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Behavioural precautions to avoid transmission of the COVID-19 virus – low educated groups are not always lagging behind

Leif Edvard Aarø[1], Tony Leino[1], Øystein Vedaa[1], Marit Knapstad[1], Jens Christoffer Skogen[1,2,3], Thomas Nilsen[4], Mats Svalebjørg[1], Knut-Inge Klepp[5]

[1]Department of Health Promotion, Norwegian Institute of Public Health, Bergen, Norway
[2]Department of Public Health, University of Stavanger, Norway
[3]Alcohol & Drug Research Western Norway, Stavanger University Hospital, Norway
[4]Department of Mental Health and Suicide, Norwegian Institute of Public Health, Oslo, Norway
[5]Division of Mental and Physical Health, Norwegian Institute of Public Health, Oslo, Norway

ABSTRACT

Introduction: According to the 'diffusion of innovations' model, innovations do not spread randomly in a population, but follow specific patterns. Changes in health behaviours tend to start among high status groups. The purpose of the present study is to describe dimensions of coronavirus-related behaviour and their relationship with level of education at a relatively early stage of the COVID-19 pandemic.

Material and methods: Data collections (internet-based) took place among adults (18+) in two Norwegian counties, Oslo and Vestland, in November and December 2020 (N = 15,071). The response rates were 39.8% (Oslo) and 37.3% (Vestland). Data were analysed with principal components analysis, construction of unweighted meanscores, and generalized linear models.

Results: Five behavioural dimensions (two single items out of 23 not included) were identified: Hygiene, Hygiene when hands are dirty, Avoiding meeting others, Keeping distance from others, and Wearing a protective face mask. Analyses with meanscores as outcome variables revealed that only one of the five dimensions, in addition to the single item Stay at home if ill (men only), was positively related to level of education, namely Wearing a protective face mask. There was no significant difference between educational groups with regard to Hygiene when hands are dirty and Keeping distance from others. On Hygiene, Avoiding meeting others (men only), and Avoided public transport (single item) scores were inversely related to level of education.

Conclusions: Behavioural precautions to avoid transmission of COVID-19 do not follow the general tendency for positive health behaviours to be most rapidly adopted by well-educated groups. On four of five behavioural components, this association is either close to zero or reversed. In addition to high levels of trust in authorities in Norway, there are characteristics of the COVID-19 health education campaign which might explain why: Continuous and intense mass media coverage, use of multiple communication channels, strength of appeals, and high communicator credibility.

KEY WORDS: COVID-19, behaviour, level of education, hygiene, social distancing, use of face masks, precautions.

ADDRESS FOR CORRESPONDENCE: Leif Edvard Aarø, Senior Researcher, Norwegian Institute of Public Health, Department of Health Promotion, Zander Kaaes gt. 7, 5015 Bergen, Norway, e-mail: leea@fhi.no

INTRODUCTION

When COVID-19 started spreading in Norway in early 2020, the government, with strong support from the Directorate of Health and the Norwegian Institute of Public Health, launched the most comprehensive health education effort ever seen in Norway. Information about spread of the virus and precautions that needed to be taken were communicated continuously, in all possible media channels and with heavy appeal over several months. There were no obvious and visible disagreements among the central level communicators. From a health education research perspective it is interesting to examine the compliance with the recommendations advocated and its relationship with demographic factors. Knowledge about differences in compliance across population segments and insights into processes determining compliance are important for our ability to cope with future pandemics and health crises.

A series of data collections on COVID-19-related behaviour were carried out by the Norwegian Institute of Public Health. The present paper is based on a data collection which took place in two Norwegian counties in November and December 2020. The purpose is to examine the association between level of education and behavioural precautions to avoid transmission of the COVID-19 virus among the adult population.

Studies have generally confirmed that there is a strong and mostly consistent association between level of education and health-related behaviour. A series of reports from large-scale data collections in Norwegian counties have demonstrated that this is indeed the case. Higher levels of education are associated with healthier eating, more physical activity, and less smoking. There are two main exceptions. Sedentary behaviour (number of inactive hours per day) is more widespread among the well-educated, and so are moderate levels of alcohol intake [1].

Associations between indicators of socioeconomic status, such as level of education, and health-related behaviour are generally in line with a well-established model for how innovations spread in populations [2]. Higher status and well-educated groups tend to change first and take the roles of "pioneers", "innovators", and "early majority". High education has not always been associated with healthy behaviour. Cigarette smoking, probably more researched from a diffusion of innovations perspective than any other health-related behaviour, started in highly educated population segments. But, when smoking education and control programmes emerged, well-educated groups were the first ones to quit [3].

