one or more members smoking cigarettes at the time of interview. The values above represent the real spending of cigarettes which had been adjusted for Indonesia's annual inflation rate from 2007 to 2014.

Table 2
Adjusted regression analyses of being a smoker, average number of cigarette sticks per day, and average money spent on cigarettes per week according to socio-demographic factors, 2007 and 2014[a].

	OR of being a smoker[b] (95% CI)	Number of sticks/day[c] β (95% CI)	IDR spent on cigarettes/week[d] (95% CI)
Year			
2007	Ref	Ref	Ref
2014	0.98 (0.93 to 1.03)	0.95 (0.73 to 1.17)	2775 (1124 to 4426)
Gender			
Male	110.00 (99.28 to 121.87)	4.09 (3.32 to 4.86)	13,543 (8304 to 18,782)
Female	Ref	Ref	Ref
Age (years)			
≤25	1.99 (1.78 to 2.21)	−0.26 (−0.77 to 0.24)	14,593 (11,634 to 17,552)
26–40	2.28 (2.10 to 2.48)	1.18 (0.78 to 1.58)	13,128 (10,367 to 15,888)
41–55	1.78 (1.64 to 1.93)	1.61 (1.20 to 2.02)	11,999 (9203 to 14,795)
> 55	Ref	Ref	Ref
Highest completed education level			
Not attended school	Ref	Ref	Ref
Elementary school	1.36 (1.20 to 1.55)	0.38 (−0.29 to 1.05)	7916 (3126 to 12,706)
High school	1.13 (0.99 to 1.28)	1.19 (0.51 to 1.88)	17,216 (12,331 to 22,102)
College/university	0.57 (0.50 to 0.66)	1.89 (1.13 to 2.66)	22,783 (17,330 to 28,237)
Marital status			
Unmarried	Ref	Ref	Ref
Married	1.19 (1.10 to 1.30)	0.98 (0.60 to 1.35)	4976 (2233 to 7719)
Divorced/separated	1.84 (1.60 to 2.13)	1.13 (0.47 to 1.78)	4740 (55 to 9426)
Employment status			
Employed	Ref	Ref	Ref
Non-employed	0.73 (0.66 to 0.80)	−1.03 (−1.50 to −0.56)	−5866 (−9302 to −2429)
Attending school	0.25 (0.22 to 0.28)	−4.29 (−5.00 to −3.58)	−10,397 (−16,360 to −4435)
Housekeeping	0.84 (0.75 to 0.93)	−0.90 (−1.48to −0.32)	−6942 (−11,009 to −2875)
Residence			
Urban	Ref	Ref	Ref
Rural	1.12 (1.06 to 1.18)	−0.22 (−0.46 to 0.02)	−5570 (−7289 to −3852)

Abbreviations: CI, Confidence Interval; Ref, Reference.
[a] Adjusted for all predictors listed on the table. Multilevel model was used to include variation among provinces.
[b] Total sample of 62,579 respondents (smokers and non-smokers) were included in the multiple logistic regression model.
[c] Total sample of 18,835 smokers were included in the multiple linear regression model.
[d] Total sample of 18,723 smokers were included in the multiple linear regression model.

4. Discussion

A key finding of this study is that smoking prevalence in Indonesia did not decline between 2007 and 2014. Within the socio-demographic context of Indonesia, it is also clear that disparities in smoking initiation and cessation exist among different socio-economic groups; cigarette consumption and spending also varied across subgroups of smokers. The lack of progress with regard to smoking prevalence is consistent with previous research, which found that Indonesia was the only country among the top five with the largest smoking population demonstrating no reduction in smoking prevalence from 2005 to 2015 (Reitsma et al., 2017). The trend may be linked to poor tobacco control policies adopted by the Indonesian government compared to other countries, which have implemented key demand-reduction measures

Table 3
Sociodemographic factors associated with changes in smoking behaviour occurred between 2007 and 2014 among longitudinal sample[a].

