Geographic distribution, socioeconomic disparity, and policy determinant of smoke-free policy adoption in Indonesia

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ABSTRACT

Background: Indonesia has the second highest smoking prevalence among adult male in the world and smoking prevalence is increasing among youth. **Objective**: We evaluated the smoke-free policy (SFP), a flagship national tobacco control, by providing evidence on geographic distribution, socioeconomic disparity, and policy determinants of SFP adoption by districts in Indonesia. Methods: We employed spatial and quantitative methods. The former provided evidence on geographic distribution of the adoption and the latter provided evidence on the disparity and associations between the national and provincial SFP regulations and adoption by districts. **Results**: Twenty one of 34 provinces adopted SFP and 345 of 514 districts did. We found significant geographic disparity: all districts outside of Papua were up to 6.3 times more likely to adopt and up to 3 years longer in duration. We also found significant socioeconomic disparity: urban, richest, and most educated districts were 3.9 times, 9.1 times, and 2.8 times more likely to adopt, respectively. Moreover, districts within provinces that had SFP regulation were 3.2 times more likely to adopt. Lastly, the national regulations were associated with district adoption. **Conclusion**: In addition to geographic and socioeconomic disparity, the national and provincial regulations and policy were determinants of adoption.

Keywords: tobacco control, smoke-free policy, regulation, district, disparity, Indonesia
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INTRODUCTION

Indonesia contributed to over 60 million current smokers and has the second highest smoking prevalence among adult male in the world.[1] The latest Basic Health Research (Riskesdas) 2018, a nationally representative health survey, showed that smoking prevalence among aged 15 years and above stagnated but remained high (36% in 2013 and 34% in 2018) but that among youth aged 10-18 years increased by almost 30% (7.2% in 2013 and 9.1% in 2018).[2] Despite all that, the government of Indonesia (with only nine other governments) still struggles to ratify the Framework Convention on Tobacco Control (2005), which provides legal framework and support for comprehensive efforts.[3]

In this limiting environment, there are two national regulations related to tobacco control: Health Act 36/2009 and Presidential Decree 109/2012 on "Safety of materials that contain addictive substance in the form of tobacco products for health".[4,5] The Act stipulated two general guidance on tobacco including (a) cigarette production and import are required to have health warning and (b) local governments are required to implement smoke-free policy (SFP) in 7 facility types (health facilities, educational facilities, children's playground, places of worship, public transportation, workplaces, and other designated public spaces. The Decree provided further details that producing, selling, advertising, promotion, and smoking of tobacco products are prohibited in the SFP areas. Also, local governments are required to enact SFP regulations.

The Ministry of Health has worked with various key stakeholders to establish SFP at subnational levels, which include provincial and district (including city) governments. Since the decentralization policy in 2000, district governments have been playing an important role in policy development and implementation. While the Ministry of Health has a list of SFP adoption by provinces and districts, there has been no or very limited systematic analyses. Thus, our study aimed to provide evidence on geographic distribution, socioeconomic disparity, and policy determinants of SFP adoption by districts in Indonesia during 2004-2018. Policy determinants included national and provincial SFP regulations. In the context of a limited tobacco control setting such as in Indonesia, this understanding is crucial to ensure that the adoption and implementation of SFP, a flagship national tobacco control program, is on track.

METHODS

This study employed spatial and quantitative methods. The spatial analyses were to provide evidence on geographic variations of SFP adoption by district. It was also to provide evidence on the rate of SFP adoption over space (district) and time (2004-2018). For the rate over time, we compared three periods: 2004-2008, 2009-2011, and 2012-2018. The 2009 cut-off was used the Health Act 36/2009 provided general guidance on SFP but no details, which gave some exposure to SFP. The 2012 cut-off was used because the Presidential Decree 109/2012 provided detailed guidance on SFP for local governments. To get the rate, we divided the number of SFP adoption by districts in each time period by the number of years in each period. The main data source for this analysis was the Excel list of districts that have adopted SFP during 2004-2018 from the Ministry of Health. Spatial analyses were performed in ArcMap 10.6.