There are a few studies which have reported on the relationship between level of education and COVID-19-related behaviour. In a study from Pakistan, Balkhi and associates found no significant differences between educational groups on a number of social distancing and hygiene outcomes. There was only one exception. Avoiding or reducing use of healthcare facilities was significantly and slightly more common among those with the highest educational level (graduates) [4]. In a study from Latvia, Šuriņa and associates did not find a significant association between level of education and a sum score based on items covering social distancing and hygiene [5]. In a German sample, Hoenig and Wenz found significant differences between groups defined by level of education in the expected direction for four out of six COVID-19-related behaviours (avoided crowded places, kept distance from others, reduced social contacts, washed hands), but differences were small [6]. In a study carried out among young adults in Switzerland, non-compliance with hygienic recommendations was found to be highest among those with the highest level of education [7]. Given the modest evidence base and potential public health relevance, further studies are needed.

The purpose of the present study is to describe dimensions of COVID-19-related behaviour and the relationship of these behaviours with level of education at a relatively early stage of the COVID-19 pandemic (November-December 2020). Associations between the dimensions of coronavirus-related behaviour and gender and age will also be described.

MATERIAL AND METHODS

SAMPLE AND DATA COLLECTION

Data were collected between the 18th of November and the 4th of December 2020 in two Norwegian counties, Oslo and Vestland. The data collection occurred at the beginning of the second infection wave in Norway. In response to the wave, the government had recently (5th of October) reintroduced stricter nation-wide infection control measures, after a period of a relatively low level of restrictions. The Norwegian Institute of Public Health was responsible for the data collection, conducted in agreement with and funded by the county authorities. Representative samples were drawn from the population registry. The Common Contact Register was used to obtain electronic contact information (e-mail/SMS) and exclude those who had not allowed their contact information to be used in for instance surveys. Individuals with no electronic contact information available were also excluded. After two reminders the response rates were 39.8% in Oslo and 37.3% in Vestland (N = 15,071).

Data collections were carried out among adults (18 years +) only and based on informed consent from study participants. Ethical approval was provided by the Regional Committee for Medical and Health Research Ethics, Northern Norway (Project 458542).

INSTRUMENTS

In this paper, 23 items on COVID-19-related precaution behaviour were used.

During the last two weeks I have washed my hands or used hand disinfection fluids…

1. …before preparing or eating food;
2. …after visiting the toilet (including changing diapers);
3. …when my hands are visibly dirty;
4. …after contact with body fluids (for instance after blowing my nose);
5. …after contact with animals;
6. …when I arrive in the workplace/kindergarten/school;
7. …after having touched surfaces in crowded places including the workplace/kindergarten/school;
8. …before putting on or after removing a face mask;
9. I have been coughing or sneezing in a paper handkerchief or elbow hook;
10. I have as much as possible avoided touching my face when among other people;
11. I have kept at least one meter distance to other people (other than those close to me);
12. I have avoided handshaking or hugging other people (other than those close to me);
13. I have avoided crowded places during leisure time;
14. I have avoided going to the supermarket;
15. I have been to the supermarket only at times when there are few other customers there;
16. I have avoided public transport;
17. I have avoided meeting friends during leisure time;
18. I have avoided visiting others or having other people visiting me;
19. I have avoided meeting family members that I don't live with;
20. I stay at home when I feel ill (including with low levels of symptoms).

I have used a face mask when I…

21. …have not been able to keep at least one meter distance from others, such as when travelling by collective transport;
22. …have been indoors in public places (stores, malls) where it has been impossible to keep others at least at one meter distance;
23. I have tried to keep at least one meter distance to other people, even when I have used a face mask.

Response options were "Yes, always", "Mostly", "Sometimes", "Almost never", and "No". In analyses of dimensionality and for the purpose of producing meanscores, the categories were coded from 0 (zero) for "No" to 5 for Yes, always". For the purpose of presenting distributions, three response categories, "Seldom", "Almost never", and "No" were collapsed into one category.

A simple question on gender only presented two response alternatives, "man" and "woman". An age variable was grouped into the following categories: 18-29, 30-39, 40-49, 50-59, 60-69, and 70+. A question on the highest completed education presented four response alternatives: (i) Primary school, Secondary school, Folk high school, (ii) Vocational education, High school, at least 3 years (iii) College or university less than 4 years, (iv) College or university, 4 years or more.

DATA ANALYSES

Statistical data analysis was done with percentage distributions, principal components analysis (pairwise deletion of cases and oblique rotation) and general linear modelling (GLM) in SPSS version 27.

