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RESEARCH PAPER

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Sociodemographic determinants of catch-up HPV vaccination completion between 2016-2019 in Norway

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ABSTRACT

Between 2016 and 2019, a catch-up human papillomavirus (HPV) vaccination took place in Norway for women born between 1991 and 1996. The aim of this study was to identify sociodemographic determinants of complete vaccination (3 doses) and partial vaccination (1–2 doses). A random sample of 10,000 women who were offered catch-up HPV vaccination were invited. We assessed the association between sociodemographic characteristics and vaccination completion using univariable and multivariable multinomial logistic regression.

Of 4,967 respondents, 3,464 (63%) received complete vaccination and 298 (7%) received partial vaccination. 30% did not receive any vaccination and functioned as reference group. Compared with having Norwegian caregivers, having a caregiver from non-western countries decreased the odds of partial and complete vaccination (aOR = 0.57; 95%CI = 0.35–0.95 and aOR = 0.57; 95%CI = 0.44–0.74). Having a caregiver from other western countries decreased the odds of complete vaccination (aOR = 0.72; 95%CI = 0.52–0.98). Residing in Norway for 10 years or longer significantly increased the odds of complete vaccination (aOR = 2.65; 95%CI = 1.58–4.43). Being in a relationship significantly increased the odds of partial vaccination compared with being single (aOR = 1.50; 95%CI = 1.02–2.21). Being married (aOR = 0.66; 95%CI = 0.50–0.86) and having children (aOR = 0.53; 95%CI = 0.42–0.68) decreased the odds of complete vaccination. Having university education increased the odds of both partial and complete vaccination (aOR = 2.19; 95%CI = 1.47–3.25 and aOR = 4.11; 95%CI = 3.33–5.06).

Having a caregiver born outside of Norway, having children and being married decreased the odds of receiving complete HPV vaccination. This highlights the need to target communication around HPV vaccination toward different ethnic communities and include more specific messaging that having children and being married does not necessarily prevent HPV infections.

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Introduction

Human papillomavirus (HPV) infections are the most common sexually transmitted viral infections among young women.[1] While most HPV infections are self-limiting, prolonged infection with carcinogenic types increases the risk of cell changes that can lead to pre-stages of cervical cancer. HPV types 16 and 18 especially are carcinogenic strains responsible for approximately 70% of cervical cancer worldwide.[2] The age-standardized incidence rate of cervical cancer in Europe varies widely by country (between 3 and 25 per 100,000 women-years).[3] The incidence rate in Norway was 10.7 per 100,000 women-years in 2018. Over the past two decades, different vaccines have been developed that protect against HPV types 16 and 18 with high clinical efficacy (93–99%).[2] Many countries, including Norway, implement a 3-dose HPV vaccination schedule, despite some indications that a 2-dose and even 1-dose schedule may have high efficacy. Some authors, however, have expressed concerns regarding the long-term protection offered by less than 3 doses of the HPV vaccine.[4] HPV vaccines only protect against the types of HPV with which a person has not yet been infected.[5]

In 2009, Norway included HPV vaccination in the national childhood immunization program. HPV vaccination was routinely offered only to girls in the seventh grade (12–13 years of age), as of birth cohort 1997 and later.[6] HPV vaccination uptake increased from 72.5% in 2009 to 87.3% in 2014.[7] In 2016, the Norwegian authorities organized catch-up vaccination for young women who were born between 1991 and 1996 and for those who missed the opportunity to access HPV vaccination through the childhood immunization program.[8] This campaign was coordinated by the Norwegian Institute of Public Health (NIPH), which was responsible for the organization and communication regarding the catch-up vaccination at a national level. The vaccination for persons above the age of 14 consists of three doses given over a period of 6–12 months. Municipalities were responsible for the actual implementation of the catch-up HPV vaccination, to achieve the highest possible vaccination coverage.[9,10]To raise awareness of women born in 1991 and later about HPV and the free HPV vaccination, NIPH developed a targeted communication strategy. The communication strategy consisted of different integrated communication measures, including social media campaigns (Facebook, Instagram and Snapchat), text messages, brochures

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and posters. In addition, a webpage was established for health professionals and women in the target group on the institutional website.

In this publication, we aimed to identify sociodemographic determinants of complete vaccination (3 doses) and partial vaccination (1–2 doses) amongst young women who were invited for the catch-up HPV vaccination. A separate publication focuses more on the organizational aspects of the catch-up HPV vaccination campaign and whether those were determinants of complete and partial vaccination.[11]

Materials and methods

Study design

NIPH and Statistics Norway (SSB) conducted a nationwide cross-sectional population-based survey among women who had been offered catch-up HPV vaccination. Respondents provided informed consent before participation and the study followed requirements of the Personal Data Act. NIPH did not have access to personal identifiable information.

Study participants

Eligible women were those born between 1 January 1991 and 31 December 1996 who were invited for catch-up HPV vaccination between 1 November 2016 and 30 June 2019. All study participants consented to study participation. Eligible women who did not consent to study participation or whose vaccination status was not reported were excluded.

