## LITERATURE REVIEW

A literature review was undertaken to identify published country-level data for HPV immunization coverage.

Using the Pubmed search engine (https://pubmed.ncbi.nlm.nih.gov/) "Title/Abstract" records were searched for the following terms:

((human papilloma virus OR HPV) AND (vaccination OR immunization) AND (uptake OR coverage)).

The search yielded 1,607 results; these were limited to publication years 2015 to 2020, yielding 944 results. These were hand searched to identify studies measuring HPV immunization coverage representative of national cohorts, excluding studies evaluating narrower groups (eg ethnic) or recruiting from otherwise selective populations (eg from obstetric clinics). Where males and females were included, but reported separately, coverage rates for females were extracted. Thirty studies were identified, listed in the table below. For each study, country and year of data is identified, together with cohort age and sample size. Where immunization coverage is differentiated between first dose and course completion, this is also recorded.

Three types of data were reported: a) from registries based on social insurance, health records or school enrolment, b) surveys, and c) reimbursement records. Surveys are helpful where population based registries do not exist; these are most developed in the United States. Other surveys mostly have small sample sizes, limiting generalizability.

This literature review confirms that there is little published data on HPV immunization coverage outside high income countries, and even in these countries, coverage rates vary widely.



Spayne J, Hesketh T. *BMJ Open* 2022; 11:e052016. doi: 10.1136/bmjopen-2021-052016

| First author, year | Country | Year of Data | Data Source | Sex | n | Cohort Age | Coverage % | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1st dose | Complete |
| Bonanni 2015(1) | Italy | 2014 | Registry | Female | .. | 11 | .. | 71 |
| Borena 2016(2) | Austria | 2014 | Survey | Female | 254 | 10 | 59 | .. |
| Braeye 2020(3) | Italy | 2018 | Registry | Female | 2,011,666 | 15 | 76 | .. |
| | Spain | | | | | | 77-87 | .. |
| | UK | | | | | | 60 | .. |
| | Denmark | | | | | | 88 | .. |
| Buscail 2016(4) | France | 2015 | Survey | Female | 209 | 16-18 | .. | 30 |
| Corriero 2017(5) | USA | 2014 | Survey | Female | 2,147 | 9-33 | .. | 67 |
| Danial 2016(6) | Malaysia | 2015 | Survey | Female | 337 | Over 18 | .. | 9 |
| Ding 2019(7) | USA | 2017 | Survey | All | 3,426 | 18-26 | 32-38 | 17-19 |
| Dorji 2015(8) | Bhutan | 2014 | Registry | Female | 7,575 | 12 | 98 | 94 |
| Fonteneau 2015(9) | France | 2014 | Reimbursement | Female | | 16 | .. | 19 |
| Garon 2019(10) | Cambodia | 2017 | Survey | Female | 315 | 9 | .. | 84 |
| Hansen 2020(11) | Denmark | 2029 | Registry | Female | | 12-15 | 50-95 | .. |
| Latsuzbaia 2018(12) | Luxemburg | 2016 | Reimbursement | Female | 39,610 | 13-25 | 62 | 56 |
| Lewis 2018(13) | USA | 2016 | Survey | Female | 2,800 | 9-13 | 22 | 9 |
| | | | | | | 14-19 | 55 | 33 |
| | | | | | | 20-24 | 56 | 33 |
| | | | | | | 25-29 | 37 | 28 |
| | | | | | | 30-34 | 17 | 12 |
| | | | | | | 35-39 | 6 | 3 |
| | | | | | | 40-59 | 2 | 0 |
| Lin 2017(14) | USA | 2016 | Registry | All | 1,438,161 | 9-13 | .. | 53 |
| Martin-Merino 2019(15) | Spain | 2016 | Registry | Female | 388,690 | 9-18 | 38 | .. |
| Muhamad 2018(16) | Malaysia | 2016 | Registry | Female | 224,761 | 12-13 | .. | 100 |
| Quendri 2018(17) | Netherlands | 2016 | Registry | Female | | 12-13 | .. | 46 |
| Reagan-Steiner 2016(18) | USA | 2015 | Survey | Female | | 13-17 | 63 | .. |
| Reagan-Steiner 2015(19) | USA | 2014 | Survey | Female | | 13-17 | 60 | .. |
| Riesen 2018(20) | Switzerland | 2016 | Survey | Female | 3,108 | 14-16 | 61 | .. |
| Skufca 2018(21) | Finland | 2016 | Registry | Female | 240,605 | 11-15 | 56 | .. |
| Smith 2019(22) | Canada | 2017 | Registry | Female | | .. | .. | 55-92 |
| Suppli 2018(23) | Denmark | 2016 | Registry | Female | 243,415 | 16-18 | 92 | 79 |
| | | | | | | 15 | 87 | 71 |
| | | | | | | 14 | 81 | 53 |
| | | | | | | 13 | 53 | 29 |
| | | | | | | 12 | 42 | 15 |
| Thompson 2019(24) | USA | 2016 | Survey | Female | 1,879 | 18-26 | 46 | .. |
| Walker 2017(25) | USA | 2016 | Survey | All | 20,475 | 13-17 | 60 | .. |
| Walker 2018(26) | USA | 2017 | Survey | All | 20,949 | 13-17 | 66 | .. |
| Walker 2019(27) | USA | 2018 | Survey | All | 18,700 | 13-17 | 68 | .. |
| Wang 2019(28) | Sweden | 2014 | Registry | Female | 689,676 | 11-24 | 66-89 | .. |
| Williams 2017(29) | USA | 2015 | Survey | All | 1,806 | 19-26 | 42 | .. |
| Wymann 2018(30) | Switzerland | 2014 | Survey | Female | 2,363 | 18-24 | 51 | 41 |