RESULTS

The proportion of women in the sample was 56.2%. The mean age was 46.7 and standard deviation 15.4 years. Percentage distributions of COVID-19-related behaviour are shown in Table 1. The proportion who "Always" take a specific precaution varies widely, from 93.3% to 1.5%.

Component loadings from the principal components analysis of the whole set of behavioural variables are shown in Table 2. For the most part, only loadings as high as 0.40 or larger are shown. When a variable had no loadings as high as 0.40, the largest loading is shown. It seems reasonable, and consistent with the eigenvalue criterion, to distinguish between five components: (i) Hygiene, (ii) Hygiene when hands are dirty, (iii) Avoiding meeting people, (iv) Keeping distance and avoiding crowded places, and (v) Wearing a face mask. One variable did not load sufficiently high on any of the factors: "I stay home when I feel ill (including with low levels of symptoms)". Another single variable contributed to reducing the alpha value considerably when included in the "Keeping distance" scale namely: "I have avoided public transport". Meanscores (sum scores divided by number of items) were constructed for each component. The two items that were not included in any of the meanscores were analysed as single items. Descriptives for the meanscores are shown in Table 3.

An overview of scales with Cronbach α values is shown in Table 3. For three of the scales, Hygiene, Avoiding others, and Wearing face masks, α values were adequate (0.76, 0.74, 0.72, respectively). For two scales, Hygiene when hands are dirty and Wearing a face mask, α values were below recommended levels (0.58 and 0.56, respectively).

The five meanscores as well as the two single items were analysed against gender with adjustments for age group. Women scored significantly higher than men on Hygiene (Cohen's d = 0.44), Hygiene when hands are dirty (d = 0.32), Staying home when ill (including with low levels of symptoms) (d = 0.25), Wearing a face mask (d = 0.23), Avoiding contact with others (d = 0.17), and Keeping distance from others (d = 0.16). There was no gender difference at all for Avoiding public transport (d = 0.00).

There were a few significant interaction effects between gender and age group when analysed against

TABLE 1. COVID-19-related behaviour – one-way percentage distributions of single items

	Yes, always	Mostly	Seldom*	Total	
	% (95% CI)	% (95% CI)	% (95% CI)	%	*n*
I have washed my hands or used antibac after visiting the toilet (including change of diapers)	93.9 (93.5-94.3)	5.1 (4.8-5.5)	1.0 (0.9-1.2)	100.0	14,932
I have washed my hands or used antibac when my hands are visibly dirty	93.0 (92.6-93.4)	6.0 (5.6-6.4)	1.0 (0.8-1.1)	100.0	14,920
I have avoided handshaking or hugging other people (other than those close to me)	82.3 (81.7-82.9)	15.4 (14.8-15.9)	2.3 (2.1-2.6)	100.0	14,991
I have washed my hands or used antibac when I arrive in the workplace/kindergarten/school	78.1 (77.4-78.8)	16.9 (16.2-17.5)	5.0 (4.7-5.4)	100.0	11,928
I stay at home when I feel ill (including with low levels of symptoms)	71.4 (70.6-72.1)	23.4 (22.7-24.1)	5.2 (4.9-5.6)	100.0	13,785
I have used a face mask when I have not been able to keep at least one meter distance from others, such as when travelling by collective transport	71.1 (70.4-71.9)	22.2 (21.5-22.9)	6.7 (6.3-7.1)	100.0	13,106
I have washed my hands or used antibac before I prepare or eat food	67.6 (66.9-68.4)	27.5 (26.8-28.2)	4.9 (4.6-5.3)	100,0	15,007
I have used a face mask after having touched surfaces in crowded places including workplaces/kindergarten/school	65.2 (64.4-65.9)	27.9 (27.2-28.6)	6.9 (6.5-7.3)	100.0	14,614
I have used a face mask when I have been indoors in public places (stores, malls) where it has been impossible to keep others at least at one meter distance	59.9 (59.1-60.7)	22.0 (21.3-22.7)	18.1 (17.5-18.7)	100.0	14,185
I have tried to keep at least one meter distance to other people, even when I have used a face mask	51.8 (50.9-52.6)	43.3 (42.4-44.1)	5.0 (4.6-5.3)	100,0	13,930
I have been coughing or sneezing in a paper handkerchief or elbow hook	51.8 (51.0-52.6)	37.4 (36.6-38.2)	10.8 (10.3-11.3)	100.0	14,452
I have during leisure time avoided crowded places	48.5 (47.7-49.3)	45.3 (44.5-46.1)	6.2 (5.8-6.6)	100.0	14,940
I have washed my hands or used antibac after contact with body fluids (for instance after blowing my nose)	46.3 (45.5-47.1)	36.8 (36.0-37.6)	16.9 (16.3-17.5)	100.0	14,966
I have avoided public transport	37.1 (36.3-37.9)	37.7 (36.9-38.5)	25.2 (24.4-25.9)	100.0	13,863
I have washed my hands or used antibac after contact with animals	34.5 (33.6-35.3)	28.1 (27.3-28.9)	37.5 (36.6-38.3)	100.0	11,820
I have kept at least one meter distance to other people (other than those close to me)	32.4 (31.6-33.1)	63.0 (62.2-63.7)	4.7 (4.3-5.0)	100.0	15,024
I have washed my hands or used antibac before I put on or after removing a face mask	26.3 (25.5-27.0)	34.2 (33.4-35.0)	39.6 (38.8-40.4)	100.0	13,986
I have as much as possible avoided touching my face when among other people	17.2 (16.6-17.8)	58.6 (57.9-59.4)	24.1 (23.4-24.8)	100.0	14,969
I have avoided visiting others or having other people visiting me	12.9 (12.4-13.5)	56.1 (55.3-56.9)	31.0 (30.3-31.7)	100.0	14,927
I have avoided meeting friends during leisure time	11.9 (11.4-12.5)	53.7 (52.9-54.5)	34.4 (33.6-35.1)	100.0	14,885
I have avoided meeting family members that I don't live with	8.6 (8.2-9.1)	41.8 (41.0-42.6)	49.6 (48.8-50.4)	100.0	15,585
I have been to the supermarket only at times when there are few other customers there	8.3 (7.9-8.8)	44.2 (43.4-45.0)	47.5 (46.7-48.3)	100.0	14,805
I have avoided going to the supermarket	1.5 (1.3-1.7)	11.6 (11.1-12.2)	86.9 (86.3-87.4)	100.0	14,805