Sampling and invitation

In Norway, every citizen has a unique personal identification number, which is stored in the centralized Norwegian Population Register. The Norwegian Population Register holds sociodemographic information of registered citizens, including age, sex, location of birth and residence, education and income levels and civil status. The register is deemed to be comprehensive, since it is not possible to reach administrative governmental services without the personal number. SSB selected a random sample of 10,000 from all eligible women and sent invitation e-mails and SMS-messages with a link to the questionnaire. Invitations were sent within three months after the last day of the catch-up campaign. SSB sent reminder SMS messages on day 2 or 3 and 10. On day 8 a reminder SMS message and e-mail were sent.

Data collection

Data collection was web-based and took place between 23 September and 6 October 2019 and was conducted by SSB. Internal SSB ethical clearance procedures were followed. The web-based questionnaire was available in Norwegian. Filling out the questionnaire took approximately 8 minutes. An English translation of the questionnaire can be found in Appendix A. SSB collected informed consent from all participants prior to enrollment. Informed consent was collected as the first part of the web-based questionnaire.

Sociodemographic data was available from the population register and was linked to the questionnaire by the unique personal identification number.

Measurements and outcomes

The outcome was self-reported vaccination completion during the catch-up campaign. The variable was divided into three levels: (i) No HPV vaccination: woman who did not receive any dose, (ii) Partial HPV vaccination: woman who received one or two doses and (iii) Complete HPV vaccination: woman who received three doses.

Sociodemographic variables included age, region of residence, education level, country of origin, duration of residence in Norway, marital status, having children and household income. The country of origin and duration of residence in Norway of caregivers were also included. These variables were included based on literature review prior during the survey design phase.

Level of education was measured by asking study participants about the highest level of education they had completed. Educational level was classified into three categories: no education/primary education, secondary education and college/university education. Region of birth was captured automatically from the population register for both study participants and their caregivers (i.e. legal guardians): Norway or EU/USA/Canada/Australia/New Zealand or Asia/Africa/Latin America/Oceania/Europe outside EU. Caregivers' country of origin was classified as foreign if at least one caregiver did not originate from Norway. The duration of residence in Norway was only recorded if one had another country of origin than Norway. The marital status, household income after tax and whether the study participant had children was determined at the time of survey administration by SSB.

Analysis

We described study participants, applying sampling weights considering education level, country of origin and age of the study participants using the Survey command in STATA version 16 (StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC).

We assessed the association between sociodemographic characteristics and self-reported completion of HPV vaccination, using univariable and multivariable multinomial regression analyses. For the multinomial analyses, no HPV vaccination was used as the reference group for the partial and complete vaccination groups. Those with missing data were not included in the analysis of the variable with the missing data. We calculated odds ratios (OR) and 95% confidence intervals (95% CI) as measures of association in the multinomial univariable analyses. For the multivariable analyses we calculated adjusted ORs (aOR) and 95% CI (see Table 2 for which variables were included in the adjusted analysis). The statistical significance (p-values) of the above-investigated associations was compared between those who received partial or complete HPV vaccination, to those who were not vaccinated using logistic regression.

Results

Response proportion

Of all invited women, 5,033 women (50.3%) completed the questionnaire. Information on vaccination completion was missing for 66 study participants. Therefore, data from 4,967 study participants (49.7%) were included in the analyses.

Compared to study participants, descriptive data on non-responders showed a higher proportion who only completed primary education (non-responders: 22%, 1,093/4,967; responders: 12.5%, 629/5,033) and whose country of origin was not Norway (non-responders: 26.8%, 1,331/4,967; responders: 11.5%, 579/5,033) (Appendix B).[10]

Sociodemographic determinants of self-reported HPV vaccination completion

Overall, 63.4% (95%CI = 61.6–65.1) reported having completed the HPV vaccination schedule, 30.2 (95%CI = 28.5–31.9) reported not having received any HPV vaccination and 6.5% (95%CI = 5.7–7.5) reported having received the first doses, but not completed the full vaccination schedule. Several characteristics were independently associated (either positively or negatively) with being partially vaccinated compared to those not vaccinated (Table 1). Having at least one parent from Asia, Africa, Latin America, Oceania or Europe outside of EU (aOR = 0.57; 95% CI = 0.35–0.95; p = .038) and residing in *Hedmark og Oppland* county (aOR = 0.38; 95% CI = 0.19–0.77; p = .005) or *Østlandet ellers* county (aOR = 0.47; 95% CI = 0.30–0.73; p = .005) decreased the

Table 1. Characteristics of study participants: women born between 1991 and 1996 who were offered free catch-up HPV vaccination between 1 November 2016 and 30 June 2019 in Norway (N = 4,967).

