

**Title:** Are healthcare professionals prepared to implement HPV testing? A review of psychosocial determinants of HPV test acceptability in primary cervical cancer screening

**Running title:** Psychosocial Determinants of HPV Testing

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## 1     **1. Abstract**

2     **Background.** Guidelines for cervical cancer screening have been updated to include human  
3     papillomavirus (HPV) testing, which is more sensitive compared to cytology in detecting  
4     cervical intraepithelial neoplasia. Because of its increased sensitivity, a negative HPV test is  
5     more re-assuring for a woman that she is at low-risk for precancerous cervical lesions than a  
6     negative Pap test. Prompted by the inadequate translation of HPV test-based screening guidelines  
7     into practice, we aimed to synthesize the literature regarding healthcare providers (HCPs)  
8     knowledge, attitudes and practices related to HPV testing and the influence of psychosocial  
9     factors on HCPs acceptability of HPV testing in primary cervical cancer screening.

10    **Methods:** We searched Medline, Embase, PsycINFO, CINAHL, Global Health, and Web of  
11    Science for journal articles from January 1, 1980 to July 25, 2018. A narrative synthesis of HCPs  
12    knowledge, attitudes and practices related to HPV testing is provided. Informed by the Patient  
13    Pathway framework, we used deductive thematic analysis to synthesize the influence of  
14    psychosocial factors on HCPs acceptability of HPV testing.

15    **Results:** The most important HCPs knowledge gaps are related to the superior sensitivity of the  
16    HPV test and age specific guidelines recommendations for HPV testing. 30-50% of HCPs are not  
17    compliant with guideline recommendations for HPV testing e.g., screening at shorter intervals  
18    than recommended. Barriers, facilitators and contradictory evidence of HCPs' acceptability of  
19    the HPV test are grouped by category: a) factors related to the HCP; b) patient intrinsic factors;  
20    c) factors corresponding to HCP's practice environment; d) healthcare system factors.

21    **Conclusions:** HCP's adherence to guidelines for HPV testing in cervical cancer screening is  
22    suboptimal and could be improved by specialty organizations ensuring consistency across  
23    guidelines. Targeted educational interventions to address barriers of HPV test acceptability

24 identified in this review may facilitate the translation of HPV testing recommendations into  
25 practice.

26 **Keywords:** HPV test; cervical cancer screening; healthcare providers; knowledge, attitudes and  
27 beliefs; HPV test acceptability; cervical cancer screening guidelines

28

## 29 **2. Introduction**

30 Worldwide, approximately 530,000 women are newly diagnosed with cervical cancer  
31 annually, and almost 266,000 will die from the disease<sup>(1)</sup>. As long-term persistent infection with  
32 an oncogenic genotype of human papillomavirus (HPV) has been found to be a necessary risk  
33 factor for developing cervical cancer<sup>(2,3)</sup>, recommendations for cervical screening to include the  
34 HPV DNA test together with cytology (co-testing) were issued in the US as early as 2002<sup>(4)</sup>. In  
35 recent years, evidence has accumulated that in the primary cervical cancer screening setting,  
36 HPV testing has superior sensitivity compared to cytology in detecting cervical intraepithelial  
37 neoplasia<sup>(5-8)</sup> and that screening intervals can be extended to five years or beyond—compared to  
38 three years for cytology alone—in women with a negative HPV test<sup>(9-11)</sup>. Consequently, in the last  
39 decade, recommendations of major health organizations in the US, Europe, and Australia have  
40 been updated repeatedly and currently include HPV testing—either as a stand-alone test or as co-  
41 testing—for primary cervical cancer screening of women older than 30 years (or even as low as 25  
42 years in some jurisdictions)<sup>(12-15)</sup>.

43 In the context of continuous change in primary cervical cancer screening recommendations  
44 (for both cytology and HPV testing) related to women's age of screening initiation, age-specific  
45 screening intervals and screening discontinuation, research indicates that less than 20% of  
46 healthcare providers (HCPs i.e., family practitioners (FPs), internal medicine specialists (IMs),  
47 obstetrics-gynecologists (OB/GYNs), nurse practitioners (NPs), physician assistants (PAs)) in the

48 US follow all age-related guideline recommendations released in 2009 or in 2012 by the  
49 American College of Obstetricians and Gynecologists (ACOG), American Cancer Society  
50 (ACS), and the United States Preventive Services Task Force (USPSTF)<sup>(16, 17)</sup>. Poor practice  
51 implementation of HPV testing guidelines have been driven by HCPs' worry that increasing  
52 screening intervals with the HPV test would put women at increased risk of pre-cancer and  
53 cancer<sup>(18)</sup> and perception that the HPV test alone is less effective than cytology (Pap) in detecting  
54 pre-cancerous lesions<sup>(19)</sup>. HCPs are concerned that gynecologic health issues other than cervical  
55 cancer prevention could be missed if yearly examinations are not performed. Women might feel  
56 less motivated to consult a doctor annually if the cervical cancer screening interval is increased  
57 to 3 years or more by using HPV test-based screening instead of annual Pap screening<sup>(17, 20)</sup>.

58 To our knowledge, there has been no review of psychosocial factors that influence HCPs'  
59 recommendations of the HPV test in primary screening for cervical cancer to date. This study  
60 synthesizes the literature regarding current HCPs practices and attitudes related to HPV testing  
61 and the influences of psychosocial factors on HCPs acceptability of HPV testing in primary  
62 cervical cancer screening. It is important to more comprehensively understand HCPs' concerns  
63 related to modified cervical cancer screening recommendations in order for interventions to  
64 adequately address these concerns and more effectively translate the latest guideline  
65 recommendations for HPV testing into practice to ensure optimal cervical cancer screening.

### 66 **3. Materials and Methods**

67 The review was guided by the following three research questions: 1) "What are HCPs'  
68 perceptions related to HPV testing in primary screening for cervical cancer?", 2) "How is HPV  
69 testing used by HCPs in primary screening for cervical cancer?", and 3) "How do psychosocial  
70 factors influence HCPs' acceptability of HPV testing in primary screening for cervical cancer?".

71 We searched Medline, Embase, PsycINFO, CINAHL, Global Health, and Web of Science for  
72 journal articles between January 1, 1980 and July 25, 2018. The search strategy was developed  
73 for Medline by our research team and adapted for the other databases<sup>1</sup>. The following eligibility  
74 criteria were applied: 1) Population: HCPs involved in *primary screening*<sup>2</sup> for cervical cancer;  
75 2) Outcome: knowledge, attitudes, beliefs, and acceptability<sup>3</sup> related to using HPV testing in  
76 primary cervical cancer screening; 3) Study design: empirical studies, without restrictions of  
77 study methodology; and 4) Languages: English, French, or German. References retrieved from  
78 database searches were saved in EndNote and duplicates were removed. We used a combination  
79 of keywords in EndNote to identify references related to healthcare providers and HPV test use  
80 (Figure 1). Then, we selected references in two phases: in phase one, we screened for eligible  
81 articles based on titles and abstracts, and in phase two, full text articles were retrieved and read,  
82 and the final set of eligible articles was identified. In phase two, the selection of references was  
83 performed independently by two researchers (KW and OT) and disagreements on whether an  
84 article should be retained were mediated by the senior researcher (ZR). In the second phase, we  
85 decided to exclude articles referring to HCPs not directly involved in the clinical decision of  
86 using the HPV test in primary screening (e.g., HCPs working in laboratories, students, etc).  
87 Qualitative (e.g., quotes) and quantitative (e.g., proportions, odds ratios) data from  
88 included studies were extracted and organized in an Excel spreadsheet in the following  
89 categories and were used in the data synthesis phase: knowledge, attitudes/beliefs, practice and  
90 factors related to HPV test acceptability. In line with the first two research questions, we provide

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<sup>1</sup> The search strategy for Medline is available at:  
[https://www.crd.york.ac.uk/PROSPEROFILES/78254\\_STRATEGY\\_20181017.pdf](https://www.crd.york.ac.uk/PROSPEROFILES/78254_STRATEGY_20181017.pdf)

<sup>2</sup> In primary screening, the HPV test (including HPV co-testing) is used in women with no history of cervical cytological abnormalities i.e., abnormal Pap results. The addition of the HPV DNA test to cytology (Pap test) is known as co-testing.

