

Title

HPV Self-Sampling for Cervical Cancer Screening: A Rapid Review [Draft for comments]

Author

Novatus Apolinary Tesha

Email

n.tesha.1@research.gla.ac.uk

Address

Health Economics and Health Technology Assessment
School of Health & Wellbeing
College of Medical, Veterinary & Life Sciences
University of Glasgow
Clarice Pears Building, 90 Byres Road, Glasgow, G12 8TB

Review Team

Novatus Apolinary Tesha (University of Glasgow)
Clareece Nevill (University of Leicester)
Martin Taylor-Rowan (University of Glasgow)
Ryan Mulholland (University of Glasgow)
Terry Quinn (University of Glasgow)
Anna Noel-Storr (Cochrane and University of Glasgow)
Alex Sutton (University of Leicester)
Olivia Wu (University of Glasgow)

Sources

This rapid review was conducted by the Evidence Synthesis Group at the Complex Reviews Synthesis Unit (ESG @CRSU). Evidence relevant to the forthcoming publication of the YouScreen study, which estimated the impact of offering HPV self-sampling to non-attenders within the cervical screening programme in England, was synthesised.(1)

Funder

This study was funded by the NIHR Evidence Synthesis Programme.

Role of Funder

The protocol was developed independently of the funder of the study (NIHR). Feedback on a draft protocol, and approval of the final protocol, were sought from the UK National Screening Committee (NSC).

Conflict of interest

No authors have known conflicts of interest to declare.

Abstract

Introduction

Cervical cancer is ranked the fourth most frequently diagnosed and the fourth leading cause of cancer deaths in women in the world. The WHO published a new guideline on using the Human Papillomavirus DNA (HPV DNA) test as primary screening in place of a Pap smear and Visual Inspection with Acetic Acid (VIA). HPV DNA tests can be done on both clinician and self-collected samples. Several countries, including France, Sweden and Australia, have incorporated self-sampling into their national screening programs, either as a primary screening approach or as a method targeted at under-screened individuals.

There is interest within the National Screening Committee to incorporate self-sampling into the cervical screening program in the UK, specifically for non-attenders.⁽¹⁾ YouScreen was an implementation feasibility study that evaluated the impact of opportunistically offering HPV self-sampling at primary care encounters to people who did not attend for cervical screening in England. To contextualize, and better understand the potential policy implications of the findings of the YouScreen study, this rapid review is intended to address questions on the accuracy, concordance, uptake and acceptability of self-sampling over clinician-collected samples.

Method

This is a rapid review that has primarily been developed based on recent recommendations and methodological guidance provided by the Cochrane Rapid Reviews Methods Group. To optimise the methodological rigour of this rapid review, preference was given to restriction, rather than omission, of systematic review components. Given the required expediency of the evidence synthesis, this pragmatic approach leverages multiple existing well-conducted systematic reviews which are aligned with the respective objectives of this rapid review. These reviews formed the basis of our data extraction, with limited searches overlapping those utilised in the reviews, intended to identify new publications with which analyses could be updated. Narrative data synthesis was conducted to address the respective clinical questions. Where possible, meta-analysis was conducted on relevant outcomes related to accuracy, concordance, uptake, and acceptability.

Findings

The review included 210 studies. We have found that the self-sampling screening has similar accuracy as clinician-collected samples especially when PCR-based assays are used. Similarly, there is high concordance between the arms in which the overall agreement was 87.1% and the kappa value of 0.70. The commonly used self-sampling strategies are opt-in and mail to all self-sampling strategies, with limited studies on opportunistic self-sampling done in the health care setting in which the self-sampling is done when a non-attender visits the health facility for any other reasons. Mail-to-all strategies had more uptake in both intentions-to-treat analysis with a participation difference of 11.3 and per protocol with a participation difference of 7.7 analysis while opt-in had the same uptake with the clinician-collected sample in the PP analysis but with higher uptake in the ITT analysis (participation difference of 6.5). Although, self-sampling is highly acceptable to non-attenders (91%) with less than 1% of unsatisfactory samples requiring retest and more than 80% adherence to self-sampling, analysis has also shown that self-sampling led to pain or discomfort (18.5%), caused embarrassment (12.1%), caused anxiety (35.2%) and did not fit with their values (59.9%).

Conclusion and Recommendation

Self-sampling is a feasible strategy for reaching non-attenders in and should be considered in the national screening program to reach the non-attenders, especially on using the PCR-based assay. However, before this is done, understanding the cost-effectiveness, logistics and compliance of the strategies is important to understand country-specific strategies for reaching the non-attenders.