	No vaccination			Partial vaccination			Complete vaccination		
	Sample		Weighted % (95% CI)	Sample		Weighted % (95% CI)	Sample		Weighted % (95% CI)
	n	%		n	%		n	%	
Overall	1,205	24.3	30.2 (28.5-31.9)	298	6.0	6.5 (5.7-7.5)	3,464	69.7	63.4 (61.6-65.1)
Country of origin (study participant) (n=4,961)									
Norway	973	22.0	24.1 (22.8-25.5)	255	5.8	5.8 (5.1-6.5)	3,193	72.2	70.1 (68.7-71.5)
EU, USA, Canada, Australia, New Zealand	86	40.0	39.8 (33.4-46.5)	17	7.9	8.0 (5.0-12.5)	112	52.1	52.2 (45.6-58.9)
Asia, Africa, Latin America, Oceania, Europe (outside EU)	142	43.7	43.9 (38.6-49.4)	26	8	8.1 (5.6-11.6)	157	48.3	48.0 (42.6-53.4)
Duration of residence in Norway for non-Norwegians (study participant) (n=546)									
0-4 years	99	51.3	50.9 (43.8-57.9)	16	8.3	8.1 (5.0-12.9)	78	40.4	41.1 (34.3-55.4)
5-9 years	39	50.0	50.7 (39.7-61.7)	4	5.1	5.1 (1.9-12.9)	35	44.9	44.2 (33.6-55.4)
10 years or more	94	34.2	33.9 (28.5-39.8)	23	8.4	8.8 (5.9-12.9)	158	57.5	57.3 (51.3-63.1)
Country of origin (caregivers) (n=4,395)									
Both caregivers from Norway	769	20.9	22.6 (21.2-24.1)	207	5.6	5.5 (4.8-6.3)	2,703	73.5	71.9 (70.3-73.4)
At least one caregiver from EU, USA, Canada, Australia, New Zealand	77	27.7	32.7 (25.8-40.5)	20	7.2	9.1 (5.4-15.1)	181	65.1	58.2 (50.4-65.6)
At least one caregiver from Asia, Africa, Latin Americ,a Oceania, Europe (outside EU)	154	35.2	40.8 (35.3-46.6)	27	6.2	7.2 (4.7-11.0)	257	58.7	51.9 (46.3-57.6)
Region of residence (n=4,967)									
Akershus og Oslo	342	23	29.1 (26.1-39.3)	114	7.7	7.8 (6.2-9.8)	1,030	69.3	63.1 (59.8-66.3)
Hedmark og Oppland	87	29.6	32.5 (26.4-39.3)	11	3.7	6.0 (3.0-11.7)	196	66.7	61.5 (54.5-68.1)
Østlandet ellers	241	31.8	37.7 (33.4-42.2)	34	4.5	5.2 (3.4-7.9)	482	63.7	57.1 (52.6-61.5)
Agder og Rogaland	167	24.7	30.2 (25.9-35.0)	43	6.4	6.5 (4.5-9.2)	465	68.9	63.3 (58.5-67.8)
Vestlandet	169	20.7	28.1 (24.1-32.5)	45	5.5	7.0 (5.0-9.8)	604	73.8	64.9 (60.4-69.1)
Trøndelag	95	18.3	25.4 (20.6-30.9)	26	5	4.3 (2.9-6.3)	399	76.7	70.4 (65.0-75.3)
Nord-Norge	104	24.9	27.4 (22.5-32.8)	25	6	6.2 (3.8-9.9)	288	69.1	66.5 (60.8-71.7)
Marital status (n=4,967)									
Single	348	21.6	27.9 (25.1-30.9)	76	4.7	5.5 (4.1-7.2)	1,187	73.7	66.6 (63.5-69.6)
In a relationship	187	19.4	25.3 (21.7-29.2)	62	6.4	6.9 (5.1-9.4)	717	74.2	67.8 (63.8-71.6)
Cohabitating	461	24.4	28.4 (25.9-31.1)	126	6.7	6.8 (5.6-8.3)	1,305	69	64.8 (62.0-67.4)
Married	195	40.9	46.4 (40.8-52.0)	33	6.9	7.7 (5.1-11.6)	249	52.2	45.9 (40.4-51.5)
Separated	14	66.7	64.0 (38.5-83.5)	1	4.8	7.3 (1.0-37.6)	6	28.6	28.7 (11.8-54.8)
Children (n=4,967)									
Yes	395	40.1	45.7 (41.9-49.5)	73	7.4	7.4 (5.6-9.7)	518	52.5	47.0 (43.2-50.8)
No	810	20.4	26.0 (24.1-27.8)	225	5.7	6.3 (5.3-7.4)	2,946	74	67.8 (65.8-69.7)
Highest completed education (n=4,967)									
Primary	282	45.4	47.7 (43.3-52.2)	41	6.6	7.6 (5.4-10.7)	298	48	44.7 (40.3-49.1)
Secondary	441	32.3	36.7 (33.6-39.9)	83	6.1	6.4 (5.0-8.2)	841	61.6	56.9 (53.7-60.1)
University or college	482	16.2	20.2 (18.3-22.4)	174	5.8	6.2 (5.1-7.5)	2,325	78	73.6 (71.3-75.7)
Household income after tax (in NOK) (n=4,872)									
P10 214000	319	19.8	26.6 (23.7-29.7)	100	6.2	6.8 (5.3-8.6)	1,191	74	66.7 (63.5-69.6)
P20 266000	162	31.2	37.9 (32.8-43.3)	30	5.8	6.7 (4.3-10.3)	327	63	55.4 (50.0-60.7)
P30 305000	111	28.8	32.6 (27.0-38.8)	23	6	6.0 (3.7-9.5)	251	65.2	61.4 (55.2-67.3)
P40 339000	107	29.1	36.5 (30.4-43.1)	21	5.7	6.5 (3.8-10.7)	240	65.2	57.0 (50.5-63.3)
P50 372000	106	29	34.3 (28.5-40.7)	18	4.9	5.8 (3.3-10.0)	241	66	59.9 (53.5-66.0)
P60 408000	79	22.4	27.8 (17.9-28.6)	18	5.1	6.2 (3.6-10.6)	256	72.5	66.0 (59.4-72.1)
P70 450000	72	20.3	22.8 (17.9-28.6)	17	4.8	4.8 (2.8-8.1)	266	74.9	72.4 (66.5-77.7)
P80 507000	89	24.7	26.0 (21.0-31.7)	24	6.7	7.3 (4.5-11.7)	247	68.6	66.7 (60.6-72.3)
P90 606000	70	20.5	21.2 (16.5-26.8)	22	6.4	6.4 (3.9-10.3)	250	73.1	72.4 (66.4-77.8)
P100 >606001	46	21.4	23.6 (17.5-31.2)	20	9.3	9.4 (5.6-15.5)	149	69.3	66.9 (59.0-74.0)
	Median (range)			**Median (range)**			**Median (range)**		
Age (n=4,967)	26 (23-28)			26 (23-28)			26 (23-28)		