Spayne J, Hesketh T. *BMJ Open* 2022; 11:e052016. doi: 10.1136/bmjopen-2021-052016

## References


1. Bonanni P, Ferro A, Guerra R, et al. Vaccine coverage in Italy and assessment of the 2012-2014 National Immunization Prevention Plan. *Epidemiol Prev*. 2015;**39**(4 Suppl 1):146-58.
2. Borena W, Luckner-Hornischer A, Katzgraber F, Holm-von Laer D. Factors affecting HPV vaccine acceptance in west Austria: Do we need to revise the current immunization scheme? Papillomavirus Res. 2016;2:173-7.
3. Braeye T, Emborg HD, Llorente-Garcia A, et al. Age-specific vaccination coverage estimates for influenza, human papillomavirus and measles containing vaccines from seven population-based healthcare databases from four EU countries - The ADVANCE project. *Vaccine*. 2020;**38**(16):3243-54.
4. Buscail C, Gagnière B. Vaccination coverage of adolescents: Results of a Defense and Citizenship Day-based survey. *Med Mal Infect*. 2016;**46**(1):25-31.
5. Corriero R, Gay JL, Robb SW, Stowe EW. Human Papillomavirus Vaccination Uptake before and after the Affordable Care Act: Variation According to Insurance Status, Race, and Education (NHANES 2006-2014). *J Pediatr Adolesc Gynecol*. 2018;**31**(1):23-7.
6. Danial M, Sivasangari S, Arulappen A, Ong L. Journey of the Human Papillomavirus (HPV) in a Developing Country over 5 Years (2010 - 2015). *Asian Pac J Cancer Prev*. 2016;**17**(3):1363-8.
7. Ding X, Tian C, Wang H, Wang W, Luo X. Characteristics associated with human papillomavirus vaccination initiation and completion among young adults. *Am J Infect Control*. 2019;**47**(9):1096-101.
8. Dorji T, Tshomo U, Phuntsho S et al. Introduction of a National HPV vaccination program into Bhutan. *Vaccine*. 2015;**33**(31):3726-30.
9. Fonteneau L, Ragot M, Parent du Châtelet I, Guthmann JP, Lévy-Bruhl D. The use of reimbursement data for timely monitoring of vaccination coverage: the example of human papillomavirus vaccine following public concerns about vaccine safety. *BMC Public Health*. 2015;**15**:1233.
10. Garon J, Wuddhika IV, Sreenivasan N, et al. Community-based household assessment of human papillomavirus (HPV) vaccination coverage and acceptability - HPV vaccine demonstration program, Cambodia - 2017. *Vaccine*. 2019;**37**(9):1202-8.
11. Hansen PR, Schmidtblaicher M, Brewer NT. Resilience of HPV vaccine uptake in Denmark: Decline and recovery. *Vaccine*. 2020;**38**(7):1842-8.
12. Latsuzbaia A, Arbyn M, Weyers S, Mossong J. Human papillomavirus vaccination coverage in Luxembourg - Implications of lowering and restricting target age groups. *Vaccine*. 2018;**36**(18):2411-6.
13. Lewis RM, Markowitz LE. Human papillomavirus vaccination coverage among females and males, National Health and Nutrition Examination Survey, United States, 2007-2016. *Vaccine*. 2018;**36**(19):2567-73.
14. Lin X, Rodgers L, Zhu L, Stokley S, Meites E, Markowitz LE. Human papillomavirus vaccination coverage using two-dose or three-dose schedule criteria. *Vaccine*. 2017;**35**(43):5759-61.
15. Martin-Merino E, Llorente-Garcia A, Castillo Cano B, Montero Corominas D, Huerta-Alvarez C. The Longitudinal Incidence of Human Papillomavirus Vaccination in Spanish Primary Care in the First 10 Years After Approval. *Pharmaceut Med*. 2019;**33**(6):519-30.
16. Muhamad NA, Buang SN, Jaafar S, et al. Achieving high uptake of human papillomavirus vaccination in Malaysia through school-based vaccination programme. *BMC Public Health*. 2018;**18**(1):1402.
17. Qendri V, Schurink-Van 't Klooster TM, Bogaards JA, Berkhof J. Ten years of HPV vaccination in the Netherlands: current evidence and future challenges in HPV-related disease prevention. *Expert Rev Vaccines*. 2018;**17**(12):1093-104.
18. Reagan-Steiner S, Yankey D, Jeyarajah J, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years - United States, 2015. *MMWR Morb Mortal Wkly Rep*. 2016;**65**(33):850-8.