	Quit smoking[b]		Start smoking[c]	
	Adjusted[d] OR	95% CI	Adjusted[d] OR	95% CI
Gender				
Male	Ref	Ref	Ref	Ref
Female	1.42	0.46 to 4.47	< 0.01	< 0.01 to 0.01
Age years				
≤25	Ref	Ref	Ref	Ref
26–40	1.69	0.75 to 3.81	0.20	0.09 to 0.46
41–55	3.91	1.58 to 9.67	0.11	0.04 to 0.29
> 55	12.98	4.93 to 34.20	0.14	0.04 to 0.44
Highest completed education level				
Not attended school	Ref	Ref	Ref	Ref
Elementary school	1.01	0.43 to 2.38	0.09	0.03 to 0.26
High school	1.64	0.66 to 4.08	0.04	0.01 to 0.12
College/university	6.52	2.35 to 18.12	0.01	0.00 to 0.03
Marital status				
Unmarried	Ref	Ref	Ref	Ref
Married	1.15	0.54 to 2.45	0.37	0.16 to 0.87
Divorced/ separated	0.93	0.32 to 2.71	2.88	0.83 to 9.95
Employment status				
Employed	Ref	Ref	Ref	Ref
Non-employed	1.26	0.70 to 2.26	0.89	0.26 to 3.06
Attending school	1.82	0.38 to 8.78	1.11	0.40 to 3.08
Housekeeping	1.50	0.48 to 4.65	0.48	0.21 to 1.11
Change of employment status				
No change	Ref	Ref	Ref	Ref
Stop working	26.89	13.06 to 55.36	1.74	0.33 to 9.25
Start working	1.11	0.90 to 1.59	8.88	4.46 to 17.67
Residence				
Urban	Ref	Ref	Ref	Ref
Rural	0.83	0.55 to 1.23	1.57	0.89 to 2.78

[a] Individuals present in both 2007 and 2014 wave. A multilevel model was used to account for clustering within provinces.
[b] Among smokers in 2007; n = 7183.
[c] Among non-smokers in 2007; n = 14,442.
[d] Adjusted for all sociodemographic predictors listed in table using a multiple logistic regression.

(Gravely et al., 2017). Indonesia remains one of only few countries, which have not ratified WHO FCTC (Organization World Health, 2015).

The rising popularity of manufactured cloves-blend cigarettes, known as kretek in Indonesia may be explained by the promotion of this particular product in the country, where kretek defenders promote it as "part of Indonesia's culture and heritage" (The Jakarta Post, 2017). Internal industry documents provide evidence that transnational tobacco companies took over Indonesian domestic kretek manufacturers and marketed this product in Indonesia despite their knowledge on kretek's comparable harmful effects to conventional cigarettes (Hurt et al., 2012).

This study found males, those younger than 55 years of age, and those with lower educational levels are at the greatest risk of tobacco smoking in Indonesia. This pattern of inequality in smoking has been extensively identified by studies in low- and middle-income countries, which have shown sociodemographic gradients in tobacco use (Sreeramareddy et al., 2018; Hosseinpoor et al., 2011; Tee et al., 2016). For example, older smokers are more likely to quit (Hosseinpoor et al., 2011; Tee et al., 2016) and education is inversely associated with smoking in multiple settings (Tee et al., 2016).

Evidence suggests that increasing tobacco price has the greatest potential to reduce socioeconomic disparities in smoking (Hill et al., 2014). The multi-tiered tobacco excise system in Indonesia has created a wide range of cigarette prices which allows smokers to switch to the more affordable brands instead of quitting smoking (Barber and Ahsan, 2009; World Health Organization, 2015b). As a result, cigarette prices in Indonesia remained affordable including for young persons. To our knowledge, this is the first study to evaluate cigarette expenditure and consumption among Indonesian smokers in relation to their socio-demographic characteristics. We found that female smokers reported lower cigarette expenditure and consumption, which reflects that smoking among women continues to be socially unacceptable in Indonesia (Barraclough, 1999). Smokers with higher levels of education had higher cigarette expenditure and consumption, despite the lower likelihood of being a smoker shown for university graduates. This may indicate that once more highly educated adults with, presumably, higher disposable income become smokers, they may smoke and spend more on cigarettes. This finding is in line with a study in Ghana which found that better-educated smokers smoked more than less educated smokers (Townsend et al., 2006). However, this finding warrants further research within the Indonesian context.

