



Health educational background as a predictor of non-participation in national colorectal cancer screening: A cross-sectional population study among 886,088 invited Danes



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ABSTRACT

Health information knowledge may affect attitude toward colorectal cancer screening, but the participation of health educated citizens are unknown. Therefore, we investigated non-participation in a sample of 886,088 invited participants, based on educational length, type, and level. Logistic regression analyses were conducted to estimate the odds of non-participation in Danish men and women based on educational type and length. Models were adjusted for age, income, marital status and immigration status. Information was derived from National registers. Men with long educational length level had increased odds of non-participation if their education was within the field of medicine/medical science (OR 1.87) or belonged to other long health educations, but not in nursing and health care, compared to other long educations after full model adjustment. Women with long educational length level had increased odds of non-participation if they were educated in the field of medicine/medical science (OR 1.47), whereas they had decreased odds in the fields of nursing and health care and other long health educations, compared to other long educations after full model adjustment. Men within short educational length level did not have different odds of nonparticipation, after full model adjustments, whereas women within short health educations were at increased odds in the youngest age group and at decreased odds in the eldest age group. Having an education in the field of medicine/medical science is associated with non-participation in colorectal cancer screening in Denmark 2014–2015. Opposite, an educational background in nursing and health care increased participation in women, but not in men.

1. Introduction

Sociodemographic and socioeconomic differences in participation for colorectal cancer screening are common and causes social inequality in health outcomes from screening, for instance, measured by length and level of education. In most populations, men participate less often than women (Buchman et al., 2016; Deding et al., 2017; Le Retraite et al., 2010; Pornet et al., 2010). Several studies have investigated the role of health professionals in endorsing screening to increase participation (Buchman et al., 2016; Van Roosbroeck et al., 2012; Wardle et al., 2016; Zajac, 2010). Health care providers' attitudes toward and knowledge of colorectal cancer screening varies (Dawson et al., 2017; Muliira et al., 2016; Ramos et al., 2010) and may affect their willingness to recommend screening participation to their patients (Buchman et al., 2016; Federici et al., 2006; Le Retraite et al., 2010; Ramos et al., 2010), but whether or not health professionals participate

themselves are unknown. Health professionals may not agree with screening methods (Dawson et al., 2017), which could affect their own decision to participate when invited. This study examines the participation of men and women with health educations compared to other educations.

2. Methods

Colorectal cancer screening was introduced in Denmark in 2014. Citizens aged 50–74 were invited to submit a stool sample. Invitation order was randomly distributed based on the month of birth, with the exception of those turning 50 or 75 during the year, who would be invited just before their birthday (Larsen et al., 2017). Citizens were invited by a mailed invitation letter containing a sample kit, guidelines on completion of the sample and a prepaid return envelope. The stool sample was tested for blood in a hospital laboratory, and if blood levels

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exceeded a set threshold, the citizen was invited for further colonoscopic examination in hospital. In this study, an individual was registered as participating in the screening program if a stool sample was received by a hospital laboratory. Individuals included in this study were all those invited during 2014 and 2015 and had completed either a health education or had an educational level equivalent to the various health educations. Follow-up for submitted samples continued until July 2016. All information for this study was derived from national registers and were linked using encrypted personal identification numbers.

2.1. National registers

Information on dates of invitations for screening and dates of stool sample reception at laboratories was derived from The Danish Colorectal Cancer Screening Database. The data in the Danish Colorectal Cancer Screening Database was gathered from the National Pathology Registry, the National Patient Register and the Invitation and Administration Module for the national colorectal cancer screening (Thomsen et al., 2017). Annual household income and registered partners, spouses and cohabiting partners was derived from the Income Statistics Register (Baadsgaard and Quitzau, 2011). Information on highest achieved level of education was derived from the Population's Education Register (Jensen and Rasmussen, 2011). Date of birth, gender, and country of origin was derived from the Danish Civil Registration System (Pedersen, 2011). Dates of death were derived from the Danish Register of Causes of Death (Helweg-Larsen, 2011). Previous colorectal cancer diagnoses were derived from the Danish National Patient Register, which held information on all patient diagnoses provided in Danish hospitals since 1977 (Lyngge et al., 2011).