Table 2. Sociodemographic characteristics of women who were offered free catch-up HPV vaccination in Norway between 1 November 2016 and 30 June 2019, with those not receiving any vaccination as reference group.

	Partial vaccination (N=298)						Complete vaccination (N=3,464)					
	Univariable analysis			Multivariable analysis			Univariable analysis			Multivariable analysis		
	OR	95% CI	p	aOR	95% CI	p	OR	95% CI	p	aOR	95% CI	p
Country of origin (study participant) (n=4,961)			.186			.517			<.001***			.231
Norway				Ref.						Ref.		
EU, USA, Canada, Australia, New Zealand	0.75	0.44-1.29		1.19	0.57-2.49		0.40	0.30-0.53		0.71	0.46-1.10	
Asia, Africa, Latin America, Oceania, Europe (outside EU)	0.70	0.30-0.53		1.53	0.82-2.86		0.34	0.27-0.43		0.85	0.59-1.23	
Duration of residence in Norway for non-Norwegians (study participant) (n=546)			.053			.178			<.001***			<.001***
0-4 years				Ref.						Ref.		
5-9 years	0.64	0.20-2.02		0.65	0.19-2.21		1.14	0.66-1.96		1.41	0.75-2.67	
10 years or more	1.61	0.94-2.78		1.82	0.78-4.25		3.99	2.94-5.41		2.65	1.58-4.43	
Country of origin (caregivers) (n=4,395)												
Both caregivers from Norway				Ref.						Ref.		
At least one caregiver from EU, USA, Canada, Australia, New Zealand	1.05	0.63-1.75	.840	0.85	0.49-1.48		0.81	0.61-1.06	.128	0.72	0.52-0.98	
At least one caregiver from Asia, Africa, Latin America, Oceania, Europe (outside EU)	0.68	0.44-1.05	.079	0.57	0.35-0.95	.038*	0.55	0.44-2.85	<.001***	0.57	0.44-0.74	.031*
Region of residence (n=4,967)			<.001***			.005**			<.001***			<.001***
Akershus og Oslo				Ref.						Ref.		
Hedmark og Oppland	0.38	0.20-0.74		0.38	0.19-0.77		0.75	0.57-0.99		0.87	0.64-1.18	
Østlandet ellers	0.42	0.28-0.64		0.47	0.30-0.73		0.66	0.55-0.81		0.84	0.68-1.05	
Agder og Rogaland	0.77	0.52-1.15		0.87	0.58-1.32		0.93	0.75-1.15		1.19	0.94-1.51	
Vestlandet	0.80	0.54-1.18		0.90	0.60-1.35		1.19	0.96-1.46		1.45	1.15-1.83	
Trøndelag	0.82	0.51-1.33		0.96	0.58-1.58		1.40	1.08-1.80		1.74	1.32-2.31	
Nord-Norge	0.72	0.44-1.17		0.84	0.50-1.39		0.92	0.71-1.19		1.19	0.90-1.58	
Marital status (n=4,967)			.023*			.094			<.001***			.007**
Single				Ref.						Ref.		
In a relationship	1.52	1.04-2.22		1.50	1.02-2.21		1.12	0.92-1.37		1.11	0.90-1.38	
Cohabitating	1.25	0.91-1.72		1.37	0.97-1.93		0.83	0.71-0.97		0.94	0.78-1.12	
Married	0.78	0.50-1.21		0.96	0.57-1.61		0.37	0.30-0.47		0.66	0.50-0.86	
Separated	0.33	0.04-2.53		0.60	0.07-4.79		0.13	0.05-0.33		0.42	0.15-1.19	
Children (n=4,967)			.006**			.212			<.001***			<.001***
Yes	0.67	0.50-0.89		0.97	0.63-1.87		0.36	0.31-0.42		0.53	0.42-0.68	
No				Ref.						Ref.		
Highest completed education (n=4,967)			<.001***			<.001***			<.001***			<.001***
Primary				Ref.						Ref.		
Secondary	1.30	0.87-1.94		1.20	0.79-1.81		1.81	1.48-2.20		1.64	1.33-2.03	
University or college	2.48	1.71-3.60		2.19	1.47-3.25		4.57	3.77-5.52		4.11	3.33-5.06	
Household income after tax (in NOK) (n=4,872)			.080			.474			<.001***			.136
P10 214000				Ref.						Ref.		
P20 266000	0.59	0.38-0.93		0.68	0.43-1.09		0.54	0.43-0.68		0.74	0.58-0.94	
P30 305000	0.66	0.40-1.09		0.82	0.49-1.38		0.61	0.47-0.78		0.89	0.67-1.17	
P40 339000	0.63	0.37-1.05		0.68	0.40-1.16		0.60	0.46-0.78		0.74	0.56-0.99	
P50 372000	0.54	0.31-0.94		0.60	0.34-1.05		0.60	0.47-0.79		0.76	0.57-1.01	
P60 408000	0.73	0.42-1.27		0.68	0.39-1.23		0.87	0.66-1.15		0.92	0.68-1.24	
P70 450000	0.75	0.42-1.34		0.80	0.44-1.45		0.99	0.74-1.32		1.10	0.81-1.50	
P80 507000	0.86	0.52-1.42		0.83	0.49-1.40		0.74	0.57-0.98		0.76	0.56-1.01	
P90 606000	1.00	0.59-1.70		0.97	0.56-1.67		0.96	0.71-1.28		0.94	0.69-1.29	
P100 >606001	1.39	0.78-2.46		1.27	0.70-2.28		0.87	0.61-1.24		0.81	0.55-1.17	
Age	0.99	0.92-1.07	.820	1.00	0.92-1.09		0.95	0.91-0.98	.005**	0.99	0.94-1.03	.570