Cigarette spending increased between 2007 and 2014, both at the individual and household level, even after adjusting for inflation, which may be a result of the increasing affordability of cigarettes in Indonesia. The cigarettes' price increase was unable to offset the Indonesian GDP growth. With smoking becoming more affordable, the financial incentives to reduce cigarette consumption have weakened among smoking households in Indonesia. This result builds on findings by Blecher et al., which suggest that between 2003 and 2006 cigarettes had generally become more affordable in developing countries, including Indonesia (Blecher and van Walbeek, 2008). By 2014, Indonesian tobacco tax accounted only for 53.4% of the retail price which was far below the recommended WHO minimum tobacco tax at 70% (Lian et al., 2016; World Health Organization, 2015b). The Indonesian government would be unable to meet the WHO recommendation as its Excise Law set the maximum tobacco excise at 57% of the retail price.

Although the government enacted regulations concerning tobacco control and implemented MPOWER measures over the seven-year period, the likelihood of smoking among Indonesian adults remained unchanged between 2007 and 2014. Moreover, after adjusting for inflation, cigarette consumption and expenditure increased among smokers, regardless of socio-demographic status. Indonesia has not committed to WHO FCTC despite recent evidence showing that implementation of key WHO FCTC demand-reduction measures, especially tax and tobacco control media campaigns, are significantly associated with reduced population smoking prevalence (Gravely et al., 2017; Wakefield et al., 2008). It has been reported that none of the MPOWER measures in Indonesia followed the best practice of WHO FCTC at that time (World Health Organization, 2015a).

We also identified socio-demographic discrepancies in smoking cessation and smoking initiation between 2007 and 2014. In particular, smokers with university level education were much more likely to quit than those with lower education. Stopping work (i.e. either becoming unemployed or retiring) during the study was associated with higher odds of quitting. There are inequalities in quitting smoking shown in many countries (Hiscock et al., 2011; Tchicaya et al., 2016; Brown et al., 2014; Monsó et al., 2001; Jeong Yang et al., 2015). Indonesia has set its goals pertaining to smoking cessation through the Tobacco Control Roadmap (Ministry of Health Indonesia, 2013). However, the Roadmap does not specifically address the provision of cessation support in Indonesia. A study in the Yogyakarta Province found that doctors didn't feel confident engaging in smoking cessation activities (Ng et al., 2007). In addition, cessation aids and medications were less accessible by low-income groups, as they were not covered by Indonesia national health insurance (World Health Organization, 2015a). These findings highlight the need for future interventions to make smoking cessation support more accessible to all smokers.

This study also revealed that there was socio-demographic inequality in smoking initiation between 2007 and 2014, which further widens the gap between the uneducated and the well-educated, and, the young and old. Those below 25 years of age were the most likely to start smoking. Most smokers in multiple countries start smoking at a younger age (Filippidis et al., 2015). In Indonesia, this is further exacerbated by the increasing influence of tobacco industry marketing on the young population. A cross-sectional study involving students in the Yogyakarta Province found that youths perceived cigarette advertisements as encouraging them to smoke (Prabandari and Dewi, 2016). Additionally, the implementation of the Indonesian regulations regarding tobacco advertising, promotion and sponsorship (TAPS) which were enacted in 2012 varied and did not follow the WHO best practice (World Health Organization, 2015a; Kids ILC at the C for T-F, 2015). A comprehensive ban for all kinds of TAPS in Indonesia could potentially reduce smoking initiation by the youth.