Table of Content

Abstract.....	2
Conclusion and Recommendation	2
Table of Content	3
Definition of Key Terms	4
List of Abbreviations	5
Introduction.....	6
Rationale.....	6
Aim.....	7
Objectives	7
Methods	8
Eligibility Criteria.....	8
Screening Process.....	8
Data Extraction.....	8
Synthesis.....	8
Tailored Methodological Approaches for Individual Review Questions	9
Results.....	13
Included Studies	13
[I] Accuracy of HPV testing in self-collected samples compared with health professional-collected samples	14
[II] The level of concordance between HPV-DNA testing in self-collected samples and health professional collected samples in cervical screening non-attenders	24
[III] Uptake of cervical screening in screening non-attenders offered HPV self-sampling compared with those offered health professional sampling.....	39
[IV] Acceptability of HPV self-sampling screening strategies to those that have not attended the regular cervical screening programme	51
Discussion.....	64
References.....	66
Appendix.....	68

Definition of Key Terms

Biopsy	<i>A medical procedure that involves taking a small sample of body tissue to be examined.</i>
Cervical intraepithelial neoplasia	<i>A precursor of cervical cancer which is classified according to the severity of dysplasia as CIN1 (low grade), CIN2 (moderate grade) and CIN3 (high grade).</i>
Community mobilization and outreach	<i>Community campaigns with outreach supported by mass media in which attending women were offered a self-sampling kit at the end of a sensibilization session as well as, an individualized self-sampling kit delivery approach in which community healthcare workers directly contacted women at their homes or workplaces.</i>
Direct offer at a healthcare service	<i>Study participants were offered a self-sample at the end of an individual appointment (when they contacted a health service for whatever reason) and were given the choice to do it on-site in a private room or to take it home.</i>
Door to door	<i>A self-sampling where self-sampling kit are distributed and collected by a community health worker at home</i>
HPV DNA testing	<i>A laboratory test in which cells are scraped from the cervix to look for DNA of human papillomaviruses HPV.</i>
Intention-to-treat	<i>In the intention-to-treat (ITT) analyses, study participants who had been offered a self-sample but visited an HCP to have a sample taken instead were also counted as participants.</i>
Mailed to all	<i>Self-sampling kit sent without request.</i>
Opportunistic	<i>Request or on HCP recommendation for self-sampling, without organised invitation.</i>
Opt-in	<i>Offering study participants the possibility to obtain a self-sampling kit: women had to request the self-sampling kits to be received by mail or, alternatively, these could be collected from the local clinic/pharmacy.</i>
Per protocol	<i>Only study participants who took a self-sample in the experimental groups were counted as participants.</i>
YouScreen	<i>An implementation feasibility study that evaluated the impact of opportunistically offering HPV self-sampling at primary care encounters to people who did not attend cervical screening in England.</i>

List of Abbreviations

CIN	Cervical intraepithelial neoplasia
COVID-19	Coronavirus disease-19
CRSU	Complex Reviews Synthesis Unit
DNA	Deoxyribonucleic acid
HC	Hybrid capture
HPV	Human papillomavirus
HPV-DNA	Human Papillomavirus-DNA
hrHPV	High-risk human papillomavirus
ITT	Intention to treat
LLETZ	Large loop excision of the cervical transformation zone
NSC	National Screening Committee
NHS	National Health Service
PCR	Polymerase chain reaction
PP	Per protocol
SA	Signal amplification
SES	Socioeconomic status
TA	Target amplification
UK	United Kingdom

Introduction

Rationale

Globally, cervical cancer is the fourth most frequent malignancy, and in the UK, has an approximate incidence of 3200 diagnoses annually.(2) Persistent genital infection with Human Papillomavirus (HPV), one of the most common sexually transmitted infections, is responsible for an estimated 99.7% cases of cervical cancer.(3) Indeed, more than 200 HPV genotypes may be stratified into high-risk (hrHPV) and low-risk/non-oncogenic strains; the former includes types 16, 18, 31 and 33. Protracted HPV infection is associated with the development of cervical intraepithelial neoplasia (CIN), a precursor of cervical cancer which is classified according to the severity of dysplasia as CIN1 (low grade), CIN2 (moderate grade) and CIN3 (high grade).(4) The development of cervical cancer from CIN3 can take over a decade. Owing to the considerable lag period between HPV infection and the development of cervical cancer, there is substantial opportunity for early detection of precancerous lesions via screening.(5)

The NHS cervical screening programme was introduced in 1988. Currently, individuals with a cervix in England and Northern Ireland are invited for screening three-yearly between the ages of 25 and 49, and five-yearly between ages 50 and 64. In Scotland and Wales, eligible individuals are screened at intervals of five years.(2) Owing to greater sensitivity in identifying CIN, hrHPV DNA detection has replaced cytological techniques as the preferred screening method. Those with a positive result are referred for cytology; individuals with abnormal cytology are invited for colposcopy. Clinical guidelines recommend monitoring CIN1 lesions for progression to more severe dysplasia, whilst CIN2+ lesions should be managed by removing the abnormal cells, most frequently by large loop excision of the cervical transformation zone (LLETZ).(4)