**The category "Seldom" includes three response groups: "Sometimes", "Almost never", and "No"*

TABLE 2. Principal components analysis of behaviour items – component loadings larger than 0.40 (bolded) or highest loading for each item. Oblique rotation and pairwise deletion of observations

	Components				
	Hygiene	Avoiding meeting people	Face masks	Hygiene when hands are dirty	Keeping distance
1. I have washed my hands or used antibac before I prepare or eat food	**0.49**			**0.43**	
2. I have washed my hands or used antibac after visiting the toilet (including changing diapers)				**0.72**	
3. I have washed my hands or used antibac when my hands are visibly dirty				**0.69**	
4. I have washed my hands or used antibac after contact with body fluids (for instance after blowing my nose)	**0.69**				
5. I have washed my hands or used antibac after contact with animals	**0.64**				
6. I have washed my hands or used antibac when I arrive in the workplace/kindergarten/school	**0.54**				
7. I have used a face mask after having touched surfaces in crowded places including workplaces/ kindergarten/school	**0.62**				
8. I have washed my hands or used antibac before I put on or after removing a face mask	**0.74**				
9. I have been coughing or sneezing in a paper handkerchief or elbow hook	0.38				
10. I have as much as possible avoided touching my face when among other people	**0.57**				
11. I have kept at least one meter distance to other people (other than those close to me)					**0.58**
12. I have avoided handshaking or hugging other people (other than those close to me)					**0.71**
13. I have during leisure time avoided crowded places					**0.59**
14. I have avoided going to the supermarket		**0.52**			
15. I have been to the supermarket only at times when there are few other customers there		0.37			
16. I have avoided public transport					**0.43**
17. I have avoided meeting friends during leisure time		**0.81**			
18. I have avoided visiting others or having other people visiting me		**0.82**			
19. I have avoided meeting family members that I don't live with		**0.75**			
20. I stay at home when I feel ill (including with low levels of symptoms)					0.23
21. I have used a face mask when I have not been able to keep at least one meter distance from others, such as when travelling by collective transport			**0.82**		
22. I have used a face mask when I have been indoors in public places (stores, malls) where it has been impossible to keep others at least at one meter distance			**0.82**		
23. I have tried to keep at least one meter distance to other people, even when I have used a face mask					**0.42**