The quantitative analyses were to provide evidence on geographic and socioeconomic disparity and the associations between having the provincial SFP, national regulations, and SFP adoption and duration by districts. In addition to the spatial analysis, quantitative analysis was also conducted on geographic disparity including region and urbanicity. The National Planning Agency (Bappenas)

divides the provinces into 7 regions including Sumatera, Java, Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua. However, because of fewer districts in Nusa Tenggara and Maluku, we combined them as one region with Papua. Furthermore, quantitative analysis was conducted on socioeconomic disparity including urbanicity, income and education indicators. We defined cities as urban and regents as rural; we used district-level poverty rate (in percent) for income quintile with quintile 5 equals lowest poverty rate; we used net enrollment ratio of senior secondary for education quintile (in percent). The source for socioeconomic data was the World Bank website and for urban/rural and provincial SFP was the Ministry of Health.

For data analysis, two main dependent variables are SFP adoption and duration of adoption. Adoption was defined as having SFP regulation as per the Ministry of Health's database. While there was variation in the adoption namely mayor's regulation and local parliament regulation, we treated the two as the same as "adoption" because there was no evidence of degree of implementation. Duration of adoption was calculated by subtracting 2019 with each year (for example, 2018 enactment equals to one-year duration). We performed bivariate regressions of dependent variables (logistic regression for adoption and ordinary least square for duration) on each covariate including region, urbanicity, income quintile, and education quintile. For provincial SFP, we regressed the dependent variables on provincial SFP status; results from bivariate and multivariate analyses (controlling for geographic, income, and education variables) were similar. For national regulations, we calculated the adoption rate per year and compared between the three period of before Health Act 2009 (2004-2008), before Decree 2012 (2009-2011), and after Decree (2012-2018). We used chi-square to test the statistical significance of the adoption rate among the three periods. Quantitative analyses were performed in Stata 15.1.

RESULTS

Figure 1 shows the spatial distribution of SFP adoption by province and districts in Indonesia. During the 2004-2018, 21 of all 34 provinces have adopted some form of SFP regulation (panel a) and 345 of all 514 districts did (panel b). The map qualitatively shows the regional disparity that Kalimantan and Java regions had more provinces without the SFP regulation – shown by the non-shaded areas in panel a. The map also qualitatively shows the regional disparity that many districts within those non-SFP provinces adopted SFP – shown by the areas highlighted in yellow (panel b) and in shaded and yellow (panel c). There were 260 districts that had both provincial and district SFP regulation.

Table 1 shows the socioeconomic disparity and policy determinants of SFP adoption by districts during 2004-2018. In terms of SFP adoption, 67% or 345 districts had adopted some form of SFP regulation with significant geographic and socioeconomic disparity (columns 2, 3, and 5). In terms of region (panel a), the variation ranged from 43% of districts adopted in Papua (including Maluku and Nusa Tenggara) to 83% of districts in Sulawesi. The regression (column 5) shows that all districts outside Papua had higher odds of adoption, up to 6.3 times for districts in Sulawesi. In terms of urbanicity (panel b), data shows disparity with the proportion of adoption was 63% in rural and 87% in urban districts. The regression shows that urban districts were 3.9 times more likely to adopt, relative to rural ones. In terms of income, data shows significant disparity with the proportion of adoption ranging from 43% and 87% in poorest and richest quintiles. The regression shows that districts in the richest income quintile were 9.1 times more likely to adopt, relative to those in the poorest quintile. In terms of education, data shows significant disparity with the proportion of adoption ranging from 50% and 74% in lowest and highest education quintiles, respectively. The regression shows that districts in the highest education quintile were 2.8 times more likely to adopt,

relative to those in the lowest quintile. In terms of policy (panel c), data shows disparity with the proportion of adoption of 55% and 79% among districts without and with provincial SFP. The regression shows that the districts with provincial SFP were 3.2 times more likely to adopt, relative to those without; similar result (2.6 times) after controlling for the geographic and socioeconomic variables. All the regressions were significant at 5%.

