Abstract

A panel study for smokers and its in-depth analysis

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Smoking adversely affects overall health, and is one of the leading causes of adult cancers, such as lung, esophageal, and oral cancer, and of cataracts and diseases such as cardiovascular, respiratory, and infectious diseases. Accordingly, to understand the smoking behavior of adult smokers in Korea and to identify the determinants that affect smoking cessation and re-smoking, an 'Adult Smokers Panel Survey' was conducted from 2015 to 2020 using the 'National Health and Nutrition Survey' of 1,018 adults in Korea. In addition, the characteristics of each factor, such as the change in smoking amount, smoking urge and the frequency of exposure to smoking cessation advertisements of participants, were analyzed during the follow-up surveys conducted over three years (2018-2020) and conducted for two years during the COVID-19 pandemic (2019, 2020). Through these in-depth surveys, the need to prepare a plan to relieve the stress of smokers to improve the induction of smoking cessation and to support a cessation plan for smokers who have not quit smoking was recommended. In particular, the percentage of 'No Attempt to Quit Smoking' increased from 39.4% to 44.3% during two years of the COVID-19 pandemic (2018-2020). In the future, the need for additional research with a panel of a sufficient number of female smokers and the application of customized medical research through the analysis of individual smoking factors based on biological samples of smokers was presented.

Keywords: Smoking, Smoker Panel, Smoking Behavior, Smoking Questionnaire, COVID-19

Table 1. The number of participants in the base survey and follow-up survey by year

Unit: number of participants

Year of participation in the base survey	Number of participants											
	2015 (1st)		2016 (2nd)		2017 (3rd)		2018 (4th)		2019 (5th)		2020 (6th)	
	New panel (n=164)	Follow-up (n=94)	New panel (n=249)	Follow-up (n=245)	New panel (n=309)	Follow-up (n=283)	New panel (n=258)	Follow-up (n=477)	New panel (n=38)	Follow-up (n=346)	New panel (n=0)	Follow-up (n=427)
2015	164	94	–	100	–	73	–	58	–	47	–	57
2016			249	145	–	102	–	112	–	93	–	99
2017					309	108	–	160	–	101	–	136
2018							258	147	–	94	–	116
2019									38	11	–	19
Participation rate*	57.3%		59.3%		39.2%		48.7%		34.0%		41.9%	

*A follow-up survey participation rate = (the number of follow-up survey participants in the year / the number of cumulated base survey participants) * 100
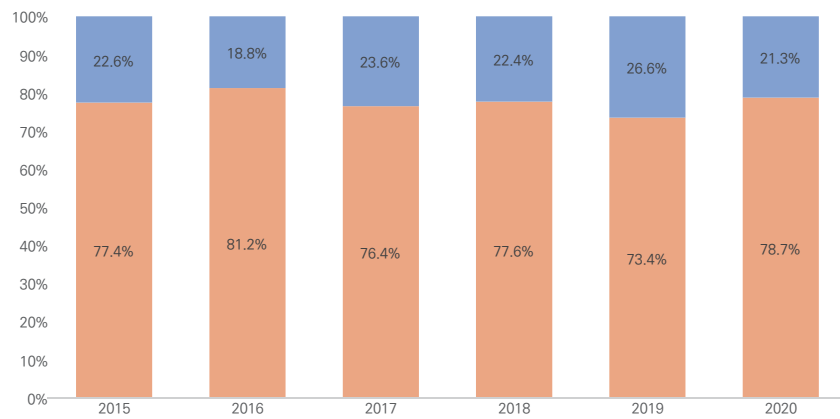
Figure 1. Distribution of smokers and non−smokers as reported in the adult smoker panel
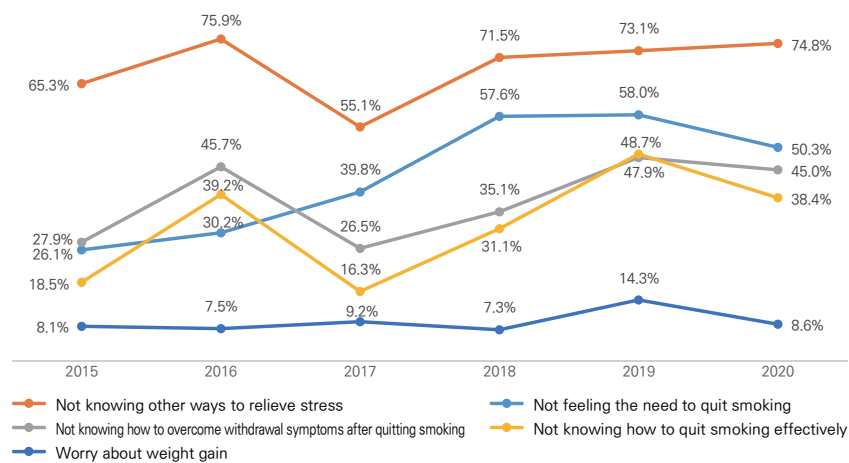