2.2. Health education and educational level

In order to divide individuals within each level of education in those who had completed a health education from other educations at the same levels, the Population's Education Register was used. In the education register, each education is assigned with a unique numerical code (transformable to International Standard Classification of Education). This code was used to identify both the educational length level and the health educations. Educations regarded as health educations were those in the fields of social health care, dental care and treatment, medicine/medical science, nursing and health care, health technique and aid, hospital laboratory technics, therapy and rehabilitation in health, pharmacy, interdisciplinary health educations and care for handicapped and the elderly. Educational length level was divided into three groups: no education beyond basic school, high school or vocational school level (short education) and short, medium and long length higher education (long education). For details on the defined health educations and their length level, see Table 1. All individuals without education beyond basic school were excluded from the study as no health educations are present in this group and they would therefore not be at a comparable educational length level. Individuals with short education were divided into "other short education" and "other short health education". Individuals with a long education were divided into four groups; one consisting of Medicine/Medical science, a second consisting of Nursing and health care, a third consisting of "Other long health education" and a fourth group consisting of "Other long education". We formed four groups based on gender and educational length level (female short education, male short education, female long education and male long education) and analysed them separately.

2.3. Sociodemographic variables

Age at invitation was calculated using the date of birth and date of invitation for screening. Age was divided in groups of five-year

intervals (≤ 55 , $> 55-60$, $> 60-65$, $> 65-70$ and > 70). Income was calculated as annual household income the year previous to the invitation and divided by 1.5 if the individual had a partner (OECD, 2013). Income was divided into quartiles for each group examined. Marital status was dichotomised as being with a partner or being single. Being with a partner was defined as being married, being registered partners, cohabiting with an individual with whom they had a child or if they were cohabiting with an individual of opposite gender who's age differed no more than 15 years from their own. Immigration status was grouped as native Danes, Western immigrants and non-Western immigrants. Immigrants were defined as Western if their country of origin was a member country of the European Union as of January 2018 or was Andorra, Australia, Canada, Iceland, Liechtenstein, Monaco, New Zealand, Norway, San Marino, Switzerland, Czechoslovakia, the United States of America or Vatican state. All other immigrants were defined as non-Western.

2.4. Statistics

Participation were calculated as proportions within each of the four groups under analysis and compared using the chi-squared test. The main analyses consisted of univariate logistic regression models, estimating the odds ratio with 95% confidence intervals of non-participation depending on education type, as well as multivariate logistic regression models adjusting for age, gender, income and immigration status. Tests for interactions between education and age groups were conducted. Due to interaction, analyses of females with short education were stratified by age and analyses were therefore conducted on groups of ≤ 55 years of age, $> 55-70$ and those over 70. Tests for interactions between immigration status and education were conducted. Data management was conducted using SAS software, version 9.4 (SAS Institute Inc., Cary, NC, USA), and all statistical analyses were performed using R statistical software package, version 3.3.2 (R Core Team, 2016).

2.5. Ethics

The Danish Data Protection Agency approved the study (Ref. 2008-58-0028, 2016–34). All data in the study were linked and stored in computers held by Statistics Denmark. Data was made available with de-identified personal information. In accordance with the Act on Processing of Personal Data, this study only publishes aggregated statistical analyses and results. Retrospective anonymized register-based studies do not require written informed consent and ethical approval (Thygesen et al., 2011).

3. Results

886,088 individuals were invited to participate in colorectal cancer screening during 2014–15. 31,845 (3.60%) were excluded. 22,205 due to missing information on covariates, 4 due to faulty date registrations, 153 were registered as deceased prior to invitation distribution and 9483 had a previous colorectal cancer diagnose. This left 854,243 individuals with complete information. 236,647 (27.70%) of those were excluded, as their educational length level was lower than the defined health educations. The rest was divided into individuals with health education (78,393) and individuals with other education (539,203). 71.81% of the health educated participated in screening compared to 67.13% of those with other educations (Fig. 1).

Among males with short educational length level ($n = 203,676$), the group with other health education participated less than those with other education. The youngest participated the least. Participation increased with income quartile and native Danes participated more than Western immigrants, who participated more often than non-Western immigrants. Singles participated less often than those with a partner (Table 2).

Table 1
Definitions and length level of health educations in this study, Denmark 2014–15.