In terms of SFP duration, among 345 districts that adopted, the average duration was 5.5 years with some geographic and socioeconomic variations (columns 4 and 6). In terms of region, the variation ranged from 4.3 years of adoption in Papua (including Maluku and Nusa Tenggara) to 7.3 years in Java. The regression (column 6) shows that districts in Java had on average 3 years longer than those in Papua (significant at 5%). However, no significant regional variations between Papua and the other regions including Sumatera, Kalimantan, and Sulawesi. In terms of urbanicity, data shows disparity with the duration of adoption of 5 years in rural and 7.1 in urban districts. The regression shows that districts in urban had on average 5 years longer than those in rural areas (significant at 5%). In terms of income, the variation ranged from 4.6 and 6.3 years of SFP adoption in poorest and richest quintiles, respectively. The regression shows that districts in highest income quintile had on average 1.7 years longer than those in lowest income quintile (significant at 5%). However, no significant income variations between the lowest income quintile and the middle income-quintiles (Q2-4). In terms of education, the variation ranged from 5.1 and 5.7 years of adoption in districts with least and most educated population, respectively. The regression, however, show no statistical significance for all education quintiles. In terms of policy, data shows some variation in the duration of adoption, but the regression shows no statistical significance.

Figure 2 shows the spatial distribution and rate of SFP adoption by three time period: 2004-2008, 2009-2011, and 2012-2018. The time cut-off was based on two relevant national regulations, Health Act 36/2009 and Presidential Decree 109/2012, that provided the mandate and technical details for the Ministry of Health to encourage and for local governments to adopt. This is to provide evidence on whether the two regulations were associated with SFP adoption by districts. Results show significant associations between having the national regulations and district adoption. In panel a, 25 districts adopted during the five years of 2004-2008: adoption rate of 5 per year. In panel b, 47 districts adopted during the 3 years of 2009-2011: adoption rate of 16 per year). In panel c, 273 districts adopted during the seven years of 2012-2018: adoption rate of 39 per year. We conducted Chi-square tests that confirmed the differences in adoption rate among the three periods are statistically significant at 5%.

DISCUSSION AND CONCLUSION

Our study provides evidence on at least four main findings. First, there was significant geographic distribution and disparity of SFP adoption and duration by districts. All districts outside the region of Papua, Maluku, and Nusa Tenggara were up to 6.3 times more likely to adopt SFP (in Sulawesi) and up to 3 years longer in duration (in Java). In addition to be the farthest in distance from the central government, this region is also the least developed in the country. Similarly, evidence from the United States shows that SFP adoption is lowest in the Alaska/Hawaii region (i.e. SPF at playgrounds) and the Appalachians mountains (i.e. SPF at workspaces and restaurants).[6,7]

Second, there was a significant socioeconomic disparity of SFP adoption and duration by districts. Urban districts were 3.9 times more likely to adopt and had on average 5 years longer in duration than rural ones; districts in the richest income quintile were 9.1 times more likely to adopt and had 1.7

years longer in duration than those in the poorest income quintile; districts in the highest education quintile were 2.8 times more likely to adopt, relative to those in the lowest education quintile. Similarly, evidence from the literature shows the odds of having SFP at playgrounds were lower for areas with higher proportions of poor and with no high school diploma; and that of having SFP at worksites were lower among rural employers.[6,8]

Third, the provincial SFP regulation was significantly associated with higher SFP adoption by districts even in a country setting where the decentralization is at the district level. Districts with provincial SFP were 3.2 times more likely to adopt SFP. This aligns with the literature showing that high compliance with the national comprehensive smoke-free law in 41 countries was associated with policy by involving the local jurisdictions in providing training and/or guidance for inspections.[9] Fourth, the national regulations were associated with higher SFP adoption by districts. Particularly, after the Presidential Decree 2012 that provided technical details on SFP, the number of districts adopted SFP per year (adoption rate) was 7.8 times (39/5) and 6.5 times (39/16) higher compared to the period 2004-2008 and 2009-2011.

For policy, the government and key stakeholders should encourage and facilitate cross learning among regions, provinces, and districts especially for non-SFP districts that are in rural areas, poorer, and least educated. The cross learning could be done among districts with SFP and without SFP with similar socioeconomic characteristics. At the provincial level, given the significant positive association, SFP adoption at the provincial level should be further encouraged even in a district-level decentralization setting. For Indonesia, they include 13 provinces namely Aceh, Banten, West Java, Central Java, East Java, West Kalimantan, Central Kalimantan, North Kalimantan, North Maluku, East Nusa Tenggara, Papua, Riau, and Southeast Sulawesi. Moreover, our results also show that both the general guidance in the Health Act and technical details in the Presidential Decree were needed for the policy adoption to be most effective. This could also be a lesson leant for local adoptions of other tobacco control efforts that are currently lacking such as banning outdoor tobacco advertisement and banning product display at point-of-sales.[10,11] All this should serve as an evaluation and evidence for the government to improve the SFP policy and to reach the current targets to decrease smoking prevalence among youth from 7.2% in 2014 to 5.4% in 2019 and to reach a minimum of 50% SFP compliance at schools.[12,13]