<sup>3</sup> The term acceptability defined herein includes HPV test uptake (already recommended by the HCPs); and intentions or willingness to recommend the HPV test

91 a narrative synthesis of HCPs' knowledge, attitudes and beliefs related to the HPV test and its  
92 uptake and intentions to be used in primary screening for cervical cancer. For the third research  
93 question, we used the Patient Pathway framework<sup>(21)</sup>— a conceptual model that categorizes  
94 factors with influence on the patient-HCP encounter and the level of preventive care that a  
95 patient receives—to synthesize the influence of psychosocial factors on HPV test acceptability.  
96 The Patient Pathway framework has been previously used in explaining screening  
97 mammography referral rates<sup>(22)</sup> and stipulates that the probability that a patient will receive  
98 screening services by clinicians is determined by factors related to the HCP, patient intrinsic  
99 factors, and characteristics specific to patients' and HCP's environment<sup>(21)</sup>. In our synthesis, we  
100 conceptualized environmental factors as two different entities: factors corresponding to HCP's  
101 practice environment and healthcare system factors. Informed by the Patient Pathway framework  
102 we performed *deductive* qualitative thematic analysis and grouped psychosocial factors into four  
103 categories: a) factors related to the HCP, b) patient intrinsic factors (from the perspective of  
104 HCPs), c) factors corresponding to HCP's practice environment and d) healthcare system factors.  
105 For each category, we synthesized evidence of factors' influence on HPV test acceptability into  
106 barriers, facilitators, and contradictory evidence (i.e., evidence for both barriers and facilitators),  
107 and presented the results in tabular form. Deductive analysis was performed by OT and  
108 supervised by ZR.

#### 109 **4. Results**

110 In Figure 1 we present the study selection diagram. In total, we retained 32 studies, four used  
111 qualitative<sup>(23-26)</sup> and 28 used quantitative methodology<sup>(2, 16-20, 27-47)</sup>. Included studies covered  
112 HCPs opinions from five continents: Europe (i.e., UK<sup>(47)</sup>, Germany<sup>(38)</sup> and Italy<sup>(39)</sup>), North  
113 America (i.e., Canada<sup>(24, 26, 35)</sup> and the US<sup>(2, 16-20, 23, 29-31, 34, 36, 40-44, 46)</sup>), Africa (i.e., Cameroon<sup>(28)</sup>

114 and Nigeria<sup>(25)</sup>), Asia (i.e., China<sup>(27)</sup>, Jordan<sup>(45)</sup>, South Korea<sup>(33)</sup> and Thailand<sup>(37)</sup>) and Oceania  
115 (i.e., Australia<sup>(32)</sup>). Details of each included study can be found in Appendix A.

116

#### 117 **4.1 Knowledge**

118 While HCPs were found to have up-to-date knowledge related to the prevalence of HPV  
119 infection and the causal relationship between persistent infection with high-risk HPV and  
120 cervical cancer, gaps in knowledge were identified as fewer than 50% of HCPs in Hong Kong  
121 knew that infection can occur in the absence of identifiable sexual risk factors and that HPV  
122 genotypes associated with cervical cancer differ from those associated with genital warts<sup>(27)</sup>. As  
123 expected, HCPs' knowledge about HPV and HPV testing increased over time after 2006 when  
124 the first HPV vaccine was approved which represented a turning point in cervical cancer  
125 prevention. While in 2006, 10% of US physicians were not even aware that an HPV test was  
126 already available<sup>(36)</sup>, data from 2011 showed that 47% of physicians and nurses in Cameroon  
127 knew that the HPV test can be used for cervical cancer screening<sup>(28)</sup>. In the UK, Patel et al (2016)  
128 found increased HPV test knowledge among nurses (>70% correct answers) who participated in  
129 regular screening education sessions; their knowledge gaps were related to the sample collection  
130 procedure for HPV testing and reassurance offered by a negative HPV test result for low-risk of  
131 cervical lesions<sup>(47)</sup>.

132 Surprisingly, despite recommendations of specialty organizations in the US, Europe and  
133 Australia to include HPV testing in primary screening for cervical cancer<sup>(12-15)</sup>, HPV test  
134 knowledge among HCPs remains insufficient, highlighting a lack of understanding of the  
135 indications for HPV testing and implications of a positive result. Thus, more than half of HCPs

136 in Hong Kong (in 2010) and Italy (in 2015) were unaware that HPV testing (including co-  
137 testing) is more sensitive than cytology in detecting high-grade cervical intraepithelial  
138 neoplasias<sup>(27, 48)</sup>, that the HPV test is not generally recommended in primary screening of women  
139 younger than 30<sup>(27, 48)</sup>, that a negative HPV test (without cytology), in Italy, allows extension of  
140 the cervical cancer screening interval to five years<sup>(48)</sup>, and that no recommendations have been  
141 issued for more frequent HPV testing for cervical cancer in women diagnosed with genital  
142 warts<sup>(27)</sup>. In the US, Teoh et al. (2015) found that only 5.7% of HCPs were knowledgeable about  
143 all age specific cervical cancer guidelines updated in 2012 by the ACS, ASCCP and ASCP<sup>4</sup> but  
144 83.7% of respondents knew that in women 30-65 years the recommended screening interval for  
145 co-testing (combined Pap and HPV test) increased from 3 to 5 years<sup>(40)</sup>.

146 Among OB/GYNs in Italy, correlates of higher HPV test knowledge in primary screening for  
147 cervical cancer were found to be related to: HCPs perceiving their cervical cancer screening  
148 knowledge to be good to excellent (OR = 1.46; CI: 1.12–1.91), higher number of hours worked  
149 (OR = 1.02; CI: 1.01–1.03), and knowledge that the Pap test is not recommended annually<sup>(48)</sup>.

## 150 **4.2 Attitudes and beliefs**

151 HCP's attitudes and beliefs were grouped into five sub-categories: acceptability of guidelines,  
152 beliefs about test efficacy, communication of results to patients, HPV self-sampling and point of  
153 care testing, and beliefs about screening intervals.

### 154 **4.2.1 Acceptability of guidelines**

155 Irwin et al. (2006) and Boone et al. (2014) found that half of US HCPs in their study  
156 considered cervical cancer screening guidelines valuable<sup>(16, 36)</sup> while 35% of all HCPs do not

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<sup>4</sup> ACS: American Cancer Society; ASCCP: American Society for Colposcopy and Cervical Pathology; ASCP: American Society for Clinical Pathology;



157 consider current guidelines clinically reliable and appropriate (including 59% of obstetrics-  
158 gynecologists (OB/GYNs), 28% of family practitioners (FPs), 38% of nurse practitioners (NPs)  
159 and physician assistants (PAs), and 26% of internal medicine specialists (IMs))<sup>(16)</sup>. While over  
160 90% of OB/GYNs in Italy<sup>(48)</sup> and over 80% of colposcopists in Canada<sup>(35)</sup> were comfortable  
161 with recommendations endorsing HPV testing in primary screening for cervical cancer and  
162 believed that guidelines released by scientific associations and national and international  
163 agencies are very useful in cervical cancer prevention, 41% of OB/GYNs in Italy suggested that  
164 cervical cancer screening should be done annually (against recommendations), irrespective of the  
165 test used<sup>(48)</sup>.