No vaccination = reference group.
Ref. = reference group per variable.
*significant at $p < .05$.
**significant at $p < .01$.
***significant at $p < .001$.

odds of partial vaccination. Being in a relationship (aOR = 1.50; 95% CI = 1.02–2.21; $p = .094$) and having completed university or college (aOR = 2.19; 95% CI = 1,47–3.25; $p < .001$) increased the odds of partial vaccination.

Several characteristics were independently associated (either positively or negatively) with being completely vaccinated compared to those not vaccinated (Table 2). Residing in Norway for 10 years or longer (aOR = 2.65; 95% CI = 1.58–4.43; $p < .001$), residing in *Vestlandet* county (aOR = 1.45; 95% CI = 1.15–1.83; $p < .001$) or *Trøndelag* county (aOR = 1.74; 95% CI = 1.31–2.31; $p < .001$), having completed secondary school (aOR = 1.64; 95% CI = 1.33–2.03; $p < .001$) or university or college (aOR = 4.11; 95% CI = 3.33–5.06; $p < .001$) increased the odds of complete vaccination. While having at least one parent from outside of Norway (EU, USA, Canada, Australia, New Zealand: aOR = 0.72; 95% CI = 0.52–0.98; Asia, Africa, Latin America, Oceania or Europe outside of EU: aOR = 0.57; 95% CI = 0.44–0.74; $p = .031$), being married (aOR = 0.66; 95% CI = 0.50–0.86; $p = .007$) and having children (aOR = 0.53; 95% CI = 0.42–0.68; $p < .001$) decreased the odds of complete vaccination.

Discussion

This survey among young women who were offered catch-up HPV vaccination in Norway, sought to identify sociodemographic determinants of the self-reported decision to complete HPV vaccination. This investigation focused on comparing these determinants between women who did not initiate vaccination (0 doses), those who were partially vaccinated (1–2 doses) and those who were completely vaccinated (3 doses).