Main education group	Education types	Defined as	Length level		
Medicine/Medical science Nursing and health care	Medicine/Medical science	Medicine/Medical science	Long		
	Midwives	Nursing and health care	Long		
Social health care	Health care and health science	Other health educations	Long		
	Nursing and nursing science		Long		
	Social health care		Short/Long ^a		
	<i>Social health care (vocational)</i>		Short		
	<i>Social health care (short higher education)</i>		Long		
	<i>Social health care (medium higher education)</i>		Long		
	<i>Social health care (longer higher education)</i>		Long		
	<i>Social health care (bachelor)</i>		Long		
	<i>Health (Ph.D.)</i>		Long		
	<i>Health, care and pedagogy (vocational)</i>		Short		
Dental care and treatment	<i>Social health care, unspecified</i>	Other health educations	Short		
	Dental care and assistance in dental clinic		Short/Long ^a		
	<i>Dental clinic assistant</i>		Short		
	<i>Dental hygienist</i>		Long		
	<i>Diploma graduate in oral health</i>		Long		
	Dental technique and dental laboratory technique		Short/Long ^a		
	<i>Dental laboratory technician</i>		Short		
	<i>Dental technician, removable prosthetics</i>		Short		
	<i>Basic dental technician</i>		Short		
	<i>Clinical dental technician</i>		Long		
	Dentist and dentist specialist		Long		
	Health technique and aid		Audiology assistants and neurophysiology assistants	Other health educations	Short
			Radiography and radiology		Long
Optometry		Short/Long ^a			
<i>Optometrist (vocational)</i>		Short			
<i>Optometrist, Prof. Bach.</i>		Long			
Orthopaedic mechanic		Short			
Orthotist educations		Long			
Hospital laboratory technics Therapy and rehabilitation in health	Biomedical analysis	Other health educations	Long		
	Psychomotor and relaxation technique		Other health educations		
Pharmacy	Occupational and physical therapy	Other health educations	Long		
	Podiatry		Short		
	Musical therapy		Long		
	Health and nutrition		Long		
	Biomechanics		Long		
	Pharmacist and pharmaceutical educations		Short/Long ^a		
	<i>Pharmacy technician</i>		Short		
	<i>Pharmacist</i>		Long		
	Interdisciplinary health educations		Public health science	Other health educations	Long
			Physical education and health		Long
Health, other interdisciplinary educations		Long			
Care for handicapped and the elderly	Social and health assistance	Other health educations	Short		

^a Within this field of education, some specific educations are at short length level and some at long length level. Specified educations shown below in italic font.

In females with short educational length level ($n = 175,960$), the group with other health education participated equally to those with other education. The youngest and the eldest participated the least. Participation increased with income quartile and native Danes participated more than Western immigrants, who participated more often than non-Western immigrants. Singles participated less than those with a partner (Table 2).

Among males with a long educational length level ($n = 108,966$), the group with other education participated more than any of the three health education groups with medicine/medical science having the lowest participation. The youngest participated the least. Participation increased with income quartile from 1st to 3rd but fell for 4th quartile. Native Danes participated more than Western immigrants, who participated more often than non-Western immigrants. Singles participated less than those with a partner (Table 3).

Among females with a long educational length level ($n = 128,994$), the group with other education participated more than those with an education in medicine/medical science, but less than nursing and health care and other health education. The youngest and the eldest participated the least. Participation increased with income quartile from 1st to 3rd but fell for 4th quartile. Native Danes participated more than Western immigrants, who again participated more often than non-Western immigrants and singles participated less than those with a

partner (Table 3).

Short education ≤ 55 $n = 65,633$, short education $> 55-70$ $n = 77,837$, short education > 70 $n = 32,490$, long education $n = 128,994$.

In females with short education, those aged 55 or younger were at increased odds of non-participation if they held a health education compared to others before (OR 1.18 CI 95% 1.13;1.24) and after (OR 1.13 CI 95% 1.08;1.18) model adjustment. Those aged from 55 to 70 years were not at different odds, whereas those aged over 70 years were at decreased odds if they held a health education before (OR 0.90 CI 95% 0.84;0.96) and after (OR 0.88 CI 95% 0.83;0.94) model adjustment. Among females with a long educational length level, those with an education within medicine/medical science had increased odds of non-participation (OR 1.33 CI95% 1.22;1.44), compared to other long educations, whereas those with an education in nursing and health care (OR 0.72 CI95% 0.70;0.75) and those in other long health educations (OR 0.75 CI95% 0.72;0.78) had decreased odds in univariate models. After full model adjustments, nursing and health care (OR 0.76 CI95% 0.73;0.79) and other health educations' (OR 0.78 CI95% 0.75;0.81) odds remained at the same level, whereas those in medicine/medical science had a further increased odds ratio (OR 1.47 CI95% 1.35;1.60), compared to other long educations (Fig. 2).