#### 166 **4.2.2 Beliefs about test efficacy**

167 Approximately 85% of HCPs in the US perceived liquid-based cytology as the most effective  
168 test for reducing cervical cancer mortality, followed by co-testing (64-82%) and Pap (~50%)<sup>(29,</sup>  
169 <sup>30, 34, 43)</sup>. Despite the fact that over 70% of HCPs (OB/GYNs, IMs and FPs) in the US agree that  
170 the HPV test alone represents an effective screening modality<sup>(19)</sup>, it was generally perceived to be  
171 less effective than Pap<sup>(19, 38)</sup>, co-testing<sup>(19)</sup>, or colposcopy<sup>(38)</sup>. Among Italian OB/GYNs, Caglioti  
172 et al. (2017) found that the preferred cervical cancer screening test in women  $\geq 30$  years was Pap  
173 (~39%) (followed by an HPV test in case of an abnormal Pap test); about 28% of OB/GYNs  
174 preferred the HPV test (with triage using the Pap test in case of a positive HPV-DNA test) or co-  
175 testing<sup>(48)</sup>. In contradiction with recommendations for cervical cancer screening, ~41% of  
176 OB/GYNs preferred the HPV test alone to screen women aged  $< 30$  years<sup>(48)</sup>. In less developed  
177 healthcare systems, OB/GYNs believe that introducing HPV testing into antenatal care would be  
178 an innovation due to its increased sensitivity in detecting precancerous lesions and could  
179 contribute to increasing screening uptake<sup>(25)</sup>. Generally, over 70% of HCPs consider co-testing

180 easy to implement and useful in planning next steps after an abnormal Pap result and in  
181 estimating the cancer risk<sup>(41)</sup>.

#### 182 **4.2.3 Communication of results to patients**

183 Lin et al. (2015) found that 75% of HCPs ordering a co-test, would engage in discussing  
184 possible results with their patients; compared to Pap positive and HPV test positive (co-test)  
185 results, HCPs were more likely to believe that Pap negative and HPV positive co-test results  
186 would be too complicated for patients to understand and could trigger patients' worries related to  
187 treatment options<sup>(42)</sup>. HCPs believe that providing positive HPV test results require appropriate  
188 communication strategies to alleviate women's stigma associated with an sexually transmitted  
189 infection (STI) diagnosis<sup>(26)</sup>.

#### 190 **4.2.4 HPV self-sampling and point of care testing**

191 HPV testing on self-collected cervical samples (i.e., self-sampling) represents an alternative to  
192 physician collected samples and is performed by using a specially designed self-sampling  
193 devices which are commercially available in many countries. Interviews with HCPs revealed that  
194 discussing the self-collection option with under-screened women is probably more important  
195 than offering them alternative diagnostic procedures (i.e., cytology versus HPV testing)<sup>(26)</sup>.  
196 Trope et al (2009) found high perceived benefits and increased preference among field-oriented  
197 HCPs (compared to hospital-oriented) for a new hypothetical protocol that includes HPV self-  
198 sampling at home for women living in villages, followed by visual inspection with acetic acid  
199 (VIA) in HPV positive women; this protocol would represent an alternative to performing VIA  
200 in all women<sup>(37)</sup>. In the US Affiliated Pacific Islands, more than 30% of HCPs felt that a point-  
201 of-care HPV test (which can identify high-risk HPV types faster than the standard HPV test,

202 allowing for therapeutic measures to be taken on the same day) would be better than the  
203 conventional HPV test<sup>(34)</sup>.

#### 204 **4.2.5 Beliefs about screening intervals**

205 Encouragingly, Regier et al. (2013) found a significant increase over time in the proportion of  
206 colposcopists who openly advocate for HPV testing as the primary tool in cervical cancer  
207 screening (19% increase from 2010 to 2011, CI: 0.01–0.38); colposcopists' confidence that their  
208 personal attitudes would affect family practitioners' attitudes toward primary HPV testing  
209 increased by 13% from 2010 to 2011 (CI: 0.01–0.30)<sup>(35)</sup>. Most HCPs showed positive attitudes  
210 towards extending the screening interval in women  $\geq 30$  years with normal co-test results;  
211 providers who recommended a three year interval after a normal co-test, reported more often that  
212 extending routine screening to three years would be good (80%), easy (67%) and beneficial  
213 (68%) compared to providers who recommended annual screening after a normal co-test ( $p <$   
214  $.05$ )<sup>(18)</sup>. Roland et al. (2013) found that after normal co-test results, ~24% of HCPs perceived  
215 extending the screening interval in women  $\geq 30$  years as being harmful, difficult or bad<sup>(20)</sup>. In  
216 2010 and 2011, 40% and 53% of colposcopists, respectively, felt that four years between HPV  
217 tests was too long<sup>(35)</sup>. Benard et al. (2016) found that educational interventions (grand rounds,  
218 academic detailing sessions, etc.) significantly increased the odds of HCPs reporting that  
219 extending the screening interval for women with a normal co-test result to three years would be  
220 good (OR 6.45,  $p = 0.038$ ), easy (OR = 5.18,  $p = 0.032$ ), beneficial (OR = 8.53,  $p = 0.034$ ), and  
221 that it would not cause patients to lose contact with the medical system (OR = 9.80,  $p =$   
222  $0.044$ )<sup>(41)</sup>.

### 223 4.3 Practice and intentions

224 In Table 1, we present a synopsis of the applicable cervical screening recommendations used  
225 by each author in relation to the year of data collection as shown in the far right-hand column.  
226 Against recommendations for age-specific practices, 31-43% of HCPs would prematurely initiate  
227 cervical screening before age 21 with either cytology or co-testing<sup>(16, 17)</sup>. For women in the age  
228 range 21-29, practitioners generally over-screened by performing annual Pap tests (74% of  
229 OB/GYNs)<sup>(17)</sup>, 35-85% of HCPs (lowest proportion among OB/GYNs) inappropriately screened  
230 with the co-test<sup>(36, 40, 44, 46)</sup> and recommended it yearly or every three years (13-42% of  
231 OB/GYNs, FPs, IMs, NPs, PAs)<sup>(16, 44)</sup>. Cooper et al. (2017) found that for women less than 25  
232 years old, approximately 24% of OB/GYNs and 43-61% of FPs and IMs would incorrectly  
233 recommend the HPV test alone<sup>(46)</sup>. In women aged 30-65 years, reported co-testing use is highly  
234 variable: 28-80% among HCPs in the US<sup>(17, 19, 20, 30, 36, 40)</sup> and 28% among OB/GYNs in Italy<sup>(39)</sup>.  
235 In the US, 23-43% of HCPs stated they do not conduct an HPV test at all in women 30-65 years  
236 old<sup>(17, 30)</sup>. In women aged 30 to 65 years, with a normal Pap result and negative HPV test results,  
237 over-screening remained an issue as 25-48% of HCPs (higher among OB/GYN than FP)  
238 perform/would perform co-testing every three years instead of the recommended five years<sup>(16, 40,</sup>  
239 <sup>46, 48)</sup> or even at one or two year intervals (20-55% of physicians)<sup>(19, 30, 41, 46, 48)</sup>. After a negative  
240 HPV test, 44% of Italian OB/GYNs comply with European guidelines and recommend the next  
241 HPV test after five years<sup>(48)</sup>. In women  $\geq 30$  years old, most OB/GYNs (78-84%), and to a lesser  
242 extent IMs and FPs (45-64%) prefer to use the Pap test in primary screening, with triage using  
243 HPV testing in case of a positive Pap<sup>(30, 48)</sup>. Remarkably, Perkins et al. (2013) found that 53% of  
244 OB/GYN still perform annual Pap in women older than 30 years<sup>(17)</sup>. After age 65, 14-50% of

245 providers continue to recommend ongoing screening<sup>(16, 17, 40)</sup> and ~11% continue to use co-  
246 testing<sup>(16, 40)</sup>.

247 HCPs reported low to medium intentions (34-60%) to change their screening practices from  
248 annual cytology to extended three or five yearly co-testing in women aged >25 years<sup>(32, 33)</sup> or >  
249 30 years old women<sup>(43)</sup>, if new recommendations were about to be released. Intentions of HCPs  
250 to recommend HPV self-sampling varied between 32-78%, if the test were proven to have high  
251 sensitivity, specificity, cost-effectiveness and were acceptable by the patient<sup>(31, 34)</sup>.