Young women with at least one caregiver whose country of origin was Asia, Africa, Latin America, Oceania or Europe outside of EU were less likely to receive any dose of HPV vaccination. In the multivariable analysis, the country of origin of caregivers was significantly associated with complete vaccination among study participants, but the country of origin of study participants was not. This could indicate that, despite their adult age, caregivers of young women still played a role in their decision to take the HPV vaccine. This is supported by the analysis of self-reported barriers and facilitating factors in adhering HPV vaccination that was also based on this survey and is described elsewhere.[11] Other studies have also recorded racial and ethnic differences in caregivers' HPV vaccination acceptability.[12] A recently published study from Norway showed that the increase in HPV vaccination initiation in the routine childhood vaccination program amongst young girls (birth cohorts 1997–2002) varied depending on the country of origin of caregivers.[13] However, a study from the Netherlands did not identify differences between groups.[14] Whereas later studies in the Netherlands identified ethnicity as a determinant of HPV vaccine initiation.[15] Similarly, a Swedish study showed that there was a slight trend for study participants born outside Europe to be less willing to vaccinate their children compared with those born in Sweden (OR: 0.88; 95% CI: 0.69–1.12).[16] Although some barriers to receiving HPV vaccination are likely to be universal, there could be additional barriers that are culturally specific. The sexually transmitted nature of HPV may mean that vaccination may be less acceptable to some religious groups which are represented largely by ethnic minorities,[15,17] likely because of fear that by encouraging their child to get vaccinated, caregivers would promote earlier initiation of sexual activity, or implicitly approve their child's engagement in sexual activity.[18–21] However, not all studies identified perceived earlier initiation of sexual activity as a barrier to vaccination initiation by caregivers.[22]

Women who were not born in Norway but stayed in Norway for 10 years or more were more likely to complete all HPV vaccine doses. Young women residing 10 years in Norway quite certainly went to primary and secondary school in Norway, speak Norwegian and are better integrated with the society.[23] They may have had better access to information and communication campaigns on HPV vaccination and proactive health seeking behaviors, than women who spent their childhood in their home countries. In addition, women who were in a relationship were most likely to start, but not complete, HPV vaccination. Compared to single women, married women were less likely to complete the full three doses of HPV vaccination. Qualitative focus group discussions prior to the HPV catch-up vaccination already indicated that there was lower acceptability of HPV vaccination among women who were married or had children (6). In the communication campaign, NIPH emphasized the importance of HPV vaccination completion despite marital status. Similarly, other studies have found that unmarried women were more likely to be vaccinated than married women.[24–26] This could be explained by higher perceptions of risk of HPV infection among sexually active young women with multiple sexual partners and the perception that married women with one partner are therefore not at risk.[24,27] Our study showed that young women who had completed university education were more likely to receive vaccination compared to those who completed primary education. This could indicate that information on HPV vaccination was more readily accessible to or more easily to follow by young women with higher education.[28–30] The association between education levels and HPV vaccination acceptability, initiation and completion has been disputed and appears to differ between contexts. Studies from the USA showed that caregivers with lower levels of education reported higher HPV vaccination acceptability.[12] Whereas other studies showed that higher education from caregivers was associated with decreased HPV vaccine acceptability.[16,31,32]

We also found important regional differences in completing 3 doses of HPV vaccination, without a consistent pattern. This could indicate that different organization of the catch-up vaccination program in municipalities, such as organizing easily accessible and well-advertised vaccination points, could facilitate completion of full vaccination schedule (7). Finally, we found that low household income was associated with decreased odds of vaccination completion, but not the odds of partial vaccination. Although the odds of vaccination completion seemed to increase with increasing household income, we could not identify a clear trend. This is consistent with the study from Norway that showed that the increase in HPV vaccination initiation in the routine childhood vaccination program amongst young girls increased with household income, which could be explained by a correlation between household income and education level, in which a higher

household income and education level could result in increased health literacy and access to information on HPV vaccination (9).[33]

Our study has several limitations. First, there was a potential selection bias in study participants as most study participants (69.7%) self-reported to have completed the full schedule (three doses) of HPV vaccination. This was higher than the official figure of 45–50% vaccinated women born between 1991 and 1996 during the catch-up campaign. This means that women with a positive attitude to vaccination were overrepresented. Additionally, descriptive analysis of non-responders showed a higher proportion of women who had not completed any education, or only completed primary education, and whose country of origin was outside of Norway, EU, USA, Canada, Australia or New Zealand compared to study participants. As these factors were associated with lower vaccination initiation, we may even have overestimated partial vaccination. Second, the country of origin of study participants and their caregivers were grouped into three categories, each of which included multiple different regions. Because this categorization was done prior transferring the data to NIPH, we were unable to distinguish between countries of origin, or even regions of origin, and further explore more specific geographic and cultural determinants of self-reported HPV vaccination completion. For example, a recently published study amongst migrants in Norway showed that measles vaccine initiation may differ based on country of origin.[34] Third, all variables, including vaccination status, were self-reported by study participants, which could have led to potential misclassification of vaccination completion. Fourth, self-reported marital status of all study participants was asked at the time of survey administration. Marital status at the time of the catch-up HPV vaccination was only asked to those who were vaccinated. It would have been more informative to know the marital status of the women when the decision was made whether to receive HPV vaccination. However, considering the short delay between the end of the catch-up HPV vaccination and survey administration (less than three months), we do not anticipate any changes in the marital status of study participants. Fifth, study participants were not asked their vaccination date, nor whether they had been exposed to NIPH's extensive communication campaign. Therefore, we do not know their feedback on the communication campaign, which remains for further exploration after a subsequent catch-up vaccination campaign. Finally, the questionnaire was web-based and available only in Norwegian. Women with less digital competence, with language barrier or limited access to a computer may have decided not to participate.