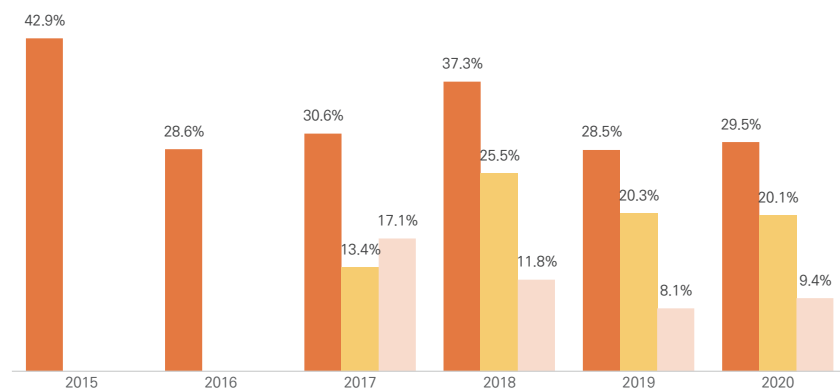**Figure 2.** Reasons for not attempting to quit smoking as reported in the adult smoker panel

Figure 3. E−cigarette use rates as reported the adult smoker panel
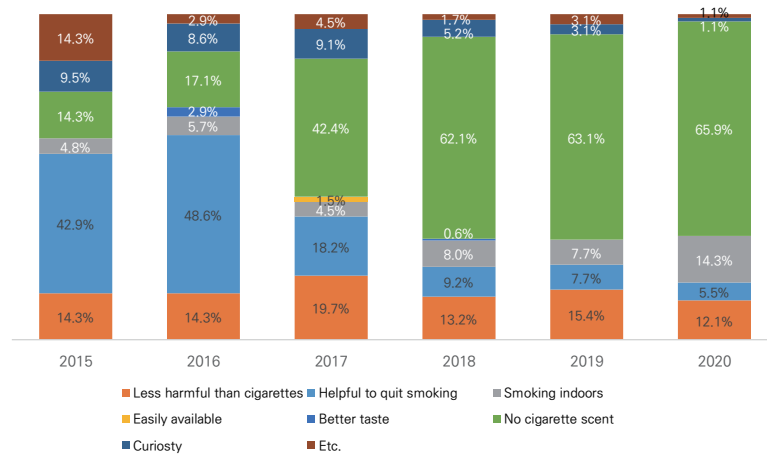
Figure 4. Reasons for using e−cigarettes by e−cigarette users as reported in the adult smoker panel
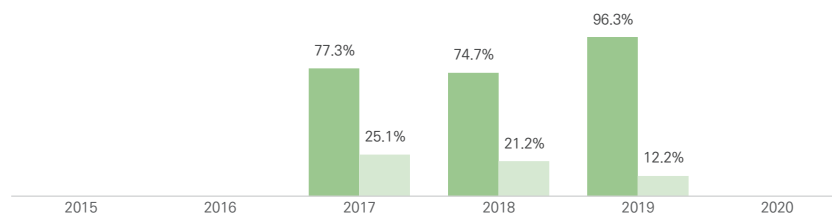