#### 252 **4.4 Influence of psychosocial factors on HCPs acceptability of HPV testing**

253 In Table 2 we present (informed by the Patient Pathway framework) the influence of factors  
254 on HPV test acceptability grouped into: 1) factors related to the HCP, 2) patient intrinsic factors,  
255 3) factors corresponding to HCP's practice environment and 4) healthcare system factors.

### 256 **5. Discussion**

257 In the present review, we included published articles of qualitative and quantitative  
258 methodology to provide the most comprehensive synthesis of psychosocial factors (i.e.,  
259 knowledge, attitudes and behaviors) associated with HCPs acceptability of HPV testing in  
260 primary cervical cancer screening.

261 Surprisingly, we found that 30-50% of HCPs did not follow age-specific guideline  
262 recommendations for HPV testing and that over-screening (e.g., screening at shorter intervals  
263 than recommended by guidelines) with the HPV test and/or cytology represents a widespread  
264 practice. In the context of HPV-based testing, over-screening (e.g., beginning of screening before  
265 25 years, yearly testing in women aged 30-65) could inflict psychological distress on women  
266 receiving a positive HPV test result, has no clinical relevance since most HPV infections are  
267 cleared by the immunological system, and requires unnecessary medical costs. Insufficient

268 knowledge of cervical cancer screening guidelines<sup>(40)</sup> and HPV test knowledge gaps (e.g., higher  
269 sensitivity of the HPV test compared to cytology (Pap) in detecting high-grade cervical  
270 intraepithelial neoplasia and/or a negative HPV test allowing the extension of screening intervals  
271 to 5 years or beyond)<sup>(27, 39)</sup> could explain low HCPs' compliance with guidelines. While  
272 educational interventions were found to positively influence HCPs attitudes towards HPV test-  
273 based cancer screening guidelines (i.e., considering extending the screening interval after a  
274 normal co-test as being good, easy and beneficial)<sup>(41)</sup>, these changing attitudes might not  
275 translate into implementation of guidelines. For example, Caglioti et al. (2017) found that ~40%  
276 of HCPs who viewed screening guidelines as useful still considered that screening should be  
277 done annually, independent of the test used<sup>(39)</sup>. On the other end of the spectrum are HCPs who  
278 consider current guidelines clinically unreliable and inappropriate (~ 35% of HCPs)<sup>(16)</sup> and who  
279 might be reluctant to change their practice; this could be the case, especially if screening  
280 guidelines in their jurisdiction/health system/organization do not incorporate HPV testing<sup>(26, 36,</sup>  
281 <sup>40)</sup>, their administration and/or colleagues discourage the use of HPV test-based screening<sup>(2, 20, 36)</sup>  
282 or they feel at risk for liability when adopting extended screening intervals and cervical dysplasia  
283 is missed<sup>(20)</sup>.

284 The inconsistent translation of HPV test-based screening guidelines into practice may likely  
285 be complicated by the multiple changes in recommendations (guidelines) since 2001 by different  
286 national and international specialty organizations that were often out of synch related to the  
287 optimal age of screening debut, age specific screening intervals and discontinuation of screening  
288 (see Table 1). For example, the contradictory influence of HCPs specialty on HPV test  
289 acceptability could be explained by the discrepancies in HPV test recommendations by different  
290 organizations, as HCPs have the option to either follow the recommendations issued by their

291 professional organization or those issued by other national or international authorities (which  
292 may be slightly different). An important barrier towards adopting extended screening intervals  
293 with the HPV test (i.e., not sooner than every 3 years) is represented by the long-standing annual  
294 Pap screening practice, which is no longer recommended by any organization. For women, the  
295 annual Pap screening could represent a culturally-embedded and difficult to dismantle  
296 expectation while for physicians it could be associated with economic incentives for continuing  
297 annual gynecologic follow-ups. This conclusion is further explained in that HCPs (notably,  
298 OB/GYNs) are worried that longer screening intervals would put patients at increased risk for  
299 cancer (with potential risk of HCP liability), would then result in higher rates of pre-cancer<sup>(18)</sup>  
300 and/or would negatively influence adherence to other annual examinations (e.g., pelvic  
301 examination) or screening tests<sup>(17, 20)</sup>.

302 Among high-income countries, HPV testing is being increasingly incorporated into cervical  
303 screening programs. Organized, HPV test-based screening programs (that replace cytology) are  
304 in various stages of implementation in Australia<sup>(15, 49)</sup>, the Netherlands<sup>(49, 50)</sup>, Sweden<sup>(49)</sup> and  
305 Italy<sup>(49)</sup> while the United Kingdom<sup>(51)</sup> and Norway<sup>(49)</sup> will begin in 2019 and New Zealand<sup>(52)</sup>  
306 will follow in 2021. The overview of barriers and facilitators provided in our synthesis is  
307 especially useful for understanding HPV test acceptability in opportunistic cervical cancer  
308 screening environments where adherence to the latest screening recommendations is highly  
309 dependent on HCPs opinions—as opposed to organized programs where screening follows a pre-  
310 determined strategy—and could assist policy makers in planning and implementation of HPV test-  
311 based cervical cancer screening programs in new jurisdictions. Given the successful results of  
312 national HPV vaccination programs, it is highly likely that national HPV screening programs  
313 would be equally successful.

314 Another major innovation with potential to increase acceptability and lower cost is HPV  
315 testing on self-collected cervical samples (self-sampling). Self-sampling “represents a new  
316 advance in cancer control that is unequivocally empowering to women”<sup>(53)</sup> as it can effectively  
317 reach, in both organized and opportunistic cervical cancer screening environments, under-  
318 screened (and often marginalised) women in which about half of all invasive cervical cancers are  
319 diagnosed<sup>(53)</sup>. Despite a slightly lower sensitivity and specificity in detecting cervical  
320 intraepithelial neoplasia (CIN2 and CIN3) of HPV testing on self-samples than of HPV testing  
321 on a clinician-taken sample<sup>(54, 55)</sup>, Nelson et al. (2017) found that 97% of women found self-  
322 sampling to be generally acceptable, 65% would prefer self-sampling over clinician-based  
323 sampling for HPV testing and considered self-sampling less embarrassing, respecting privacy  
324 and easy to use<sup>(56)</sup>. In our review, we found that HCPs viewed self-sampling as a facilitator of  
325 HPV testing as it alleviates women’s concerns about privacy and body discomfort during Pap  
326 examination, has the potential to reach women in underserved locations and reduces the burden  
327 of women’s return to the medical system<sup>(23, 24)</sup>. Strategies to increase HCPs recommendations for  
328 self-sampling should take into consideration HCPs worries that self-sampling could be  
329 associated with missed opportunities to address other health issues and that women’s decreased  
330 health literacy represents a barrier to an efficient screening, mostly due to poor quality of the  
331 self-collected sample<sup>(23, 31)</sup>.

332 We found the Patient Pathway Framework useful to synthesize factors that influence HCPs  
333 acceptability of the HPV test into following categories: a) HCP specific, b) patient-specific, c)  
334 HCP practice specific and d) healthcare system specific. Importantly, we found an overlap  
335 between patient-specific psychosocial factors related to HPV test acceptability and the results of  
336 our previous systematic review of factors that influence women’s acceptability of HPV testing in



337 primary screening for cervical cancer<sup>(57)</sup>. These overlapping patient-specific factors merit special  
338 consideration as they can act as barriers in the uptake of HPV testing and include: women's  
339 negative attitudes toward increasing the screening interval, negative emotions and perceptions  
340 related to HPV testing (e.g., shame and anxiety linked to testing for a sexually transmitted  
341 infection), women's low health literacy (i.e., decreased HPV test knowledge and insufficient use  
342 of health information channels), risky health behaviors (e.g., smoking), low socioeconomic status  
343 and non-white ethnicity<sup>(57)</sup>. Given these additional barriers, it becomes exceedingly important to  
344 recognize that while guidelines, policy changes and training for HCPs to assure improved HPV  
345 screening implementation, we must also make equally strong interventions in gauging, guiding  
346 and educating all women successfully in kind and in synchrony. Failure to engage, consult and  
347 inform women's needs in the immense task of  
348 changing 70 years of cervical screening practices can lead to confusion and resistance, as has  
349 occurred recently in Australia. Systematic and informed policy decisions must be made with all  
350 stakeholders involved.