Our study has several strengths. First, in addition to the traditional regression results, our study also provided the spatial patterning of SFP adoption over time and space. Second, the availability of both provincial and district regulations allowed us to show evidence on the associations between the two, which is very useful especially in the context of district-level decentralization. Third, having over 500 districts as the unit of analysis provides huge variation in both spatial and quantitative analyses. Our study, however, has at least two limitations. First, our study focused only on policy adoption and lacked evidence on the implementation and compliance to ensure impact.[14,15] Second, while the understanding of the geographic and socioeconomic disparity is important, our study has not included other important indicators such as mayor's political alliance or will, policy advocacy, civil society engagement, and tobacco industry interference. One issue was unavailability of district-level data as the adoption goes all the way from 2004, not just recently. Another issue was that the indicator such as industry interference is at the national level, not at the district level for our subnational analysis.[16] In the Appendix, we used a proxy indicator for interference by using whether a district has tobacco manufacturers, based on data from the Ministry of Industry. Districts with at least 5 tobacco manufacturers had lower SFP adoption and duration but the differences were not statistically significant, which may be due to small sample problem (only 17 districts with at least 5

manufacturers, or 3% of the total of 514 districts).

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Authors' contributions: MW and DK conceived the study. MSH, RAA, and VA conducted data collection and cleaning. MW and DK analyzed the data. DK drafted the manuscript and MW, MSH, RAA, and VA provided inputs. All authors approved the final version of the manuscript.

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Table 1 Characteristics and determinants of smoke-free policy adoption by districts in Indonesia, 2004-2018

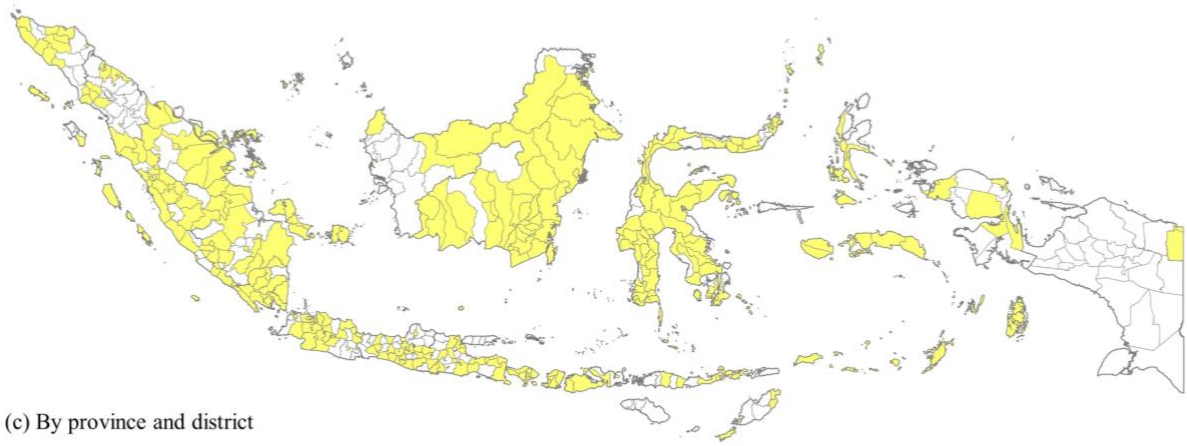
	District total	District adopted n	%	Duration years	Adoption (1=yes) Odds ratio	(SE)	Duration (years) Coef.	(SE)
	[1]	[2]	[3]	[4]	[5]		[6]	
(a) Geographic								
Region								
Papua	95	41	43%	4.3	(reference)			
Java	128	88	69%	7.3	2.90**	(0.82)	3.02**	(0.53)
Sumatera	154	107	69%	5.0	3.00**	(0.81)	0.74	(0.52)
Kalimantan	56	42	75%	5.1	3.95**	(1.47)	0.80	(0.62)
Sulawesi	81	67	83%	5.1	6.30**	(2.27)	0.82	(0.56)
(b) Socioeconomic								
Urban								
Rural	417	261	63%	5.0	(reference)			
Urban	97	84	87%	7.1	3.86**	(1.22)	5.01**	(0.18)
Income/poverty								
Q1 poor	102	44	43%	4.6	(reference)			
Q2	103	72	70%	4.8	3.06**	(0.90)	0.13	(0.56)
Q3	103	64	62%	5.6	2.16**	(0.62)	0.99	(0.57)
Q4	103	75	73%	5.7	3.53**	(1.05)	1.07	(0.56)
Q5 rich	103	90	87%	6.3	9.13**	(3.27)	1.71**	(0.54)
Education								
Q1 least	103	51	50%	5.1	(reference)			
Q2	103	73	71%	5.3	2.48**	(0.73)	0.20	(0.55)
Q3	103	71	69%	5.7	2.26**	(0.66)	0.67	(0.55)
Q4	103	75	73%	5.7	2.73**	(0.81)	0.69	(0.54)
Q5 most	102	75	74%	5.7	2.83**	(0.85)	0.62	(0.54)
(c) Policy								
Province SFP								
No	254	139	55%	5.7	(reference)			
Yes	260	206	79%	5.4	3.16**	(0.63)	-0.31	(0.33)
N [mean]	514	345	67%	[5.5]	514		345	