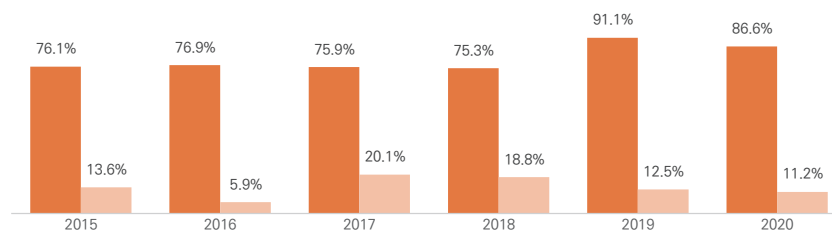**Figure 5.** Warning picture recognition and the effect as reported in the adult smoker panel

Figure 6. Warning statements recognition and the effect as reported in the adult smoker panel
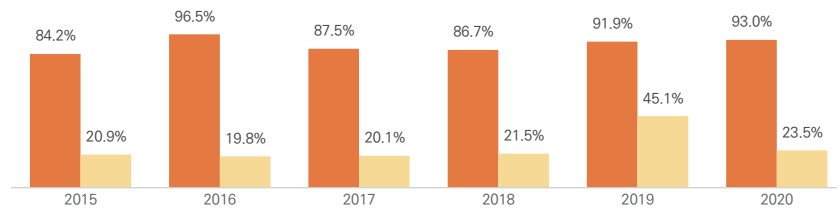
Figure 7. Tobacco display and smoking desire as reported in the adult smoker panel

Table 2. Demographic characteristics of 4th (2018), 5th (2019), and 6th (2020) follow−up participants as reported in the adult smoker panel

Unit: number of participants (%)

Type	Frequency (percentage)
Total	203 (100.0)
Age	
19−29	27 (13.3)
30−39	55 (27.1)
40−49	64 (31.6)
50−59	27 (13.3)
60−69	21 (10.3)
70 or older	9 (4.4)
Current smoking status	
Smoking	155 (76.4)
Non−smoking	48 (23.6)
Type of attempt to quit smoking	
Group 1: no attempt to quit smoking	92 (45.3)
Group 2: failure to quit smoking at the time of investigation after multiple attempts	63 (31.0)
Group 3: maintain smoking cessation at the time of investigation after multiple attempts	17 (8.4)
Group 4: attempt to quit smoking successful	31 (15.3)
Type of behavior change in smoking	
No change in smoking	68 (33.5)
Attempt to smoke	89 (43.9)
Attempt to quit smoking	24 (11.8)
No change in non−smoking	22 (10.8)
Type of cigarette product use (among smokers)	
Tobacco only	105 (52.9)
(Liquid−type) e−cigarette only	4 (2.0)
Heated tobacco only	23 (11.6)
Both tobacco and e−cigarette	11 (5.5)
Both tobacco and heated tobacco	8 (4.0)
Both e−cigarette and heated tobacco	1 (0.5)
All type of cigarettes	3 (1.5)
Type of survey	
Online survey	156 (76.8)
Telephone survey	47 (23.2)

Table 3. Comparison of characteristics by change in attempts to quit smoking and maintenance