4.1. Strengths and limitations

To the authors' knowledge, this is the first study to investigate the potential impact of tobacco control policies in Indonesia using both cross-sectional and longitudinal data. A key strength of this study is the longitudinal analysis of Indonesia's only large-scale robust health and lifestyle survey. However, we were unable to conduct separate analysis for each province in Indonesia. Some tobacco control measures in Indonesia were decentralised to the provincial and district/city authority. To overcome this limitation, we performed multi-level analyses to account for some of these differences among provinces. This study used two waves of data collected seven years apart (2007–2014), which limited our ability to evaluate the direct impact of individual tobacco control measures implemented during this period. We could only capture the combined effect of the overall tobacco control policies and any underlying trends in the Indonesian society. Our analyses on tobacco consumption and spending included current smokers only; hence, our findings cannot be generalised to the entire population. The definition of smoking did not account for early experimentation with smoking, which may hamper comparisons with international data; however, this definition was consistent across waves. Although data on wealth is collected in the survey, almost two thirds of the respondents did not provide such information; hence, we were only able to use educational level as a proxy for socio-economic status.

4.2. Conclusion

We found that smoking prevalence among adults in Indonesia did not change between 2007 and 2014 with heterogeneity among socio-demographic groups. Our findings suggest that tobacco control in Indonesia has been ineffective overall, especially for disadvantaged groups, who are more likely to smoke. Inequalities in smoking may further contribute to the health inequalities cycle in the Indonesian society. Thus, the government is urged to formulate target-specific tobacco control efforts, such as disseminating tailored anti-smoking campaigns for poorly educated groups; integrating smoking cessation services and medication into the national health insurance scheme to make them accessible for poor smokers; and banning all types of TAPS to prevent smoking initiation among youths. Considering the weak effect of the current tobacco control measures, Indonesia is encouraged to immediately ratify the WHO FCTC treaty in order to receive support and be able to strengthen its tobacco control policy.

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Declaration of interests

The authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.02.025.

References

Ahsan, A., Wiyono, N.H., 2012. Beban Konsumsi Rokok, Kebijakan Cukai dan Pengentasan Kemiskinan. https://doi.org/10.13140/RG.2.1.2211.6249.

Arrazola, R.A., Ahluwalia, I.B., Pun, E., Garcia de Quevedo, I., Babb, S.A.B., 2017. Current tobacco smoking and desire to quit smoking among students aged 13–15 years — global youth tobacco survey, 61 countries, 2012–2015. MMWR Morb. Mortal. Wkly Rep. 66 (20), 533–537. https://doi.org/10.15585/mmwr.mm6620a3.

Barber, S., Ahsan, A., 2009. The tobacco excise system in Indonesia: hindering effective tobacco control for health. J. Public Health Policy 30 (2), 208–225. https://doi.org/10.1057/jphp.2009.12.

Barraclough, S., 1999. Women and tobacco in Indonesia. Tob. Control. 8 (3), 327–332. https://doi.org/10.1136/TC.8.3.327.

Blecher, E.H., van Walbeek, C.P., 2008. An analysis of cigarette affordability. Int Union Against Tuberc Lung Dis. 13 (4), 339–346. https://doi.org/10.1136/tc.2003.006726.

Brown T, Platt S, Amos A. Equity impact of population-level interventions and policies to reduce smoking in adults: a systematic review. Drug Alcohol Depend. 2014;138(1):7–16. doi:https://doi.org/10.1016/j.drugalcdep.2014.03.001.

Filippidis, F.T., Agaku, I.T., Vardavas, C.I., 2015. The association between peer, parental influence and tobacco product features and earlier age of onset of regular smoking among adults in 27 European countries. Eur. J. Pub. Health 25 (5), 814–818. https://doi.org/10.1093/eurpub/ckv068.

Gibson L. Towards a more equal Indonesia: How the government can take action to close the gap between the richest and the rest. Oxfam. 2017;(February):1–10.

Gravely, S., Giovino, G.A., Craig, L., et al., 2017. Implementation of key demand-reduction measures of the WHO Framework Convention on Tobacco Control and change in smoking prevalence in 126 countries: an association study. Lancet Public Heal. 2 (4), e166–e174. https://doi.org/10.1016/S2468-2667(17)30045-2.