351 Our study has a number of limitations. The synthesis of HCPs' practice and intentions to use  
352 the HPV test is based mostly on studies conducted in the US (13 out of 16) and cannot be  
353 reliably generalised to HCPs recommendation habits in other countries. The heterogeneity in  
354 healthcare settings, women's accessibility and affordability of HPV testing and constantly  
355 evolving guidelines for cervical screening further limit the generalizability of our results. Most  
356 studies included in our review originated in North America (22 out of 32) and no data were  
357 included from HCPs who practice in healthcare systems where an organized HPV test-based  
358 cervical screening program exists; this affects the generalisability of our results while prompting  
359 the need for further research in other healthcare environments and geographical areas. We did

360 not perform a structured quality appraisal of included studies which could have introduced bias  
361 in the interpretation of barriers and facilitators of HPV test acceptability.

## 362 **6. Conclusions**

363 While major specialty organizations have included HPV testing in their recommendations for  
364 primary cervical cancer screening, the adherence of HCPs to the guidelines is suboptimal.  
365 Possible explanations include insufficient HPV test and guidelines knowledge as well as the  
366 heterogeneity of published guidelines related to HPV testing recommendations. Psychosocial  
367 barriers of HPV test acceptability can be categorized into: factors related to the HCP (e.g.,  
368 concerns related to delaying screening initiation to 25 years, extending testing intervals beyond 5  
369 years), patient intrinsic factors (e.g., stigma and anxiety related to testing for a sexually  
370 transmitted disease), factors corresponding to HCP's practice environment (e.g., HPV testing  
371 guidelines not endorsed by their healthcare organization) and healthcare system factors (e.g.,  
372 opportunistic cervical cancer screening environment). Future research is needed to estimate the  
373 association between psychosocial factors and HPV test acceptability in primary screening for  
374 cervical cancer from the perspective of HCPs practicing in healthcare systems where organized  
375 HPV test-based screening has been implemented.

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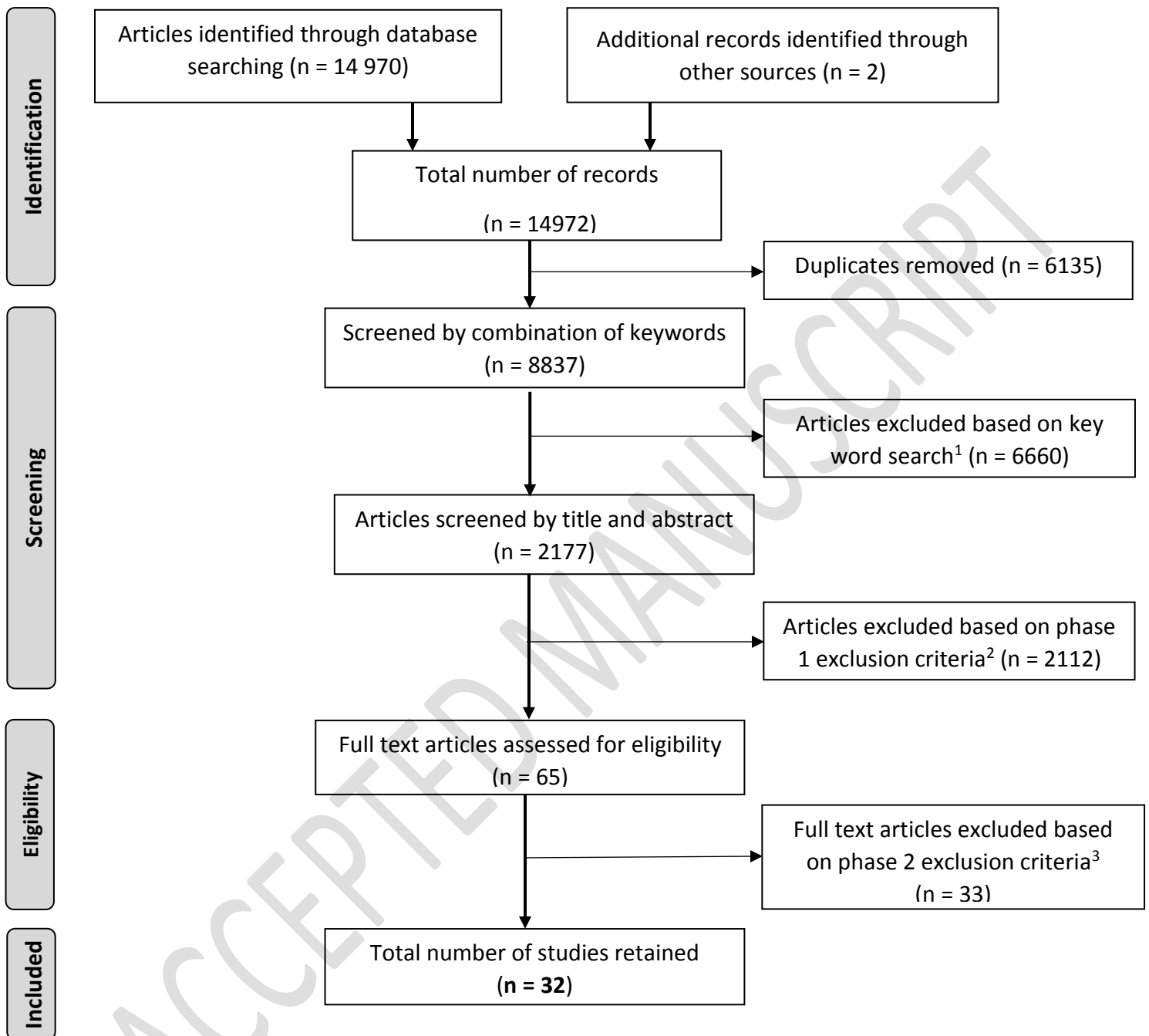
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ACCEPTED MANUSCRIPT

**Figure 1. Study selection diagram**



<sup>1</sup>Key word search terms: physician\* (any field) OR doctor\* (any field) OR provider\*(any field) OR HPV test\*(any field)

<sup>2</sup>Phase 1 exclusion criteria for titles and abstracts: 1) not population of interest (i.e. healthcare providers involved in primary screening), 2) not outcomes of interest (psychosocial factors, intentions, correlates of acceptability), 3) not empirical studies, 4) no abstract 5) not HPV testing in primary screening for cervical cancer, 6) Only knowledge of risk factors for cervical cancer, 7) Only HPV knowledge, 8) only Pap related, 9) Only HPV vaccine related

<sup>3</sup>Phase 2 exclusion criteria for full text articles: Phase 1 exclusion criteria AND full text not in English, French or German AND study population comprise only HCPs not involved in making decisions related to HPV test use (e.g., laboratory workers, students). HCP, health care provider; HPV, human papillomavirus