Having a caregiver born outside of Norway, having children and being married decreased the odds of vaccination completion, while longer residence in Norway and higher level of completed education increased the odds of vaccination completion. This highlights the need to target future communication around HPV vaccination toward different ethnic communities and adapt the messages to the context of their country of origin, for example by conducting focus groups or interviews with different target groups to understand differences in attitudes toward HPV vaccination and how to effectively address those. Education materials need to be available in different languages, be adapted to different cultural contexts and include simpler, clear arguments that can reach less educated young women and their caregivers when planning HPV vaccination. Finally, more explicit messaging should be included in future HPV educational campaigns that being married and having children does not prevent HPV infections.

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No potential conflict of interest was reported by the author(s).

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Appendix A.

English translation of questionnaire – separate document.

Appendix B.

Table B1. Demographic characteristics of non-responders. Source: SSB.

	Non-responders
Age (in years)	
23	16.8
24	15.7
25	15.7
26	16.8
27	17.4
28	17.6
	100,0
Education (completed)	
Primary	22.0
Secondary	28.8
University or college	36.6
Unspecified	12.7
	100,0
Country of origin (study participant)	
Norway	73.1
EU, USA, Canada, Australia and New Zealand	10.4
Other country	16.4
Unspecified	0.1
Region of residence in Norway	
Akershus og Oslo	29.2
Hedmark og Oppland	6.4
Østlandet ellers	16.6
Agder og Rogaland	14.6
Vestlandet	15.6
Trøndelag	8.5
Nord-Norge	9.2
Total	4,966

Vaccination study

This questionnaire is about vaccination and what factors influence your choice to vaccinate or not. The questionnaire takes about ten minutes.

By responding to the form, you agree that the information may be used to compile statistics in accordance with applicable *privacy policies*.

Privacy Policy

The answers you give should only be used to create statistics and for research. Answers that can identify individuals will never be published.

The survey is voluntary, and you can withdraw at any time and demand that the information about you be deleted. You do this by calling our answering service on 62 88 56 08 or sending an e-mail to svar@ssb.no.

To make the questionnaire as short as possible, we collect some information about you from public registers that Statistics Norway has access to. This applies to information from the National Population Register, information on education from school owners and the Loan Fund and information on income from the Tax Administration and NAV. From the National Population Register, we also collect information about how many children you have and the age of your children, as well as your parents' country of birth and the period of residence in Norway. By 1 November 2020, all information on you and your legal guardians will be anonymized.

Q1

Are you aware that you have been offered a free vaccine for a limited period of time?

Yes – q2No – q3a

If "Yes" in q1

Q2

Which vaccine is this? Multiple options possible

HPV vaccine – q4

Vaccine against cervical cancer – q4

Other vaccine (open text field where study participant fills out which vaccine) – q3a

Don't know

Do not want to answer

For anyone who has not responded "the HPV vaccine" or "cervical cancer vaccine" in q2, including those who answered "No" to q1

Q3a

Do you know or have you heard of the HPV vaccine?

Yes – q4 No – q3b

If "No" in q3a

Q3b

Do you know or have you heard of a vaccine against cervical cancer?

Yes – q4 No – q5

For those who answered "Yes" in q3a or q3b and those who answered "HPV vaccine" or "Cervical cancer vaccine" in q2

Q4

HPV vaccine is the official name of the "cervical cancer vaccine."

Have you heard about the HPV vaccine ...

via SMS?

Yes

No

Don't know

Do not want to answer

On social media?

Yes

No

Don't know

Do not want to answer

On the news?

Yes

No

Don't know

Do not want to answer

From friends, colleagues or family?

Yes

No

Don't know

Do not want to answer

From health services?

Yes

No

Don't know

Do not want to answer

In another way, please specify

Yes

No

Don't know

Do not want to answer

For those who have answered "No" in q3b

Q5

Do you remember getting information about the HPV vaccine ...

via SMS?

Yes – q6

No – q16

Don't know

Do not want to answer

To those who answered "Yes" that they have received information via SMS in q4 or q5

Q6

What do you think about receiving information about the HPV vaccine or other important health services from the Norwegian Institute of Public Health via SMS?

It is good to get information via SMS – q7

I do not think it is good to get information via SMS – q8

Don't know

Do not want to answer

To those who have answered "Yes" in q6

Q7

Over a two-year period, the Norwegian Institute of Public Health sent out 5 different SMSes to remind people of the deadline for receiving the free HPV vaccine and that the vaccination consisted of several doses. What do you think about this?