TABLE 3. Descriptives and Cronbach α values

Scale	Items	Number of items	Mean	Standard deviation	*n*	α
Hygiene	1, 4, 5, 6, 7, 8, 9, 10	8	4.22	0.54	13,333	0.76
Hygiene when hands are dirty	2, 3	2	4.92	0.30	13,340	0.58
Avoiding others	14, 15, 17, 18, 19	5	3.32	0.73	13,327	0.74
Keep distance	11, 12, 13, 23	4	4.48	0.40	13,354	0.56
Face masks	21, 22	2	4.36	0.99	12,770	0.72
Avoided public transport*	16	1	3.99	1.14	12,279	–
Stays home if ill*	20	1	4.65	0.65	12,168	–

**Items not covered by any of the multi-item scales, but included as single items.*

the five behaviour meanscores and the two single items. The pattern of change over age groups was, however, rather similar for men and women. For the sake of simplicity, we therefore report differences across age groups for men and women combined, but with adjustment for gender. Mean score increased with age group for Keeping distance from others (Cohen's $d_{\text{18-29 vs.70+}} = 0.39$), Hygiene (Cohen's $d_{\text{18-29 vs. 60-69}} = 0.25$), Staying home when ill (even with low levels of symptoms) (Cohen's $d_{\text{18-29 vs.70+}} = 0.12$), and Hygiene when hands are dirty (Cohen's $d_{\text{18-29 vs. 60-69}} = 0.10$). For the other behavioural outcomes, the pattern of change across age groups was less monotonous. Avoiding contact with others was lowest among the youngest (18-29) and highest among the middle-aged (40-49) (Cohen's $d_{\text{18-29 vs. 40-49}} = 0.10$). The mean score on Wearing a face mask was highest among the youngest ones and lowest in the age group 50-59 (Cohen's $d_{\text{18-29 vs. 50-59}} = 0.19$). The mean score on Avoiding public transport did not differ much over the age span 30 years or older, but was particularly low among the youngest (Cohen's $d_{\text{18-29 vs. 60-69}} = 0.46$).

Mean scores on all behavioural outcome variables by education and gender and with adjustment for age are shown in Table 4 and Figure 1. Mean score on Hygiene decreases with increasing level of education for both genders, and when the group with the lowest level education is compared with the group with the highest level of education the decrease is the same for both genders (Cohen's $d_{\text{lowest vs. highest level of education}} = -0.31$). A decrease in mean score with increasing level of education is also found for Avoiding public transport (Cohen's $d_{\text{lowest vs. highest level of education}} = -0.15$). Again, the estimates were the same for both genders. A decrease in mean score with increasing level of education is also found for Avoiding meeting others and Keeping distance, but only among women (Cohen's $d_{\text{lowest vs. highest level of education}} = -0.17$ and -0.09, respectively). No significant association is found between Hygiene when hands are dirty and level of education. A positive association is found between level of education and Wearing a face mask for both women and men (Cohen's $d_{\text{lowest vs. highest level of education}} = 0.30$ and 0.41, respectively) and between level of education and Staying home when ill among men only (Cohen's $d_{\text{lowest vs. highest level of education}} = 0.21$).

DISCUSSION

Women tended to report higher levels of protection against virus transmission compared to men. This is consistent with findings from other studies [8-10]. As explained in a paper by Ferrin: "No matter to which sphere of life they refer, most studies conclude that men are more risk-taking than women either because risk attitudes are attributes of masculine or feminine psychology, or because they are culturally and stereotypically learnt" [11].

Differences were rather small across age groups. For some outcomes there was an increase in compliance on outcome variables with the largest and most consistent patterns for Keeping distance from others, Hygiene (until age 60-69), and Staying at home if ill (women only). Since being infected with the COVID-19 virus increased risk of hospitalization and a fatal outcome more strongly with older age, the increasing means on behavioural precaution outcomes in this study may reflect an increasing level of fear of being infected over age.

In six out of fourteen analyses defined by gender and outcome variables, there was a significant, negative association between level of education and means on precautions to avoid transmission of the COVID-19 virus. In five analyses there was no significant association. In only three analyses, positive associations were observed. The strongest associations were with Hygiene ($d = -0.31$ for both genders) and Wearing a face mask ($d = 0.30$ among women and 0.41 among men). All other significant associations were in the range of $d = 0.09$ to $d = 0.21$, in other words small effect sizes.

The many negative and near-zero associations were unexpected. Most studies in high income countries show health-compromising behaviour other than COVID-19-related behaviour to be more widespread among the less well educated. Some support for positive associations between level of education and behavioural precautions to avoid spread of the COVID-19 virus was found in one study from Germany [6]. Our findings are, however, consistent with results from three previous studies of COVID-19-related behaviour [4, 5, 7].