Year of screening recommendation	Screening Initiation /Recommending organization	Age 21-29/Recommending organization	Age 30 to age of discontinuation/Recommending organization	Discontinuation/Recommending organization	Author and year of data collection
2001-2003	Cytology within 3 years of sexual activity or at age 21 (ACS, ACOG) OR at sexual activity debut or 20y/KSOG	Annual (conventional cytology) or every 2 years (liquid cytology) (ACS, ACOG) OR annual cytology (KSOG)	30-70y, in women who have had 3 consecutive negative cytology results the recommended screening interval with cytology was 2 to 3 years (ACS, ACOG) OR HPV co-testing no sooner than every 3 years (ACS-preliminary recommendation) ¥ OR annual cytology (KSOG) OR biannual cytology (KMHW)	>70y, in women with adequate prior screening** (ACS, ACOG)	Irwin (2004) Saraiya (2006-2007) Chung (2005) Saint (2003)
2009	21y, with cytology only (ACOG, USPTF, ACS)	Cytology only, every 2 years (ACOG, USPTF, ACS)	30-65y, cytology every 3 years OR co-testing every 3 years (ACOG, USPTF, ACS)	>70y, in women with adequate prior screening (ACOG, USPTF, ACS)	Perkins (2011) Corbelli (2012) † Roland (2009-2010) Benard (2009-2010) Townsend (2011)
2012	21y with cytology only (ACOG, ACS, USPTF, ASCCP, ASCP) OR 18 years/ (RANZCOG)	Cytology only, every 3 years (ACOG, ACS, USPTF, ASCCP, ASCP) OR cytology every 2 years/ (RANZCOG)	30-65y, cytology every 3 years OR co-testing every 5 years (ACOG, ACS, USPTF, ASCCP, ASCP) OR cytology every 2 years (RANZCOG)	>65y, in women with adequate prior screening** (ACOG, ACS, USPTF, ASCCP, ASCP) OR >69y, (RANZCOG)	Boone (2014) Teoh (2013) Cooper (2012) § Yap (2014) Mao (2013-2014)
2015-2016	21y with cytology only (ACOG, ACS, USPTF, ASCCP, ASCP) OR 20-30y (EGQACCS-2008)	Cytology every 3 years (ACOG, ACS, USPTF, ASCCP, ASCP) OR cytology every 3-5 years/ (EGQACCS-2008) OR HPV test alone every 3 years for women >25y (SGO, ASCCP*, ACOG)	30-65y, cytology every 3 years OR co-testing every 5 years (ACOG, ACS, USPTF, ASCCP, ASCP) OR cytology every 3-5 years (EGQACCS 2008) OR HPV test alone no sooner than every 3 years (SGO, ASCCP*, ACOG) OR HPV testing alone (not co-testing), no sooner than every 5 years (EGQACCS-2015)	>65y, in women with adequate prior screening** (ACOG, ACS, USPTF, ASCCP, ASCP) OR >60-65y, in women with adequate prior screening (EGQACCS-2008, 2015)	Cooper (2015) Caglioti (2015)

**Table 1.** Cervical cancer screening recommendations for included quantitative studies over time

Note: ACS: American Cancer Society; ACOG: American College of Obstetricians and Gynecologists; ASCCP: American Society for Colposcopy and Cervical Pathology; ASCP: American Society for Clinical Pathology; EGQACCS: European guidelines for quality assurance in cervical cancer screening(14, 49); KSOG: Korean Society of Obstetrics and Gynecology; KMHW: Korean Ministry of Health and Welfare; RANZCOG: The Royal Australian and New Zealand College of Obstetricians and Gynaecologists(50); SGO: Society of Gynecologic Oncology; USPTF: United States Preventive Services Task Force; \* Interim Guidance Report issued by SGO and ASCCP(12); \*\* Adequate prior screening can be defined as three consecutive negative cytology results or two consecutive negative co-test results within the previous 10 years, with the most recent test performed within the past 5 years(51); † data collected before 2012 guidelines change; § For screening practice only the 2012 data was used; ACS, ACOG and USPTF guidelines were issue shortly before the survey was distributed; ¥ Saslow et al. (2002) American Cancer Society Guideline for the Early Detection of Cervical Neoplasia and Cancer(4)

**Table 2.** Barriers and Facilitators of Healthcare Providers Acceptability of the HPV Test in Primary Screening for Cervical Cancer

<b>Factors related to the HCP</b>		
<b>Barriers</b>	<b>Facilitators</b>	<b>Contradictory evidence</b>
<ul style="list-style-type: none"> <li>• Concern that cervical cancer could be missed if screening initiation with the HPV test is delayed to 25 y<sup>(32)</sup></li> <li>• Belief that women &gt; 30 y would fear that cervical cancer could be missed by extending the co-test screening interval from 1 to 3 years<sup>(20)</sup></li> <li>• Concern that increasing screening intervals beyond 1 year with the co-test would put women at increased risk of pre-cancer and cancer<sup>(18)</sup></li> <li>• Belief that annual exams and other screening tests could be missed if Pap is not offered and the screening interval after a normal co-test is increased to 3 years<sup>(17, 20)</sup></li> <li>• Belief that using self-sampling could be associated with missed opportunities to address other health issues<sup>(31)</sup></li> <li>• Beliefs that delaying screening debut to 25y and increasing screening intervals are strategies to reduce government costs<sup>(32)</sup></li> <li>• Belief that discussing the association between a STI and cervical cancer could have negative emotional effect on women and would be time consuming<sup>(36)</sup></li> <li>• Insufficient knowledge of cervical cancer screening guidelines<sup>(40)</sup></li> <li>• Age &gt; 40 and &gt; 10 years of practice concerned about women's ability to use self-sampling<sup>(31)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Higher HPV and HPV test knowledge (e.g., higher sensitivity of the HPV test in detecting precancerous lesions)<sup>(36, 39)</sup></li> <li>• Less perceived need of information on cervical cancer screening<sup>(39)</sup></li> <li>• Knowledge that the Pap test is not recommended annually<sup>(39)</sup></li> <li>• Educational interventions increase acceptability of an interval of 3 years for co-testing<sup>(41)</sup></li> <li>• Increased cervical cancer knowledge (e.g., cervical changes in young women are usually low grade and have a high rate of regression) was associated with higher acceptability to start screening at 25y<sup>(32)</sup></li> <li>• Respecting guidelines for extended interval screening for the Pap test (i.e., 3 years instead of annually)<sup>(30)</sup></li> <li>• Perception that extending the screening interval for co-testing is promoted by professional journals, professional specialty organizations and national health organizations<sup>(18)</sup></li> <li>• Use of self-sampling method<sup>(24)</sup></li> <li>• Higher acceptability of co-testing at 3 years interval (instead of yearly) in HCPs who consider yearly pelvic examination less useful<sup>(30)</sup></li> <li>• Higher acceptability among Asian and Hispanic individuals<sup>(46)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Consider screening guidelines valuable/HCPs are influenced by guidelines<sup>(32, 36, 46)</sup></li> <li>• Influence from patients (i.e., patients either reject extended screening intervals or want to know their HPV infection status)<sup>(20, 36, 40, 46)</sup></li> <li>• Influence from administration and colleagues who discourage use of co-testing and extending screening intervals to 3 years<sup>(20)</sup></li> <li>• Concerns that integration of HPV testing in antenatal care could be associated with pregnancy loss<sup>(25)</sup></li> <li>• Specialty: higher HPV test acceptability in OB/GYN than FP<sup>(2, 19, 36)</sup> or IM<sup>(19, 36, 44)</sup> or opposite effect<sup>(32, 46)</sup>. Compared to IM, acceptability in FP was higher<sup>(44)</sup> or lower<sup>(46)</sup></li> <li>• Volume of cytology examinations: higher Pap volume increase HPV test acceptability<sup>(30)</sup>. Increased volume of liquid cytology increase<sup>(36)</sup> or decrease HPV test acceptability<sup>(30)</sup>. <math>\geq 45</math> screenings/month associated with lower HPV test acceptability for women <math>\geq 30y</math><sup>(46)</sup></li> <li>• Gender: Lower acceptability in male HCP<sup>(2, 17, 36, 44)</sup> or opposite effect<sup>(46)</sup></li> </ul>

**Table 2** (continued). Barriers and Facilitators of Healthcare Providers Acceptability of the HPV Test in Primary Screening for Cervical Cancer