19. Reagan-Steiner S, Yankey D, Jeyarajah J, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years--United States, 2014. *MMWR Morb Mortal Wkly Rep*. 2015;**64**(29):784-92.
20. Riesen M, Konstantinoudis G, Lang P, et al. Exploring variation in human papillomavirus vaccination uptake in Switzerland: a multilevel spatial analysis of a national vaccination coverage survey. *BMJ Open*. 2018;**8**(5):e021006.
21. Skufca J, Ollgren J, Artama M, Ruokokoski E, Nohynek H, Palmu AA. The association of adverse events with bivalent human papilloma virus vaccination: A nationwide register-based cohort study in Finland. *Vaccine*. 2018;**36**(39):5926-33.
22. Smith A, Baines N, Memon S, et al. Moving toward the elimination of cervical cancer: modelling the health and economic benefits of increasing uptake of human papillomavirus vaccines. *Curr Oncol*. 2019;**26**(2):80-4.
23. Suppli CH, Hansen ND, Rasmussen M, Valentiner-Branth P, Krause TG, Mølbak K. Decline in HPV-vaccination uptake in Denmark - the association between HPV-related media coverage and HPV-vaccination. *BMC Public Health*. 2018;**18**(1):1360.
24. Thompson EL, Rosen BL, Maness SB. Social Determinants of Health and Human Papillomavirus Vaccination Among Young Adults, National Health Interview Survey 2016. *J Community Health*. 2019;**44**(1):149-58.
25. Walker TY, Elam-Evans LD, Singleton JA, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years - United States, 2016. *MMWR Morb Mortal Wkly Rep*. 2017;**66**(33):874-82.
26. Walker TYMPH, Elam-Evans LDP, Yankey DP, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years - United States, 2017. Atlanta: U.S. Center for Disease Control; 2018 Aug 24.
27. Walker TY, Elam-Evans LD, Yankey D, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years - United States, 2018. *MMWR Morb Mortal Wkly Rep*. 2019;**68**(33):718-23.
28. Wang J, Ploner A, Sparén P, et al. Mode of HPV vaccination delivery and equity in vaccine uptake: A nationwide cohort study. *Prev Med*. 2019;**120**:26-33.
29. Williams WW, Lu PJ, O'Halloran A, et al. Surveillance of Vaccination Coverage among Adult Populations - United States, 2015. *MMWR Surveill Summ*. 2017;**66**(11):1-28.
30. Wymann MN, Zographos AS, Altpeter E, Spicher VM, Low N, Mäusezahl-Feuz M. Human papillomavirus vaccine uptake in adolescence and adherence to cervical cancer screening in Switzerland: a national cross-sectional survey. *Int J Public Health*. 2018;**63**(1):105-14.