Type	No change in smoking N (%)	Attempt to smoke N (%)	%diff*	95% CI	Attempt to quit smoking N (%)	% diff*	95% CI	No change in non-smoking N (%)	% diff*	95% CI
Age										
19–39	29 (42.7)	37 (41.6)	1.1	−15.0, 16.7	10 (41.7)	1.0	−22.0, 23.9	6 (27.3)	15.4	−6.6, 37.4
40–64	33 (48.5)	43 (48.3)	0.2	−16.0, 16.0	14 (58.3)	−9.8	−33.0, 13.2	11 (50.0)	−1.5	−26.0, 22.6
65 or older	6 (8.8)	9 (10.1)	−1.3	−11.0, 7.9	0 (0.0)	8.8	2.1, 15.6	5 (22.7)	−14.0	−33.0, 4.9
Type of cigarette product use (current, past)										
Tobacco	47 (70.1)	59 (71.1)	−0.9	−16.0, 13.7	20 (90.8)	−21.0	−37.0, −4.5	17 (81.0)	−11.0	−31.0, 9.3
Current: e-cigarette only, past: both tobacco and e-cigarette	7 (10.5)	7 (8.4)	2.0	−7.4, 11.5	1 (4.6)	5.9	−5.5, 17.3	1 (4.8)	5.7	−6.0, 17.4
Current: heated tobacco only, past: Both tobacco and heated tobacco	13 (19.4)	17 (20.5)	−1.1	−14.0, 11.8	1 (4.6)	14.9	2.0, 27.7	3 (14.2)	5.1	−13.0, 22.8
Change in smoking amount and urges due to COVID-19	54 (79.4)	66 (75.9)			18 (75.0)			21 (95.4)		
Yes	14 (20.6)	21 (24.1)	−3.6	−16.7, 9.6	6 (25.0)	−4.4	−24.0, 15.4	1 (4.6)	16.0	3.1, 29.0
Experience of cigarette display exposure	2 (3.0)	6 (6.9)			2 (8.3)			3 (13.6)		
Yes	65 (97.0)	81 (93.1)	3.9	−2.8, 10.6	22 (91.7)	5.4	−6.4, 17.1	19 (86.4)	10.7	−4.3, 25.6
Frequency of exposure to smoking cessation advertisements										
Everyday, more than once a week	34 (50.7)	47 (54.0)			12 (52.2)			6 (27.3)		
More than once a month, less than once a month	33 (49.3)	40 (46.0)	3.3	−12.6, 19.2	11 (47.8)	1.4	−22.0, 25.1	16 (72.7)	−24.0	−46.0, −1.4
Confidence to quit smoking for the next 6 months	45 (80.4)	45 (64.3)			10 (41.7)			1 (4.5)		
Yes	11 (19.6)	25 (35.7)	−16.1	−31.4, −0.8	14 (58.3)	−39.0	−61.0, −16.0	21 (95.5)	−76.0	−89.0, −62.0
Daily life stress	35 (52.2)	34 (38.2)			13 (54.2)			16 (72.7)		
Yes	32 (47.8)	55 (61.8)	−14.0	−29.7, 1.6	11 (45.8)	1.9	−21.0, 25.2	6 (27.3)	20.5	−1.6, 42.6
PTEDS-Average										
Less than 1.6 (no abnormality/normal)	35 (51.5)	44 (49.4)	2.0	−14.0, 17.8	12 (50.0)	1.5	−22.0, 24.7	14 (63.6)	−12.0	−36.0, 11.2
1.6 point – less than 2.5 point (lasting resentment)	21 (30.8)	37 (41.6)	−11.0	−26.0, 4.3	8 (33.3)	−2.5	−24.0, 19.4	7 (31.8)	−0.9	−23.0, 21.4
Over 2.5 point (extremely/very Resentment)	12 (17.7)	8 (9.0)	8.7	−2.2, 19.5	4 (16.7)	1.0	−17.0, 18.4	1 (4.6)	13.1	0.5, 25.7
Experience of feeling sad for more than two weeks	50 (74.6)	73 (82.0)			18 (75.0)			20 (90.9)		
Yes	17 (25.4)	16 (18.0)	7.4	−5.7, 20.5	6 (25.0)	0.4	−20.0, 20.6	2 (9.1)	16.3	0.4, 32.2
Health level compared to peers of the same age										
Good	16 (23.9)	16 (18.0)	5.9	−7.1, 18.9	5 (20.8)	3.1	−16.0, 22.2	8 (36.4)	−13.0	−35.0, 10.1
Normal	39 (58.2)	62 (69.6)	−12.0	−27.0, 3.7	15 (62.5)	−4.3	−27.0, 18.4	9 (40.9)	17.3	−6.4, 41.0
Bad	12 (17.9)	11 (12.4)	5.6	−5.9, 17.0	4 (16.7)	1.2	−16.0, 18.8	5 (22.7)	−4.8	−25.0, 15.0

*% difference means the difference from the group of 'No change in smoking'.