It is good to be reminded
It is good to get a reminder, but five is too many
I do not think they should send a reminder, one SMS about the vaccination of offer is sufficient
Don't know
Do not want to answer
For those who have answered "HPV vaccine" or "Cervical cancer vaccine" in q2 or "Yes" in q3a or "Yes" in q3b or "Yes" in q5
Q8
Have you taken the HPV vaccine?
Yes – q9
No – q15
Don't know
Do not want to answer
To those who answered "Yes" in q8
Q9
How many doses of HPV vaccine did you take?1 dose – q102 doses – q103 doses – q11
Don't know
Do not want to answer
To those who only responded "1 or 2 doses" in q9
Q10
HPV vaccination consists of three doses for anyone over 15 years of age. **How much do you agree or disagree that the following conditions led you to not take all three doses?**
I forgot to finish the three doses
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I did not have time
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
It took too long between doses and I did not want to start again
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I became pregnant and could not complete the vaccination
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I moved and did not know where to get the vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I moved abroad
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I read that someone was skeptical about the vaccine, and became skeptical myself
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I became unsure of the side effects and did not want to take more doses
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
Q11
Where did you take the HPV vaccine?
If you took doses in different locations, you can choose several response options
Community health service
Student health service
Military
GP office
Infection control office
Other location, please specify
Don't know
Do not want to answer
Q12
Where would you preferred to get the HPV vaccine?
Community health service
Student health service
Military
GP office
Infection control office
Other location, please specify
Don't know
Do not want to answer
Q13
How much do you agree or disagree that the following conditions influenced you to take the HPV vaccine?
Information in the media
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
Information from the Norwegian Institute of Public Health via SMS and in social media
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
HPV vaccine was free
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know

Do not want to answer
Vaccination was readily available
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
My parents and/or friends thought I should take the vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
Healthcare professionals and central health authorities recommended the vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
The vaccine can prevent cervical cancer
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I or someone I know has had cell changes/cervical cancer
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Q13i Were there other conditions that influenced you to take the HPV vaccine?
Yes – please specifyNo
Don't know
Do not want to answer
Q14
How easy or difficult was it for you to find out where you could get the free HPV vaccine?
Very easy
Easy
Neither easy nor difficult
Difficult
Very difficult
Don't know
Do not want to answer
To those who answered "No" in q8
Q15
In the period from 1 November 2016 to 1 July 2019, the HPV vaccine was free for women born in 1991 or later.
How much do you agree or disagree that the following conditions led you not to take advantage of the vaccination offer?
I procrastinated this for too long
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I do not want to get vaccinated in general
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I had too little information about the HPV vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I am not sure whether the vaccine works
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I thought it was too cumbersome or had too little information about where I could get the HPV vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I am scared of syringes
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I have/had a boyfriend and did not need the vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
My parents or friends thought I should not take it
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I was afraid of the side effects that the vaccine might cause
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I have had several sexual partners, and therefore thought the vaccine would not work
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree

Completely disagree
Don't know
Do not want to answer
I have/had health problems that made me unable to take the vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
Health professionals advised me not to take the vaccine
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I was pregnant
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
I was breastfeeding
Totally agree
Fairly agree
Neither agree nor disagree
Fairly disagree
Completely disagree
Don't know
Do not want to answer
Q15o Were there any other conditions that prevented you from taking the HPV vaccine
Yes – please specifyNo
Don't know
Do not want to answer
Q16
If you were to take the vaccine, where would you prefer to take it?
Community health service
Student health service
Military
GP office
Infection control office
Annet sted, please specify
Don't know
Do not want to answer
For everyone
Q17
If you wanted to get more information about vaccines and vaccinations, where would you get this information? Multiple answers possible
Internet
Friends of colleagues
Family
Community health service
GP office
Health authorities
Other, please specify
Don't know
Do not want to answer
Q18
To what extent do you trust advice on vaccines given by health authorities
1 – To a very small extent2345
67 – To a very large extent
Don't know
Do not want to answer

Only for those who have taken the HPV vaccine («Yes» in q8)
Q19
What was your main occupation when you first took the HPV vaccine?
Student at university or college
Pupil in upper secondary school/high school
Apprentice
Professionally active
Job seeker
Military
On leave
Working at home
Free year
Insured
Sick leave
Other, please specify
Don't know
Do not want to answer
For everyone
Q 20
What is your main occupation now?
Student at university or college
Pupil in upper secondary school/high school
Apprentice
Professionally active
Job seeker
Military
On leave
Working at home
Free year
Insured
Sick leave
Other, please specify
For everyone
Q21
What is your highest completed education?
University/college
High school
Primary school or lower
Only for those who have taken the HPV vaccine («Yes» in q8)
Q22
What was your marital status when you first took the HPV vaccine?
Single
Had boyfriend/in a relationship
Cohabiting
Married
Separated
Divorced
Widow
Don't know
Do not want to answer
For everyone
Q23
What is your marital status now?
Single
Have boyfriend/in a relationship
Cohabiting
Married
Separated
Divorced
Widow
Q24
Do you have children
Yes – go to q25
No – done
Q25
Did you deliver children in the period 1.11.2016 to 31.12.2018?
Yes
No
Year of birth and place of residence are retrieved from the register.