Among males with short education, those with other health

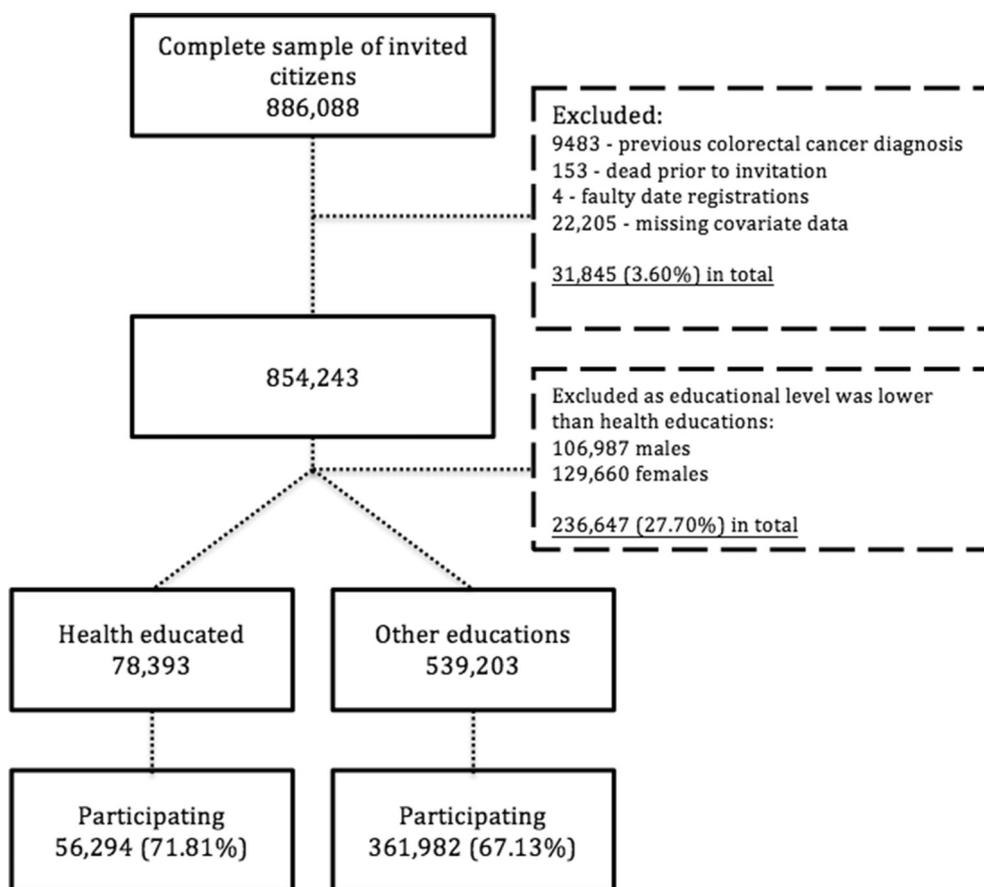


Fig. 1. Flowchart of 886,088 invited citizens for colorectal cancer screening in Denmark 2014–15.

education were at increased odds of non-participation in univariate model (OR 1.17 CI95% 1.07;1.27), compared to other short educations, but the odds ratio were not statistically significant after full model adjustment (OR 1.07 CI95% 0.98;1.17). In males with long education, those with an education within medicine/medical science (OR 1.47 CI95% 1.38;1.57) and those in other long health educations (OR 1.15 CI95% 1.05;1.26) had increased odds of non-participation, compared to other long educations, in the univariate regression model. Those with an education in nursing and health care did not have different odds (OR 1.06 CI95% 0.91;1.23) in the univariate model, compared to other long educations. After full model adjustments, nursing and health care were still not at increased odds (OR 1.01 CI95% 0.87;1.18) compared to other long educations, while the odds ratio of other long health educations decreased slightly (OR 1.11 CI95% 1.02;1.22). In contrast, those in medicine/medical science had a further increased odds ratio (OR 1.87 CI95% 1.75;2.00), compared to other long educations (Fig. 3).

Tests for interaction between immigration status and education did not indicate significant interactions. The exclusion of immigration status in multivariate logistic regression models affected odds of non-participation by no more than 0.04 in any of the strata. Odds of non-participation in Western immigrants varied from 1.16 (CI95% 1.04;1.30) in females aged 55 or younger with a short education to 1.35 (CI95% 1.24;1.48) in females aged over 55 to 70 with a short education. Odds of non-participation in non-Western immigrants varied from 1.16 (CI95% 1.08;1.25) in females aged 55 or younger with a short education to 2.13 (CI95% 1.71;2.65) in females aged over 70 with a short education.

4. Discussion

In general, those having completed an education with a health-

related content participate to a higher degree in colorectal cancer screening than those of other educations. However, having an education within the health area was not associated with participation in the same way in all fields of health educations and for both genders.

Within the short educations, males did not differ in participation, while differences were present for those with a long education. Males participate less if educated in other long health educations, to the same degree if they are educated in nursing and health and have an almost 1.9 fold increased risk of non-participation if within the field of medicine/medical science, compared to their peers of the same educational length level but without a health-related content.