Table 4. Multi-category logistic regression analysis by change of attempted smoking cessation and maintenance pattern

Type	Attempt to smoke N (%)	Unadjusted OR	Unadjusted 95% CI	Adjusted OR	Adjusted 95% CI	Attempt to quit smoking N (%)	Unadjusted OR	Unadjusted 95% CI	Adjusted OR	Adjusted 95% CI	No change in non-smoking N (%)	Unadjusted OR	Unadjusted 95% CI	Adjusted OR	Adjusted 95% CI
Age (ref=19–39)	37 (41.6)					10 (41.7)					6 (27.3)				
40–64	43 (48.3)	1.0	0.5 2.0	1.2	0.6 2.5	14 (58.3)	1.2	0.5 3.2	1.5	0.5 4.5	11 (50.0)	1.6	0.5 4.9	2.6	0.7 9.6
65 or older	9 (10.1)	1.2	0.4 3.7	1.8	0.5 6.6	0 (0.0)	–*		–*		5 (22.7)	4.0	0.9 17.6	3.0	0.6 16.4
Cigarette product use (current, past used cigarette) (ref=tobacco)	59 (71.1)					20 (90.8)					17 (81.0)				
Current: e-cigarette only, past: both tobacco and e-cigarette	7 (8.4)	0.8	0.3 2.4	0.9	0.3 3.1	1 (4.6)	0.3	0.0 2.9	0.3	0.0 3.0	1 (4.8)	0.4	0.0 3.5	0.6	0.1 6.5
Current: heated tobacco only, past: Both tobacco and heated tobacco	17 (20.5)	1.0	0.5 2.4	1.2	0.5 2.9	1 (4.6)	0.2	0.0 1.5	0.2	0.0 1.5	3 (14.2)	0.6	0.2 2.5	0.7	0.2 3.2
Change in smoking amount and urges due to COVID-19	66 (75.9)					18 (75.0)					21 (95.4)				
Yes	21 (24.1)	1.2	0.6 2.6	1.2	0.5 2.7	6 (25.0)	1.3	0.4 3.8	1.0	0.3 3.5	1 (4.6)	0.2	0.0 1.5	0.2	0.0 2.1
Experience of cigarette display exposure	6 (6.9)					2 (8.3)					3 (13.6)				
Yes	81 (93.1)	0.4	0.1 2.1	0.3	0.1 1.9	22 (91.7)	0.3	0.0 2.5	0.3	0.0 2.4	19 (86.4)	0.2	0.0 1.3	0.2	0.0 1.2
Frequency of exposure to smoking cessation advertisements (ref=everyday, more than once a week)	47 (54.0)					12 (52.2)					6 (27.3)				
More than once a month, less than once a month	40 (46.0)	0.9	0.5 1.7	0.8	0.4 1.5	11 (47.8)	0.9	0.4 2.4	0.8	0.3 2.1	16 (72.7)	2.7	1.0 7.9	3.2	1.0 10.1
Daily life stress	34 (38.2)					13 (54.2)					16 (72.7)				
Yes	55 (61.8)	1.8	0.9 3.4	2.0	1.0 4.2	11 (45.8)	0.9	0.4 2.4	1.0	0.4 2.9	6 (27.3)	0.4	0.1 1.2	0.6	0.2 2.1
Health level compared to peers of the same age (ref=good)	16 (18.0)					5 (20.8)					8 (36.4)				
Normal	62 (69.6)	1.6	0.7 3.5	1.5	0.6 3.6	15 (62.5)	1.2	0.4 4.0	1.3	0.3 4.7	9 (40.9)	0.5	0.2 1.4	0.5	0.1 1.8
Bad	11 (12.4)	0.9	0.3 2.7	0.7	0.2 2.2	4 (16.7)	1.1	0.2 4.8	1.4	0.3 7.7	5 (22.7)	0.8	0.2 3.2	0.9	0.2 4.4

*It is difficult to interpret because the upper bound of the estimated confidence interval is infinite.

Table 5. Demographic characteristics of 5th (2019), and 6th (2020) follow-up participants as reported in the adult smoker panel

Unit: number of participants (%)