Note: SE=Standard error; Q=Quintile; Coef=Coefficient. Income quintile used district-level poverty rate (e.g. Q1=20% of districts with highest poverty rate). For duration, coefficients for constants are 4.27 years for region, 2.11 for urban, 4.64 for income, 5.06 for education, and 5.71 for policy. For policy, results that controlled for covariates (panels a-b) were similar including odds ratio=2.57** (SE=0.56) and coef=-0.11 (SE=0.33).

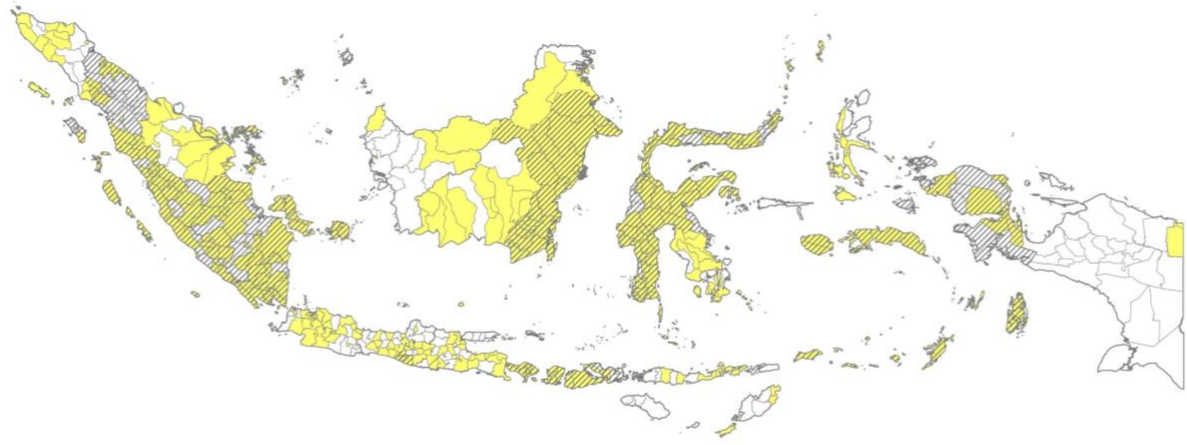
Figure 1. Distribution of smoke free policy by province and district in Indonesia, 2004-2018