There are features of the Norwegian COVID-19 campaign and the Norwegian context which may explain

TABLE 4. COVID-19-related behaviour by education and gender, adjusted for age groups. In all significance testing the "Student or < 26 year old group" is excluded. (i) Primary school, Secondary school, Folk high school, (ii) Vocational education, High school, at least 3 years (iii) College or university less than 4 years, (iv) College or university, 4 years or more.

	Gender	Education	Mean	*n*	Sign. gender	Sign. education	Sign. interaction	Sign. women/men
					p <	*p* <	*p* <	*p* < (Cohen's *d* =)
Hygiene	Women				0.001	0.001	0.280	0.001 (*d* = –0.31)
		Primary, secondary	4.42	526				
		High school or vocational	4.43	1670				
		College, university, short	4.31	2077				
		College, university, long	4.25	3060				
		Student or < 26 years old	4.25	1099				
	Men							0.001 (*d* = –0.31)
		Primary, secondary	4.17	448				
		High school or vocational	4.14	1701				
		College, university, short	4.07	1616				
		College, university, long	4.01	2235				
		Student or < 26 years old	4.03	561				
Hygiene when hands are dirty	Women				0.001	*p* = 0.130	*p* = 0.038	*p* = 0.060 (*d* = 0.02)
		Primary, secondary	4.95	526				
		High school or vocational	4.97	1673				
		College, university, short	4.96	2077				
		College, university, long	4.96	3058				
		Student or < 26 years old	4.96	1100				
	Men							*p* = 0.093 (*d* = 0.08)
		Primary, secondary	4.84	450				
		High school or vocational	4.86	1702				
		College, university, short	4.88	1618				
		College, university, long	4.87	2236				
		Student or < 26 years old	4.83	561				

TABLE 4. Cont.

	Gender	Education	Mean	*n*	Sign. gender	Sign. education	Sign. interaction	Sign. women/men
					$p <$	$p <$	$p <$	$p <$ (Cohen's d =)
Avoid meeting others	Women				0.001	$p = 0.002$	$p = 0.099$	0.001 ($d = -0.17$)
		Primary, secondary	3.36	525				
		High school or vocational	3.32	1673				
		College, university, short	3.26	2076				
		College, university, long	3.24	3059				
		Student or < 26 years old	3.27	1093				
	Men							$p = 0.910$ ($d = -0.02$)
		Primary, secondary	3.17	448				
		High school or vocational	3.16	1697				
		College, university, short	3.15	1617				
		College, university, long	3.14	2232				
		Student or < 26 years old	3.15	555				
Keeping distance	Women				0.001	$p = 0.326$	$p = 0.025$	0.001 ($d = -0.09$)
		Primary, secondary	4.54	527				
		High school or vocational	4.54	1676				
		College, university, short	4.51	2076				
		College, university, long	4.52	3062				
		Student or < 26 years old	4.45	1100				
	Men							$p = 0.478$ ($d = 0.06$)
		Primary, secondary	4.44	451				
		High school or vocational	4.44	1703				
		College, university, short	4.45	1621				
		College, university, long	4.46	2238				
		Student or < 26 years old	4.42	561				

TABLE 4. Cont.

	Gender	Education	Mean	*n*	Sign. gender	Sign. education	Sign. interaction	Sign. women/men
					p <	*p* <	*p* <	*p* < (Cohen's *d* =)
Wearing a face mask	Women				0.001	0.001	0.001	0.001 (*d* = 0.30)
		Primary, secondary	4.28	503				
		High school or vocational	4.46	1582				
		College, university, short	4.45	1984				
		College, university, long	4.56	2943				
		Student or < 26 years old	4.39	1073				
	Men							0.001 (*d* = 0.41)
		Primary, secondary	3.99	426				
		High school or vocational	4.08	1592				
		College, university, short	4.30	1553				
		College, university, long	4.40	2187				
		Student or < 26 years old	4.20	546				
Avoided public transport	Women				*p* = 0.564	0.001	*p* = 0.007	0.010 (*d* = –0.15)
		Primary, secondary	4.13	464				
		High school or vocational	3.96	1493				
		College, university, short	3.94	1928				
		College, university, long	3.96	2894				
		Student or < 26 years old	3.61	1028				
	Men							0.001 (*d* = –0.15)
		Primary, secondary	4.05	396				
		High school or vocational	4.06	1481				
		College, university, short	3.94	1488				
		College, university, long	3.88	2135				
		Student or < 26 years old	3.65	530				

TABLE 4. Cont.