<b>Patient intrinsic factors</b>		
<b>Barriers</b>	<b>Facilitators</b>	<b>Contradictory evidence</b>
<ul style="list-style-type: none"> <li>• Women's low acceptability of the HPV test and/or self-sampling<sup>(31, 39)</sup></li> <li>• Stigma associated with testing for a STI, worry about increased cervical cancer screening interval, increase perception of cancer risk, fear of procedure<sup>(23, 35)</sup></li> <li>• Irregular Pap testing history and smoking are barriers for extending screening intervals in women <math>\geq 30y</math><sup>(20)</sup></li> <li>• Decreased health literacy is a barrier for using self-sampling<sup>(23, 31)</sup></li> <li>• High risk for cervical cancer (e.g., history of cytological abnormalities, immunocompromised) act as barrier to delaying screening debut to 25 y and increasing screening intervals in women <math>\geq 30y</math><sup>(20, 32)</sup></li> <li>• Increased number of lifetime sexual partners, history of STI and sexual abuse act as barrier to delaying screening debut to 25 y and increasing screening intervals in women <math>\geq 30y</math><sup>(20, 32)</sup></li> <li>• Low socioeconomic status<sup>(35)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Concerns about privacy and body discomfort during Pap examination are viewed as facilitators of self-sampling<sup>(23, 24)</sup></li> <li>• Exclusive same-sex relationship is a facilitator for delaying screening debut to 25y<sup>(32)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• HPV vaccination status<sup>(32, 46)</sup></li> </ul>

**Table 2** (continued). Barriers and Facilitators of Healthcare Providers Acceptability of the HPV Test in Primary Screening for Cervical Cancer

<b>Factors corresponding to HCP's practice environment</b>		
<b>Barriers</b>	<b>Facilitators</b>	<b>Contradictory evidence</b>
<ul style="list-style-type: none"> <li>• Public outpatient setting (versus public hospital)<sup>(39)</sup></li> <li>• Rural/military practice (versus suburban/urban)<sup>(17)</sup></li> <li>• HPV testing guidelines not endorsed by HCP's healthcare organization<sup>(36, 40)</sup></li> <li>• HPV test not offered by their laboratory<sup>(36)</sup></li> <li>• Caring for <math>\geq 25\%</math> black population<sup>(2)</sup></li> <li>• Lower proportion (<math>&lt;75\%</math>) of privately insured patients<sup>(2, 36, 40)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Private and nonsolo (i.e., single specialty group) practice<sup>(2, 36)</sup></li> <li>• Northeastern (versus Southern) US gynecologists<sup>(17)</sup></li> <li>• Electronic medical system usage<sup>(30)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Timely access (on-site) to colposcopy<sup>(36)</sup></li> </ul>
<b>Healthcare system factors</b>		
<b>Barriers</b>	<b>Facilitators</b>	<b>Contradictory evidence</b>
<ul style="list-style-type: none"> <li>• Opportunistic cervical cancer screening environment (e.g., postponing screening debut to 25y and extending screening intervals could facilitate women to lose contact with the medical system, higher HCP's perceived risk of liability for extended screening intervals)<sup>(20, 32)</sup></li> <li>• Screening guidelines in their jurisdiction (e.g., province) do not incorporate HPV testing<sup>(26)</sup></li> <li>• Poor designed self-sampling information materials for women<sup>(23)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Use of personal communication of self-sampling results to underscreened patients creates education opportunities and promotes women to return to the medical system<sup>(23)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Cost of screening for the patient: extended screening intervals decrease cost and could act as facilitator (Roland, 2013), if the HPV test is not reimbursed HCP may not communicate the option<sup>(26, 36, 40)</sup></li> </ul>

**Note:** *Contradictory evidence* includes factors for which evidence for both barriers and facilitators was found

**Appendix A.** Summary of included studies

<b>Author and year of publication</b>	<b>Country</b>	<b>Title</b>	<b>Aim/Objectives</b>	<b>Participants</b>	<b>Data collection method</b>	<b>Year of data collection</b>
Benard V.B. et al., 2011	USA	Cancer Screening Practices Among Physicians in the National Breast and Cervical Cancer Early Detection Program	To describe the demographic and practice characteristics of participating and non-participating physicians to the National Breast and Cervical Cancer Early Detection Program, as well as their beliefs, adoption of new screening technologies, and recommendations for breast and cervical cancer screening.	886 physicians (FP, IM, GP, OB/GYN)	Cross-sectional survey	2006-2007
Benard V.B. et al., 2016	USA	Change in Provider Beliefs Regarding Cervical Cancer Screening Intervals After an Educational Intervention	The study objective was to assess changes in provider attitudes and beliefs to extending screening intervals among low-income women by using an educational intervention to promote recommended screening practices i.e., lengthening the screening interval to 3 years	84 HCPs at baseline and 52 HCPs at follow-up	Survey (baseline and 12 months' follow-up)	2009-2010
Boone E. et al., 2016	USA	Discontent and Confusion: Primary Care Providers' Opinions and Understanding of Current Cervical Cancer Screening Recommendations	To elucidate causes of non-adherence of primary care providers to primary screening for cervical cancer guidelines released in 2012 by ACOG, ACS, and USPSTF	1268 HCPs (OB/GYN, FP, IM, NP and PA)	Cross-sectional survey	2014



Author and year of publication	Country	Title	Aim/Objectives	Participants	Data collection method	Year of data collection
Cagliotti C. et al., 2017	Italy	Gynecologists and human papillomavirus DNA testing: exploring knowledge, attitudes, and practice in Italy	To examine the knowledge, attitudes, and practice of OB/GYN related to the use of HPV DNA testing in primary screening for cervical cancer	582 OB/GYN	Cross-sectional survey	2015
Chung H.H. et al., 2006	South Korea	Cost is a Barrier to Widespread Use of Liquid-Based Cytology for Cervical Cancer Screening in Korea	This study aimed to document current cervical cancer screening practices of OB/GYN in South Korea	254 OB/GYN	Cross-sectional survey	2005
Cooper C.P. et al., 2015	USA	Perceived effectiveness of HPV test as a primary screening modality among US providers	To explore HCPs perceptions of the effectiveness of the HPV test in population-based screening for cervical cancer	1040 HCPs in 2009 (189 IM, 494 FP, 141 NP and 216 OB/GYN) and 1039 HCPs in 2012 (205 IM, 435 FP, 155 NP and 244 OB/GYN)	Cross-sectional survey	2009 and 2012
Cooper C.P. et al., 2017	USA	Primary HPV testing recommendations of US providers, 2015	To examine physicians' HPV testing recommendations	843 HCPs (FP, IM and OB/GYN)	Cross-sectional survey	2015
Corbelli J. et al., 2014	USA	Differences Among Primary Care Physicians' Adherence to 2009 ACOG Guidelines for Cervical Cancer Screening	To assess the compliance of HCPs with 2009 ACOG guidelines for cervical cancer screening	316 HCPs (IM, IM-Pediatricians, FP, OB/GYN)	Cross-sectional survey	2012
Filade T. E. et al., 2017	Nigeria	Attitude to Human Papillomavirus Deoxyribonucleic Acid-Based Cervical Cancer Screening in Antenatal Care in Nigeria: A Qualitative Study	To explore the attitude of HCPs and pregnant women toward the hypothetical introduction of HPV DNA testing into routine antenatal care	82 pregnant women (focus groups) and 13 HCPs (OB/GYN and midwives)	9 focus groups and 13 in-depth interviews	2015-2016

Author and year of publication	Country	Title	Aim/Objectives	Participants	Data collection method	Year of data collection
Hoover K. et al., 2009	USA	Access of Black, Hispanic, and nonprivately insured women to liquid-based cytology, human papillomavirus DNA testing, and on-site colposcopy in the United States	To determine if patients' sociodemographics was associated with HCPs use of liquid-based cytology, HPV testing, and on-site colposcopy	2981 HCPs (OB/GYN, nurse midwives, FP, adolescent medicine physicians, IM, NP, PA)	Cross-sectional survey	2004
Irwin K. et al., 2006	USA	Cervical cancer screening, abnormal cytology management, and counseling practices in the United States	To assess HCPs knowledge and practices related to HPV testing as an adjunct to cytology and for colposcopic triage for ASCUS cytology results	2,980 HCPs (463 OB/GYN, 622 nurse midwives, 333 FP, 293 Adolescent Medicine, 220IM, 591 NP, 458 PA)	Cross-sectional survey	2004
Jain N. et al., 2006	USA	Family Physicians' Knowledge of Genital Human Papillomavirus (HPV) Infection and HPV-related Conditions, United States, 2004	To assess the relationship between family physicians' knowledge about HPV, HPV test and delivered counseling messages when collecting samples for cytology and managing anogenital warts	368 FP	Cross-sectional survey	2004
Katz M.L. et al., 2017	USA	Perspectives from health-care providers and women about completing human papillomavirus (HPV) self-testing at home	To explore among women and HCPs the perceived acceptability, barriers and facilitators of HPV self-testing	Focus groups with 28 HCPs (1 physicians, 16 nurses, 8 NP and 3 medical assistants) and nurses) and focus groups/interviews with 15 women	Focus groups and in-depth interviews	2014-2015
Kuitto K. et al., 2010	Germany	Perspectives on and experiences with early detection and preventive measures against cervical cancer. Results of an expert survey among physicians	To gain knowledge about prevention measures against cervical cancer i.e., cervical cancer screening and HPV vaccination in daily practice	112 physicians (OB/GYN, pediatricians, FP, public health)	Cross-sectional survey	2008-2009