Hill, S., Amos, A., Clifford, D., Platt, S., 2014. Impact of tobacco control interventions on socioeconomic inequalities in smoking: review of the evidence. Tob. Control. 23 (e2), e89–e97. https://doi.org/10.1136/tobaccocontrol-2013-051110.

Hiscock, R., Judge, K., Bauld, L., 2011. Social inequalities in quitting smoking: what factors mediate the relationship between socioeconomic position and smoking cessation? J Public Health (Bangkok). 33 (1), 39–47. https://doi.org/10.1093/pubmed/fdq097.

Hosseinpoor AR, Parker LA, Tursan d'Espaignet E, Chatterji S. Social determinants of smoking in low- and middle-income countries: results from the world health survey. Su Z, ed. PLoS One 2011;6(5):e20331. doi:https://doi.org/10.1371/journal.pone.0020331.

Hurt, R.D., Ebbert, J.O., Achadi, A., Croghan, I.T., 2012. Roadmap to a tobacco epidemic: transnational tobacco companies invade Indonesia. Tob. Control. 21 (3), 306–312. https://doi.org/10.1136/tc.2010.036814.

Indonesia. Law on Health No 36/2009.; 2009.

Indonesia TM for H and TM fo HA. Joint Regulation Number 188/MENKES/PB/I/2011.; 2011.

Jeong Yang, J., Song, M., Yoon, H.S., et al., 2015. What are the major determinants in the success of smoking cessation: results from the health examinees study. PLoS One 10 (12), 1–16. https://doi.org/10.1371/journal.pone.0143303.

Kids ILC at the C for T-F. Overview of Key FCTC Articles and their Implementing Guidelines. 2015;(July):1–3. www.tobaccocontrollaws.org.

Tan Yen Lian Ulysses Dorotheo A, Ritthiphakdee B, Assunta Kolandai M, et al. The Tobacco Control Atlas: ASEAN Region Third Edition.; 2016. http://seatca.org/dmdocuments/The Tobacco Control Atlas ASEAN Region 3rd Edition 2016.pdf.

Ministry of Health Indonesia. Roadmap of Cigarette Consumption Control for Health. 2013:1–19.

Monsó E, Campbell J, Tønnesen P, Gustavsson G, Morera J. Sociodemographic predictors of success in smoking intervention. Tob. Control. 2001;10(2):165 LP-169. http://tobaccocontrol.bmj.com/content/10/2/165.abstract.

Ng, N., Prabandari, Y.S., Padmawati, R.S., et al., 2007. Physician assessment of patient smoking in Indonesia: a public health priority. Tob. Control. 16 (3), 190–196. https://doi.org/10.1136/tc.2006.018895.

Organization World Health. The WHO Framework Convention on Tobacco Control an Accelerator for Sustainable Development.; 2015. http://www.who.int/fctc/about/WHO_FCTC_summary_January2015.pdf?ua=1.

Prabandari, Y.S., Dewi, A., 2016. How do Indonesian youth perceive cigarette advertising? A cross-sectional study among Indonesian high school students. Glob. Health Action 9 (1), 30914. https://doi.org/10.3402/gha.v9.30914.

Presiden Republik Indonesia. Peraturan Pemerintah Republik Indonesia Nomor 109

Tahun 2012 Tentang Pengamanan Bahan Yang Mengandung Zat Adiktif Berupa Produk Tembakau Bagi Kesehatan.; 2012. doi:https://doi.org/10.1017/CBO9781107415324.004.

RAND. Indonesian Family Life Survey (IFLS). http://www.rand.org/labor/FLS/IFLS.html. Accessed July 7, 2017.

Reitsma, M.B., Fullman, N., Ng, M., et al., 2017. Smoking prevalence and attributable disease burden in 195 countries and territories, 1990–2015: a systematic analysis from the Global Burden of Disease Study 2015. Lancet. 389 (10082), 1885–1906. https://doi.org/10.1016/S0140-6736(17)30819-X.