Women within short length education do not have the same odds of non-participation across ages. The youngest age groups are at increased odds, the eldest are at decreased odds, whereas those > 55 to 70 years of age are not at different odds, compared to those without a health-related content. Among women with a long educational length level, those within nursing and health care as well as other long health educations participate more than their peers of the same educational length level, but without health-related contents. In contrast, also among females those within medicine/medical science participate less in colorectal cancer screening.

This behaviour is unlike women in medicine/medical science in the US who compared to the general population and other women of high socioeconomic status, report behaviours exceeding national goals for the year 2000 in all examined behaviours and screening habits (Frank et al., 1998). In the area of health care use and self-treatment, a Canadian study showed that 96% of nurses reported having a family physician, female physicians 81%, male family specialists 77%, while male specialist physicians reported 52%. The study also showed that 18% of the nurses reported self-treatment compared with 48% of female physicians. The study also shows that physicians to a greater

Table 2
Participation proportions by subgroups in males (n = 203,676) and females (n = 175,960) with short educational length level, Denmark 2014–15.

Males	Participating (n = 127,737)	Non-participating (n = 75,939)	Total (n = 203,676)	p-value ^a
Education type				
Other short education	126,406 (62.8)	75,018 (37.2)	201,424	
Other short health education	1331 (59.1)	921 (40.9)	2252	< 0.001
Age groups				
≤ 55	39,594 (55.2)	32,109 (44.8)	71,703	
> 55–60	19,983 (62.3)	12,084 (37.7)	32,067	
> 60–65	21,386 (66.1)	10,982 (33.9)	32,368	
> 65–70	22,188 (70.5)	9283 (29.5)	31,471	
> 70	24,586 (68.2)	11,481 (31.8)	36,067	< 0.001
Income				
1st quartile	28,222 (55.4)	22,698 (44.6)	50,920	
2nd quartile	32,007 (62.9)	18,911 (37.1)	50,918	
3rd quartile	33,359 (65.5)	17,560 (34.5)	50,919	
4th quartile	34,149 (67.1)	16,770 (32.9)	50,919	< 0.001
Immigration status				
Native Dane	121,504 (63.3)	70,474 (36.7)	191,978	
Western immigrant	2779 (57.8)	2033 (42.2)	4812	
Non-Western immigrant	3454 (50.2)	3432 (49.8)	6886	< 0.001
Marital status				
With a partner	103,655 (67.7)	49,466 (32.3)	153,121	
Single	24,082 (47.6)	26,473 (52.4)	50,555	< 0.001
<hr/>				
Females	Participating (n = 125,566)	Non-participating (n = 50,394)	Total (n = 175,960)	p-Value ^a
Education type				
Other education	101,122 (71.4)	40,416 (28.6)	141,538	
Other short health education	24,444 (71.0)	9978 (29.0)	34,422	0.113
Age groups				
≤ 55	45,405 (69.2)	20,228 (30.8)	65,633	
> 55–60	18,478 (72.5)	7013 (27.5)	25,491	
> 60–65	18,083 (74.6)	6158 (25.4)	24,241	
> 65–70	21,170 (75.3)	6935 (24.7)	28,105	
> 70	22,430 (69.0)	10,060 (31.0)	32,490	< 0.001
Income				
1st quartile	28,388 (64.5)	15,602 (35.5)	43,990	
2nd quartile	30,978 (70.4)	13,012 (29.6)	43,990	
3rd quartile	32,535 (74.0)	11,455 (26.0)	43,990	
4th quartile	33,665 (76.5)	10,325 (23.5)	43,990	< 0.001
Immigration status				
Native Dane	118,872 (72.0)	46,289 (28.0)	165,161	
Western immigrant	3206 (65.0)	1730 (35.0)	4936	
Non-Western immigrant	3488 (59.5)	2375 (40.5)	5863	< 0.001
Marital status				
With a partner	93,730 (75.0)	31,237 (25.0)	124,967	
Single	31,836 (62.4)	19,157 (37.6)	50,993	< 0.001

^a P-values were calculated using chi-squared tests. Variables are described using frequencies with row percentages in parenthesis.

extent than nurses treat their own family with prescriptions for medication (Janes et al., 1992). This could indicate that physicians rely on, and trust their own knowledge, experience and professionalism regarding their own health care, and that it in some cases leads to self-treatment. As many countries have foreign employees working in hospitals and the health care sector, the effect of immigration status is worth notice. Immigration status were significantly associated with increased odds of non-participation across strata in line with findings from previous studies (Deding et al., 2017, 2018, 2019) but as we found no interaction between education type and immigration status, we have no reason to believe that a health education influences the odds of non-participation in different ways across natives, Western immigrants and non-Western immigrants.