	Gender	Education	Mean	*n*	Sign. gender	Sign. education	Sign. interaction	Sign. women/men
					p <	*p* <	*p* <	*p* < (Cohen's *d* =)
Staying home when ill	Women				0.001	*p* = 0.003	0.001	*p* = 0.511 (*d* = 0.00)
		Primary, secondary	4.73	497				
		High school or vocational	4.75	1543				
		College, university, short	4.71	1922				
		College, university, long	4.72	2795				
		Student or < 26 years old	4.63	1059				
	Men							0.001 (*d* = 0.21)
		Primary, secondary	4.47	417				
		High school or vocational	4.49	1569				
		College, university, short	4.57	1455				
		College, university, long	4.61	1970				
		Student or < 26 years old	4.51	530				

why less well-educated population groups to such a large extent, and in some behaviours more than highly educated groups, complied with recommendations from the authorities. First of all, the main governmental communicators, which included the Prime minister, the Minister of Health, the Director of Health, and experts from the Norwegian Institute of Public Health, all have high credibility. Vis a vis the public there was a high level of consent. Potential disagreements among the various actors were not easy to see from the perspective of the general audience. Studies have confirmed a high level of trust in authorities among Norwegians [12]. Within a context of trust in authorities and under an extremely intensive and consistent flow of information and persuasive messages, one possible explanation is that doubt and resistance may be easier to mobilize among well-educated groups. This may explain why behavioural precautions to reduce the risk of virus transmission on some points have reached higher levels among less well-educated population segments.

The higher the level of education, the higher is the proportion of people who use face masks. This is a deviation from the pattern found for most other outcomes, namely that there is no or a negative association between level of education and behavioural outcomes. So why is this deviant pattern found? Studies have shown that there are a number of problems associated with use of face masks more than with other protective behaviours such as hygiene, avoiding meeting people, and keeping distance. In a report from the World Health Organization it is maintained that use of face masks is uncomfortable and may be accompanied by physical discomfort [13]. From a study from Saudi Arabia in 2021 it was reported that use of face masks may lead to problems with breathing, pain, they are unpleasant to wear, difficult to wear for those who use glasses, and lead to skin irritation [14]. In another study it was concluded that face masks should not be used over longer periods of time due to breathing problems and skin irritation [15]. Use of face masks may be particularly problematic for people with coronary heart health problems, chronic respiratory disorders, or diabetes, and for elderly people [16]. One possible explanation of the positive association between level of education and use of face masks is that those with higher education are more strongly motivated to cope with the unpleasantness associated with use of face masks. Having low levels of education could also be associated with experiencing daily life contexts which makes it more demanding to use face masks, for instance during work.

METHODOLOGICAL CONSIDERATIONS

The main limitation of the present study is related to possible selection bias. Response rates for both counties were slightly under 40%. And non-response was higher for less well-educated groups. A recent study of the association between response willingness (responding after first