(a) By province

(b) By district



(c) By province and district

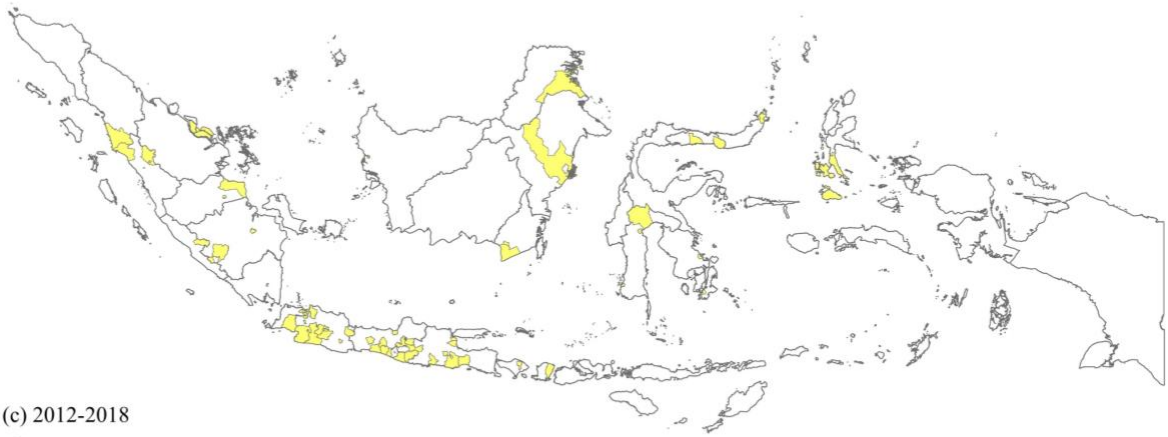


Note: During 2004-2018, 21 of 34 provinces have some form of smoke free policy (SFP) regulation (panel a), 345 of 514 districts do (panel b), and 260 districts have both provincial and district regulation (panel c). SUMUT=North Sumatera, SUMBAR=West Sumatera, SUMSEL=South Sumatera, KEPRI=Riau Islands, BABEL=Bangka Belitung, JABAR=West Java, JATENG=Central Java, JATIM=East Java, NTB=West Nusa Tenggara, NTT=East Nusa Tenggara, KALBAR=West Kalimantan, KALTENG=Central Kalimantan, KALUT=North Kalimantan, KALTIM=East Kalimantan, KALSEL=South Kalimantan, SULUT=North Kalimantan, SULBAR=West Sulawesi, SULSEL=South Sulawesi, SULTRA=Southeast Sulawesi, MALUT=North Maluku, PAPBAR=West Papua

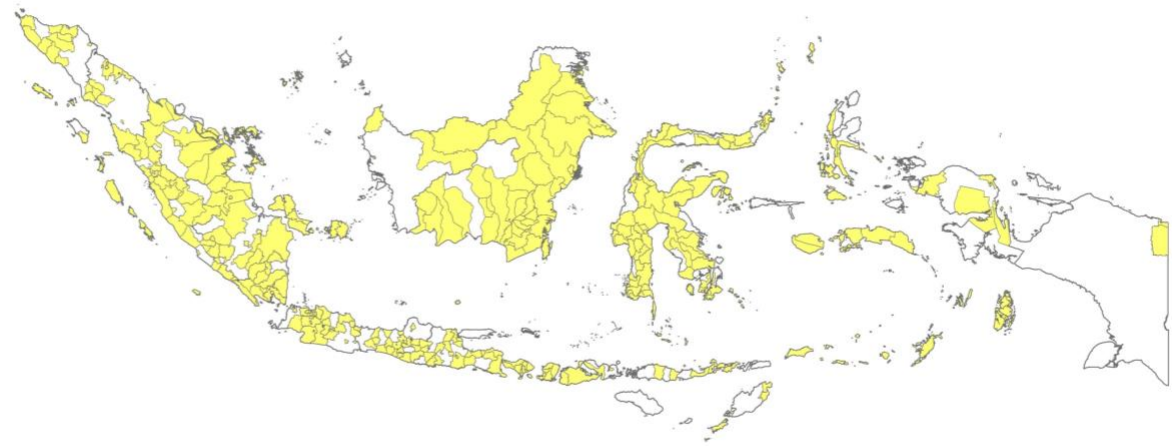
Figure 2. Rate of smoke free policy adoption overtime in Indonesia, 2004-2018

(a) 2004-2008

(b) 2009-2011



(c) 2012-2018



Note: In panel a, 25 districts adopted SFP during 2004-2008 (5 years); rate = 5 per year. In panel b, 47 districts adopted SFP during 2009-2011 (3 years); rate = 16 per year. In panel c, 273 districts adopted SFP during 2012-2018 (7 years); rate = 39 per year. In 2009, there was Health Act 36 on Health including one article on SFP but without further details on definition and scope. In 2012, there was President Regulation 109 on Tobacco including details on SFP – this was the mandate for the Ministry of Health to encourage local governments in adopting SFP regulation.