Physicians with healthy personal habits may be less reluctant to counsel their patients on nutrition and prevention (Frank et al., 2000; Tyzuk, 2012). This may also be true of screening participation. If non-participating physicians are less likely to recommend screening to their patients, their patients may participate to a lesser degree than other physicians' patients. An analytical review shows that the more physically active a physician is, the more likely the physician will provide physical activity counseling to their patients (Lobelo and de Quevedo,

2016). Non-smoking primary care physicians are more likely to encourage patients to quit smoking, and patients whose physicians were compliant in different screening and vaccination preventive practices were significantly more likely to have undergone these preventive measures, than patients with non-compliant physicians (Lobelo and de Quevedo, 2016). This indicates that a physician's own health habits influences the counseling of their patients, and it might suggest that the higher non-participation of physicians could indirectly influence the behaviour of their patients. A US study showed differences in patient outcomes associated to physician sex where patients of female physicians had lower mortality, and readmission rates across all examined medical conditions (Frank et al., 1998).

It is not possible from the result of this study to determine why men and women in medicine/medical science participate less than others do. Physicians have been reported to think of the fecal test as an ineffective examination (Aubin-Auger et al., 2011; Buchman et al., 2016; Dawson et al., 2017) and that colonoscopy is regarded as the golden standard (Buchman et al., 2016). This could partially explain the lack of participation, if physicians were more aware of the risk of false positive and false negative results when using a stool sample tested for blood in indicating colorectal cancer risk, which can cause unnecessary anxiety

Table 3
Participation proportions by subgroups in males ($n = 108,966$) and females ($n = 128,994$) with long educational length level, Denmark 2014–15.

Males	Participating ($n = 71,968$)	Non-participating ($n = 36,998$)	Total ($n = 108,966$)	p-Value ^a
Education type				
Other long education	67,725 (66.5)	34,172 (33.5)	101,897	
Medicine/Medical science	2371 (57.4)	1762 (42.6)	4133	
Nursing and health care	494 (65.2)	264 (34.8)	758	
Other long health education	1378 (63.3)	800 (36.7)	2178	< 0.001
Age groups				
≤ 55	23,610 (60.2)	15,595 (39.8)	39,205	
> 55–60	11,373 (65.4)	6029 (34.6)	17,402	
> 60–65	11,417 (68.2)	5321 (31.8)	16,738	
> 65–70	12,344 (72.2)	4764 (27.8)	17,108	
> 70	13,224 (71.4)	5289 (28.6)	18,513	< 0.001
Income				
1st quartile	16,456 (60.4)	10,785 (39.6)	27,241	
2nd quartile	18,334 (67.3)	8908 (32.7)	27,242	
3rd quartile	19,021 (69.8)	8221 (30.2)	27,242	
4th quartile	18,157 (66.7)	9084 (33.3)	27,241	< 0.001
Immigration status				
Native Dane	66,790 (66.8)	33,175 (33.2)	99,965	
Western immigrant	2547 (60.1)	1688 (39.9)	4235	
Non-Western immigrant	2631 (55.2)	2135 (44.8)	4766	< 0.001
Marital status				
With a partner	59,211 (69.4)	26,111 (30.6)	85,322	
Single	12,757 (54.0)	10,887 (46.0)	23,644	< 0.001
<hr/>				
Females	Participating ($n = 93,005$)	Non-participating ($n = 35,989$)	Total ($n = 128,994$)	p-Value ^a
Education type				
Other long education	66,729 (70.7)	27,615 (29.3)	94,344	
Medicine/Medical science	1636 (64.5)	900 (35.5)	2536	
Nursing and health care	15,036 (76.9)	4505 (23.1)	19,541	
Other long health education	9604 (76.4)	2969 (23.6)	12,573	< 0.001
Age groups				
≤ 55	34,500 (69.4)	15,212 (30.6)	49,712	
> 55–60	17,062 (73.2)	6256 (26.8)	23,318	
> 60–65	16,078 (75.2)	5289 (24.8)	21,367	
> 65–70	13,200 (75.7)	4237 (24.3)	17,437	
> 70	12,165 (70.9)	4995 (29.1)	17,160	< 0.001
Income				
1st quartile	21,133 (65.5)	11,116 (34.5)	32,249	
2nd quartile	23,533 (73.0)	8715 (27.0)	32,248	
3rd quartile	24,264 (75.2)	7985 (24.8)	32,249	
4th quartile	24,075 (74.7)	8173 (25.3)	32,248	< 0.001
Immigration status				
Native Dane	87,632 (72.7)	32,846 (27.3)	120,478	
Western immigrant	3176 (65.4)	1678 (34.6)	4854	
Non-Western immigrant	2197 (60.0)	1465 (40.0)	3662	< 0.001
Marital status				
With a partner	67,645 (75.4)	22,100 (24.6)	89,745	
Single	25,360 (64.6)	13,889 (35.4)	39,249	< 0.001