Author and year of publication	Country	Title	Aim/Objectives	Participants	Data collection method	Year of data collection
		in Mecklenburg–Western Pomerania				
Kwan T.C. et al., 2012	China	Assessment of knowledge and stigmatizing attitudes related to human papillomavirus among Hong Kong Chinese healthcare providers	To assess knowledge and attitudes related HPV and HPV testing among HCPs in Hong Kong	137 HCPs (37 physicians and 100 nurses including smear-taking trainees)	Cross-sectional survey	2010
Lataifeh I. et al., 2009	Jordan	A survey of the knowledge and attitude of Jordanian obstetricians and gynaecologists to cervical cancer screening	To assess knowledge and attitudes towards cervical screening	392 OB/GYN	Cross-sectional survey	Not reported
Lin L. et al., 2015	USA	Communication practices about HPV testing among providers in Federally Qualified Health Centers	To assess HCPs perceptions of their communication practices about the HPV co-test, and the risks and benefits of discussing co-test results with patients	98 HCPs (OB/GYN, FP or NP)	Cross-sectional survey	2009-2010
Mao C. et al., 2017	USA	Clinician and Patient Acceptability of Self-Collected Human Papillomavirus Testing for Cervical Cancer Screening	To evaluate clinician and patient attitudes related to home self-collected HPV testing for cervical cancer screening	1769 women and 118 HCPs (OB/GYN, IM, FP, midwives, NP, women's health specialist)	Cross-sectional survey	2012-women and 2013-2014-HCPs
McCarey C. et al., 2011	Cameroon	Awareness of HPV and cervical cancer prevention among Cameroonian healthcare workers	To assess knowledge and awareness of cervical cancer prevention among HCPs	401 HCPs (GP, Pediatrics, OB/GYN, nurse-midwives, nursing-midwifery students and medical students)	Cross-sectional survey	2009

Author and year of publication	Country	Title	Aim/Objectives	Participants	Data collection method	Year of data collection
Patel H. et al., 2017	UK	Knowledge, attitudes and awareness of the human papillomavirus amongst primary care practice nurses: an evaluation of current training in England	To evaluate the effectiveness of HPV education and to determine the level of HPV knowledge in nurses involved in cervical smear sampling	94 practice nurses	Cross-sectional survey	2015
Perkins R.B. et al., 2013	USA	Challenges in Cervical Cancer Prevention A Survey of U.S. Obstetrician-Gynecologists	To examine attitudes, practice, and barriers related to HPV vaccination and the 2009 ACOG cervical cancer screening guidelines among OB/GYN	366 OB/GYN	Cross-sectional survey	2011-2012
Regier D.A. et al., 2013	Canada	Exploring Colposcopists' Attitudes Towards Use of HPV Testing as a Primary Screening Tool for Cervical Cancer in British Columbia	To explore colposcopists' attitudes regarding HPV testing in primary cervical cancer screening	35 colposcopists in 2010 and 46 in 2011	Cross-sectional surveys	2010 and 2011
Roland K.B. et al., 2013	USA	Primary care provider practices and beliefs related to cervical cancer screening with the HPV test in Federally Qualified Health Centers	To assess HCPs practices, attitudes and beliefs related to primary screening in cervical cancer with HPV co-testing and extending screening intervals	98 HCPs (65 physicians, 20 NP, 6 nurse midwife, 7 PA), specialty: 35 FP, 8 IM, 52 OB/GYN, 1 Pediatrics	Cross-sectional survey	2009-2010
Roland K.B. et al., 2015	USA	Provider beliefs associated with cervical cancer screening interval recommendations: A pilot study in Federally Qualified Health Centers	To examine HCPs characteristics and attitudes and beliefs associated with their cervical cancer screening interval recommendations.	82 HCPs (55 physicians, 17 NP, 10 other), specialty: 29 FP, 46 OB/GYN, 7 other	Cross-sectional survey	2009-2010

Author and year of publication	Country	Title	Aim/Objectives	Participants	Data collection method	Year of data collection
Saint M. et al., 2005	USA	Current cervical neoplasia screening practices of obstetrician/ gynecologists in the US	To determine the cervical cancer screening practices of obstetrician/ gynecologists in the US related to the ACS 2002 guidelines	185 OB/GYN	Cross-sectional survey	2003
Saraiya M. et al., 2010	USA	Cervical Cancer Screening With Both Human Papillomavirus and Papanicolaou Testing vs Papanicolaou Testing Alone	To assess practices of primary care physicians related to cervical cancer screening, including their recommendations of extended screening intervals with Pap and/or HPV cotesting	950 HCPs (408 GP/FP, 224 IM, 318 OB/GYN)	Cross-sectional survey	2006-2007
Teoh D.G.K. et al., 2015	USA	Adherence to the 2012 national cervical cancer screening guidelines: a pilot study	To evaluate HCPs knowledge, practices, and attitudes/beliefs related to the 2012 cervical cancer screening guidelines	124 HCPs (86 physicians, 12 PA, 19 NP, 18 other) specialty: 31 OB/GYN, 27 IM, 52 FP, 19 midwifery, 6-other)	Cross-sectional survey	2013
Townsend J.S. et al., 2014	USA	Current Cervical Cancer Screening Knowledge, Awareness, and Practices Among U.S. Affiliated Pacific Island Providers: Opportunities and Challenges	To assess HCPs cervical cancer-related knowledge, screening practices, barriers of cervical cancer screening and awareness of HPV testing	72 HCPs (29 physicians, 35 nurses or midwives, 1 PA, 7 other)	Cross-sectional survey	2011
Trope L.A. et al., 2009	Thailand	Preventing Cervical Cancer Stakeholder Attitudes Toward CareHPV-Focused Screening Programs in Roi-et Province, Thailand	To rank HCPs opinions about 5 cervical screening protocols in terms of benefits for reducing cervical cancer and protocol preference	88 HCPs (48 nurses, 4 colposcopists 16 medical directors and 20 health officers)	Cross-sectional survey	2007-2008

Author and year of publication	Country	Title	Aim/Objectives	Participants	Data collection method	Year of data collection
Wakewich P. et al., 2016	Canada	Colonial legacy and the experience of First Nations women in cervical cancer screening: a Canadian multi-community study	To, elicit women's and HCPs opinions about sexual health, preventive health services and HPV self-sampling as an alternative to Pap testing in screening for cervical cancer	16 HCP (nurses, health managers/directors, community health representatives and elders) and 69 community females	Interviews (HCPs) and 8 focus groups (women)	2011-2012
Wood B. et al., 2018	Canada	"They Should Be Asking Us": A Qualitative Decisional Needs Assessment for Women Considering Cervical Cancer Screening	To examine women's shared decision-making needs in evaluating cervical cancer screening options	7 women, 3 HCPs (2 nurses and 1 GP) and 2 health system managers	Semi-structured interviews	2016
Yap D. et al., 2016	Australia	Clinicians' attitude towards changes in Australian National Cervical Screening Program	To understand HCPs acceptability, barriers and facilitators of using HPV testing starting at 25 years of age, every 5 years in primary screening for cervical cancer	956 HCPs (571 OB/GYN, 260 GP and 124 trainee)	Cross-sectional survey	2014