Type	Frequency (percentage)
Total	246 (100)
Age	
19–29	32 (13.0)
30–39	62 (25.2)
40–49	83 (33.7)
50–59	33 (13.4)
60–69	27 (11.0)
70 or older	9 (3.7)
Current smoking status	
Smoking	185 (75.2)
Non-smoking	61 (24.8)
Type of attempt to quit smoking	
Group 1: no attempt to quit smoking	109 (44.3)
Group 2: failure to quit smoking at the time of investigation after multiple attempts	76 (30.9)
Group 3: keep smoking cessation at the time of investigation after multiple attempts	23 (9.3)
Group 4: quit smoking success at once	38 (15.5)
Type of cigarette product use (among smokers)	
Tobacco only	125 (51.9)
(Liquid-type) e-cigarette only	5 (2.1)
Heated tobacco only	30 (12.5)
Both tobacco and e-cigarette	12 (5.0)
Both tobacco and heated tobacco	9 (3.7)
Both e-cigarette and heated tobacco	1 (0.4)
All types of cigarettes	3 (1.2)
Type of survey	
Online survey	182 (74.0)
Telephone survey	64 (26.0)

Table 6. Comparison of smoking behavior among 5th (2019) and, 6th (2020) follow−up participants as reported in the adult smoker panel (1)

Type	5th follow−up N (%)	6th follow−up N (%)	% difference	95% CI	
Total		246 (100.0)			
Current smoking status					
Smoking	184 (74.8)	185 (75.2)	−0.4	−8.1	7.3
Non−smoking	62 (25.2)	61 (24.8)			
Type of behavioral steps to quit smoking					
Step before consideration	63 (25.8)	48 (22.2)	3.6	−4.2	11.4
Step on consideration	69 (28.3)	69 (31.9)	−3.7	−12.1	4.7
Step on preparation	50 (20.5)	38 (17.6)	2.9	−4.3	10.1
Step on practice and maintenance	62 (25.4)	61 (28.3)	−2.8	−11.0	5.3
Type of attempt to quit smoking					
Group 1: no attempt to quit smoking	87 (35.4)	109 (44.3)	−8.9	−17.6	−0.3
Group 2: failure to quit smoking at the time of investigation after multiple attempts	97 (39.4)	76 (30.9)	8.5	0.1	16.9
Group 3: keep smoking cessation at the time of investigation after multiple attempts	21 (8.5)	23 (9.3)	−0.8	−5.9	4.2
Group 4: attempt to quit smoking successful	41 (16.7)	38 (15.5)	1.2	−5.3	7.7
Type of cigarette product use (among smokers)					
Tobacco	126 (70.4)	125 (69.0)	1.3	−8.2	10.8
E−cigarette only, Both tobacco and e−cigarette	14 (7.8)	17 (9.4)	−1.6	−7.4	4.2
Heated tobacco only, Both e−cigarette and heated tobacco	39 (21.8)	39 (21.6)	0.2	−8.3	8.8
No smoking for more than one day (24 hours)					
Yes	97 (52.7)	76 (48.7)	4.0	−6.7	14.7
No smoking for the last 6 months or more					
Yes	5 (5.2)	28 (36.8)	−31.7	−43.4	−20.0
Daily life stress					
Yes	115 (59.6)	107 (58.2)	6.1	−3.9	16.1
PTEDS−Average					
Less than 1.6 (no abnormality/normal)	127 (51.6)	87 (47.0)	4.6	−4.9	14.1
1.6 point−less than 2.5 point (lasting resentment)	92 (37.4)	74 (40.0)	−2.6	−11.9	6.7
Over 2.5 point (extremely/very Resentment)	27 (11.0)	24 (13.0)	−2.0	−8.2	4.2
Experience of feeling sad for more than two weeks					
Yes	39 (15.9)	40 (21.7)	−5.9	−13.4	1.6
Health level compared to peers of the same age					
Good	53 (21.5)	38 (20.7)	0.9	−6.9	8.7
Normal	151 (61.4)	116 (63.0)	−1.7	−10.9	7.6
Bad	42 (17.1)	30 (16.3)	0.8	−6.3	7.9

Table 7. Comparison of smoking behavior among 5th (2019), and 6th (2020) follow−up participants as reported in the adult smoker panel (2)

Type	5th follow−up Average (Standard deviation)	6th follow−up Average (Standard deviation)	t	p−value
Average daily cigarette smoking amount (units)	13.6 (6.8)	13.7 (6.1)	−0.20	0.842
Average number of days used for one bottle of liquid e−cigarette used (days)	11.9 (10.2)	3.4 (2.4)	3.27	0.005
Average daily heated cigarette smoking amount (units)	12.2 (10.2)	14.9 (6.3)	−1.19	0.238