^a P-values were calculated using chi-squared tests. Variables are described using frequencies with row percentages in parenthesis.

or false reassurance (Aubin-Auger et al., 2011; Woodrow et al., 2006). Physicians knowing that a negative stool sample is no reassurance may choose not to participate, as it would not change their situation or feelings of risk. Those in the field of medicine/medical science will also be familiar with risk estimates in diseases and therefore might not acknowledge the risk being as serious as those not familiar with risk-estimates in epidemiology and medicine. Another possibility is that those in medicine/medical science rely more on their own expertise than they do on those who invited them. They may know some of the risk factors for or symptoms of colorectal cancer and thereby determine that although they are in the chosen age group, they are not at increased risk. Perhaps some physicians consider that they are able to diagnose themselves, which constitutes a problem as the ability to make better judgements may be overshadowed by other factors such as denials (Kurland, 2002). Whether those educated in the field of health benefit from the knowledge gained during their education is not fully understood. The life expectancy of physicians have both been shown to be increased (Frank et al., 2000) as well as indifferent (Nishi et al., 1999).

A Japanese study found differences in mortality between physicians of basic medical sciences and internal medicine who had longer future lifespans than surgeons and gynaecologists-obstetricians (Nishi et al., 1999).

The behaviour of those educated within medicine and medical science differs remarkably from those in nursing. Risk factors, such as family history and symptoms are, by some physicians, regarded as important in relation to recommend screening (Dawson et al., 2017). Those educated within nursing may rely more on the expertise of those who invite them, than their peers in medicine/medical science. When individuals are invited for colorectal cancer screening, they are informed that a stool sample positive for blood will trigger an invitation for colonoscopy. A colonoscopy can be a painful and uncomfortable examination and with a risk of complications. This may be better known to those in medicine/medical science and they may, therefore, choose not to participate at all, whereas other groups may not be aware of what the screening entails (Aubin-Auger et al., 2011; Woodrow et al., 2006).

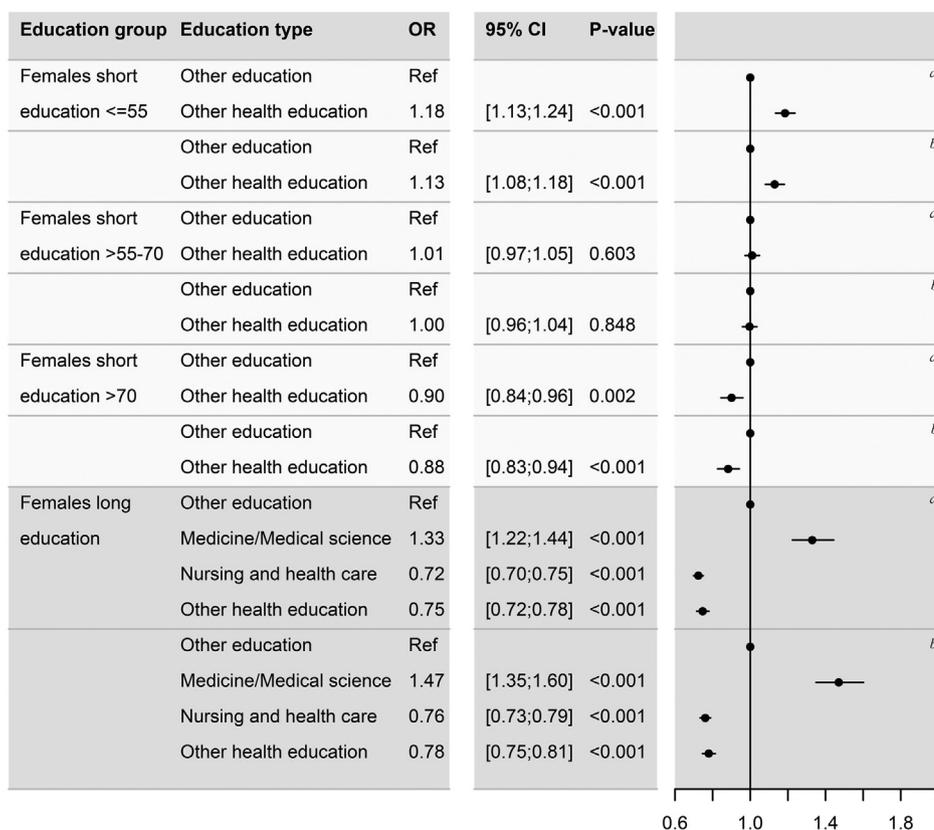


Fig. 2. Odds ratio of non-participation in females by educational type and length level, Denmark 2014–15.

a: Univariate logistic regression model. b: Multivariate logistic regression model adjusted for age, income, immigration status and marital status. Due to stratification by age groups, age group in analyses of those ≤55 and those > 70 (short education) is held constant and adjustment for age had no effect.