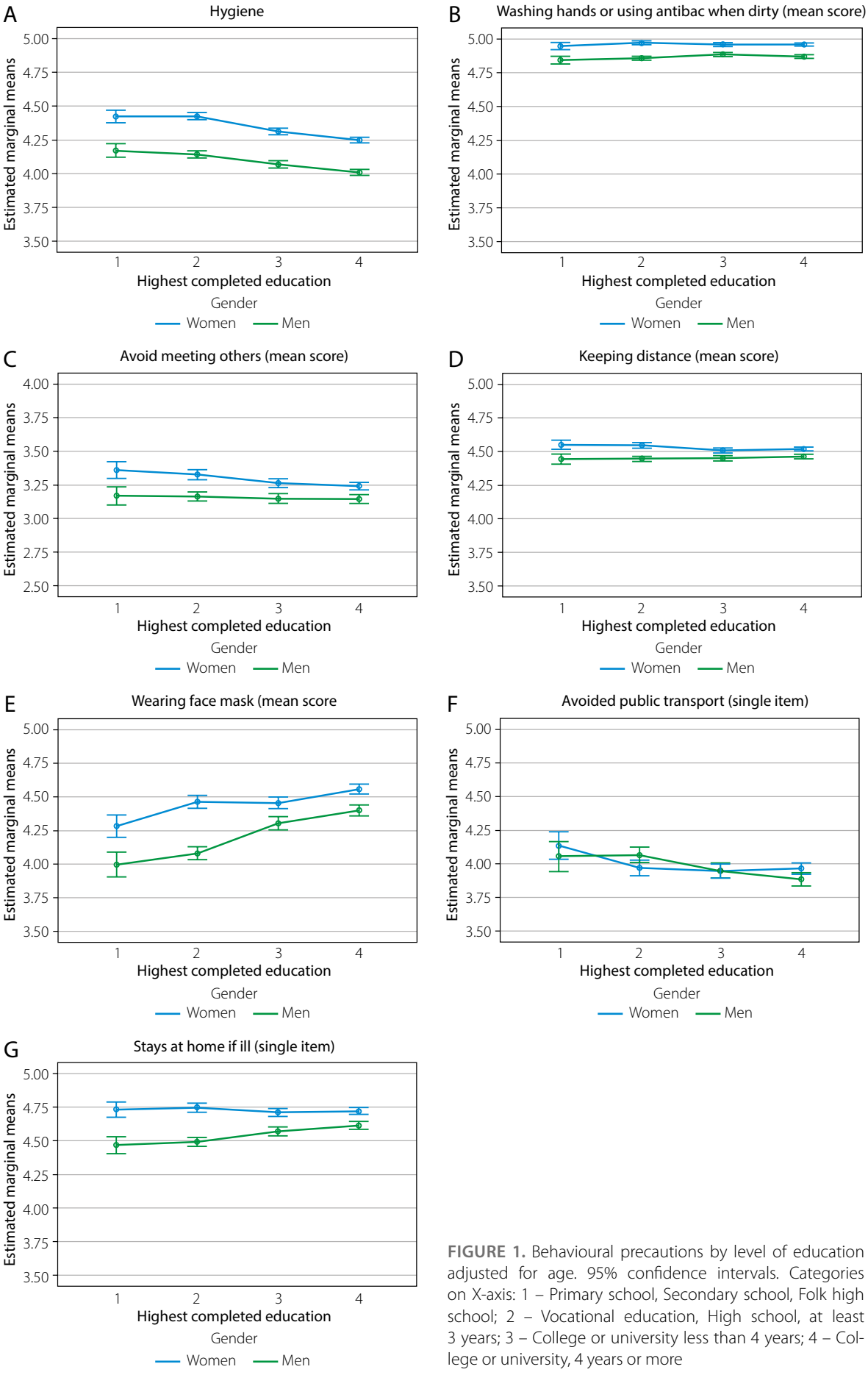

FIGURE 1. Behavioural precautions by level of education adjusted for age. 95% confidence intervals. Categories on X-axis: 1 – Primary school, Secondary school, Folk high school; 2 – Vocational education, High school, at least 3 years; 3 – College or university less than 4 years; 4 – College or university, 4 years or more

contact versus responding after one or two reminders) did not, however, indicate any noticeable level of selection [17]. To what extent this also holds true when comparing those who participate with those who do not participate remains uncertain. This may be possible to find out only through a study which, on key outcome variables, compares those who participate in the data collections with a group which is recruited among non-participants.

Strengths of the present study includes large samples, use of well-tested instruments for data collection, and use of adequate statistical techniques for the analysis of data.

CONCLUSIONS

Medium strength and positive associations between level of education and behavioural precautions to avoid transmission of the COVID-19 virus were expected. These expectations were not confirmed. For most outcome measures in this study, the associations were either negative or close to zero. Several aspects of the "Norwegian COVID-19 campaign" made it distinctly different from most media-based health education efforts which have taken place in Norway. Communication took place continuously for months across all media. Messages were strong, senders had a high level of credibility, and the high level of trust in authorities in Norway may have contributed to acceptance and compliance in most groups. Positive associations were, however found on two points. The higher the level of education was, the higher was the score on using face masks, and the higher was the score on staying at home if ill (men only). Wearing face masks is inconvenient, unpleasant, and associated with skin problems. Perhaps a high level of education is advantageous for mobilizing sufficient motivation to overcome these obstacles. Due to contextual factors, for instance related to job situations, wearing face masks may also be more challenging for less well-educated groups.

As expected, women were more compliant than men, and for at least some indicators, compliance increased with age.

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ETHICS APPROVALS AND CONSENT TO PARTICIPATE

Data collections were carried out among adults (18 years +) only and based on informed consent from study participants. Ethical approval was provided by the Regional Committee for Medical and Health Research Ethics for Norway South-East (Application number 503277). Data Protection Impact Assessment (DPIA) has been carried out by the Norwegian Institute of Public Health (No. 23/00375-1).

DISCLOSURE

The authors report no conflict of interest.

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AUTHORS' CONTRIBUTIONS

LEAa, TL, ØV, MK, JCS, and TN were involved in planning the study. LEAa, TL, and MS contributed to the analyses of data. LEAa and TL wrote the draft manuscript. All authors provided feedback on draft versions and approved the final manuscript.