Semba, R.D., De Pee, S., Sun, K., Best, C.M., Sari, M., Bloem, M.W., 2008. Paternal smoking and increased risk of infant and under-5 child mortality in Indonesia. Am. J. Public Health 98 (10), 1824–1826. https://doi.org/10.2105/AJPH.2007.119289.

Southeast Asia Tobacco Control Alliance. Indonesia on track to world's highest smoking rates – Southeast Asia Tobacco Control Alliance. https://seatca.org/?p=8057. Published 2016. Accessed January 22, 2019.

Sreeramareddy, C.T., Pradhan, P.M.S., Mir, I.A., Sin, S., 2014. Smoking and smokeless tobacco use in nine South and Southeast Asian countries: prevalence estimates and social determinants from Demographic and Health Surveys. Popul. Health Metrics 12 (1), 22. https://doi.org/10.1186/s12963-014-0022-0.

Sreeramareddy, C.T., Harper, S., Ernstsen, L., 2018. Educational and wealth inequalities in tobacco use among men and women in 54 low-income and middle-income countries. Tob. Control. 27 (1), 26–34. https://doi.org/10.1136/TOBACCOCONTROL-2016-053266.

Strauss, J., Witoelar, F., Bondan, S., 2016. The Fifth Wave of the Indonesia Family Life Survey: Overview and Field Report. 1 (March), 5. https://doi.org/10.7249/WR1143.1.

Tchicaya, A., Lorentz, N., Demarest, S., 2016. Socioeconomic inequalities in smoking and smoking cessation due to a smoking ban: general population-based cross-sectional study in Luxembourg. PLoS One 11 (4), 1–15. https://doi.org/10.1371/journal.pone.0153966.

Tee, G.H., Aris, T., Rarick, J., Irimie, S., 2016. Social determinants of health and tobacco use in five low and middle-income countries - results from the global adult tobacco survey (GATS), 2011–2012. Asian Pac. J. Cancer Prev. 17 (3), 1269–1276. http://www.ncbi.nlm.nih.gov/pubmed/27039759, Accessed date: 10 May 2017.

Thakur, J.S., Prinja, S., Bhatnagar, N., Rana, S., Sinha, D.N., 2013. Socioeconomic inequality in the prevalence of smoking and smokeless tobacco use in India. Asian Pac. J. Cancer Prev. 14 (11), 6965–6969.

The Jakarta Post. Expert warns about the dangers of clove cigarettes. http://www.thejakartapost.com/news/2015/09/30/expert-warns-about-dangers-clove-cigarettes.html. Accessed August 13, 2017.

The World Bank. Indonesia GDP Per Capita. http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=ID. Accessed July 12, 2017.

Townsend, L., Flisher, A.J., Gilreath, T., King, G., 2006. A systematic literature review of tobacco use among adults 15 years and older in sub-Saharan Africa. Drug Alcohol Depend. 84 (1), 14–27. https://doi.org/10.1016/j.drugalcdep.2005.12.008.

Wakefield, M.A., Durkin, S., Spittal, M.J., et al., 2008. Impact of tobacco control policies and mass media campaigns on monthly adult smoking prevalence. Am. J. Public Health 98 (8), 1443–1450. https://doi.org/10.2105/AJPH.2007.128991.

WHO. Global Adult Tobacco Survey: Indonesia Report 2011.; 2012. http://www.who.int/tobacco/surveillance/survey/gats/indonesia_report.pdf.

World Health Organization. WHO report on the global tobacco epidemic, 2015: Raising taxes on tobacco. World Heal Organ. 2015a:1–103. doi:ISBN 978 92 4 069460 6.

World Health Organization. WHO Report on the Global Tobacco Epidemic, 2015b. 2015:21. http://www.who.int/tobacco/surveillance/policy/country_profile/idn.pdf?ua=1.

Zhu, S.-H., Hebert, K.K., Wong, S., Cummins, S.E., Gamst, A., 2010. Disparity in smoking prevalence by education: can we reduce it? Glob. Health Promot. 17 (1 Suppl), 29–39. https://doi.org/10.1177/1757975909358361.