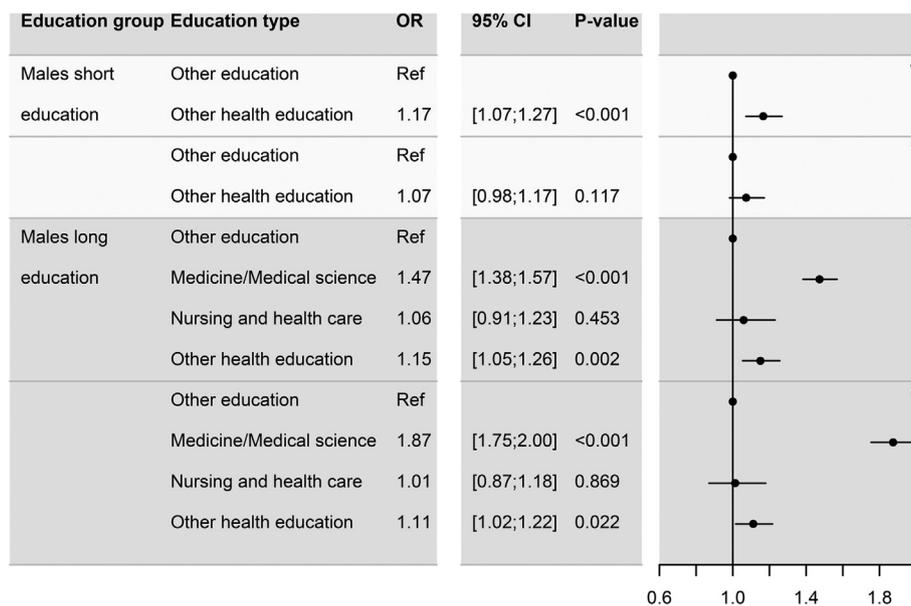


Fig. 3. Odds ratio of non-participation in males by educational type and length level, Denmark 2014–15.

a:Univariate logistic regression model. b: Multivariate logistic regression model adjusted for age, income, immigration status and marital status. Short education n = 203,676. Long education n = 108,966.

Increased odds of almost 1.5 in women and 1.9 in men within the field of medicine/medical science is a notable difference from others of the same length level of education, which likely will affect the future development of colorectal cancer cases in those groups of individuals. Furthermore, the possible consequences of a lack of support for the screening intervention may result in higher non-participation in citizens consulting non-participating physicians, limiting the health benefits from colorectal cancer screening in those citizens.

5. Strengths and limitations

The use of national registers in this study limits the risk of information bias as they are generally of high validity and quality (Baadsgaard and Quitzau, 2011; Helweg-Larsen, 2011; Jensen and Rasmussen, 2011; Lynge et al., 2011; Pedersen, 2011; Thomsen et al., 2017). The large sample size makes it possible to estimate odds ratios with narrow confidence intervals and as this is a population-based study with random invitation order, the risk of selection bias is

minimal, although the invitation procedure for those turning 50 or 75 caused a small over-representation of the youngest and eldest age groups. This is not expected to have affected odds ratios for education types. We chose to compare participation within the same level of education to minimize the effect of other sociodemographic differences and further adjusted for household income among other factors, but residual confounding may exist, as risk factors for non-participation are not well understood. The definition of health education groups were made for this study, and are broadly defined. This might suggest different content in relation to the ability to evaluate the screening program, but this should only lead to non-differential misclassification. The interaction between age group and education type was tested and was found significant in females with short educational length level, and the analyses of that group were stratified by age groups. Literature used in comparisons is mainly focused on physicians and general practitioners in primary health care and their roles in recommending participation to others whereas those in this study are all types of health professionals aged 50–74 and the subject of interest was their own participation.

6. Conclusions

Both males and females educated in the field of medicine/medical science were at increased odds of non-participation compared to others with long educational length level. Nursing showed the opposite pattern with higher participation among females and the same among men, compared to their peers of the same educational length level, even after full model adjustment for other factors known to influence participation.

Men with short education in health were not at different odds of non-participation than their peers of the same educational length level, while the youngest females with a health education were at increased odds and the eldest at decreased odds of non-participation, indicating gender differences in this group. Low personal support for colorectal cancer screening may affect willingness to recommend screening to their patients and thus influence participation for the whole population.

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Declaration of Competing Interest

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