Whilst screening programmes have been demonstrated to mitigate the incidence of cervical cancer, coverage in many countries is suboptimal, and cervical cancer is most frequently diagnosed in those who are either underscreened or who have never participated in regular screening.(6, 7) Indeed, the reasons for non-participation are multifarious, but may include insufficient time to attend a clinic, lack of awareness, anxiety regarding a gynaecological examination, or physical discomfort during specimen collection. Participation is often reduced in some patient populations, including those in minority ethnic groups, those of low socio-economic status, and transgender and non-binary people with a cervix.(8, 9) A range of diagnostic HPV-DNA tests and sampling methods are available, and samples may be self-collected from the vagina, as an alternative to collection from the cervix by a healthcare professional.(10) Indeed, self-sampling has several advantages compared to clinician-based sampling, including reduced invasiveness, greater privacy, more convenient, and it has thus been proposed as a strategy to improve uptake of cervical screening. Furthermore, there is increasing evidence that self-sampling has good diagnostic accuracy is acceptable to screenees, and that it may improve cervical screening coverage.(11) Several countries, including France, Sweden and Australia, have incorporated self-sampling into their national screening programmes, either as a primary screening approach, or as a method targeted at underscreened individuals.

There is interest within the National Screening Committee to incorporate self-sampling into the cervical screening programme in the UK, specifically for non-attenders.(1) YouScreen was an implementation feasibility study which evaluated the impact of opportunistically offering HPV self-sampling at primary care encounters to people that did not attend for cervical screening in England.

Aim

To contextualise, and better understand the potential policy implications of the findings of the YouScreen study, this rapid review is intended to address the following clinical questions:

- I. What is the accuracy of HPV testing in self-collected samples compared with health professional collected samples, and does this vary according to patient and test characteristics?
- II. In cervical screening non-attenders, what is the level of concordance between HPV-DNA testing in self-collected samples and clinician / health professional collected samples, and does this vary according to patient and test characteristics?
- III. What is the uptake of cervical screening in screening non-attenders offered HPV self-sampling compared with those offered health professional sampling, and does this vary according to patient and test characteristics?
- IV. Are HPV self-sampling screening strategies acceptable to those that have not attended the regular cervical screening programme, and does this vary according to patient and test characteristics?

Objectives

The primary objectives of this rapid review are:

- To compare the diagnostic accuracy of HPV-DNA testing on self-collected samples with testing on samples collected by a healthcare professional, in individuals who do not participate in a regular cervical screening programme
- To compare the uptake of cervical screening and adherence to follow-up, for self-sampling compared to sample collection by a healthcare professional, in people who do not participate in a regular cervical screening programme
- To evaluate the acceptability of self-collection of samples for HPV-DNA testing in individuals who do not participate in a regular cervical screening programme, and the factors which influence acceptability

The secondary objectives of this rapid review are:

- To determine if the diagnostic accuracy of HPV testing of self-collected samples varies according to patient characteristics, including socio-economic status, screening history, and clinical history, and test characteristics, including sampling device, storage medium, testing methodology, and setting
- To assess the variation in uptake of cervical screening and adherence to follow-up for self-sampling in people who do not participate in a regular cervical screening programme, according to patient characteristics, including socio-economic status and clinical history, and test characteristics, including sampling device, storage medium, testing methodology, and setting

Methods

The approach to this rapid review has primarily been developed based on recent recommendations and methodological guidance provided by the Cochrane Rapid Reviews Methods Group.(12-17) However, it also accounts for the specific challenges of rapid reviews on diagnostic tests, namely the particular statistical methods for diagnostic accuracy and methodologies explicitly designed to evaluate the conduct of studies of diagnostic tests.(18) To optimise the methodological rigour of this rapid review, preference is given to restriction, rather than omission, of systematic review components.(16) Indeed, given the required expediency of the evidence synthesis, this pragmatic approach leverages multiple existing well-conducted systematic reviews which are aligned with the respective objectives of this rapid review. Where applicable, these form the basis of our data extraction, with limited searches overlapping those utilised in the reviews, intended to identify new publications with which analyses can be updated. To meet stakeholder needs, evidence synthesis was prioritized as a deliverable over the quality assessment of included studies. Furthermore, we engaged regularly with the NSC throughout the rapid review process to ensure that outputs are aligned with their requirements. Patient and public involvement activities were embedded within the YouScreen study, so are not included within this rapid review.

Eligibility Criteria

The eligibility criteria and search methods for each respective clinical question are outlined separately below. The respective systematic reviews upon which each search strategy is based are reported, with the search strategies detailed in the Appendix. The start dates for the searches have been selected to allow for three months of overlap with the end date of the search in the prior review, to ensure that all relevant new publications are captured. The identification of ongoing studies is limited in this review to ClinicalTrials.gov, for instances in which a more comprehensive search of multiple trial registries has been conducted in the primary review(s).

Screening Process

All studies fulfilling the eligibility criteria were included in the review. Abstracts, conference proceedings and non-English language studies were excluded from the review. Screening of abstracts were conducted by two independent reviewers (NT and RM). Full text records were screened by one reviewer and validation of excluded records (20%) was undertaken by a second reviewer. All discrepancies were resolved by consensus and/or a third reviewer.

Data Extraction

Data extraction from individual reviews and studies were carried out by a single reviewer. Where feasible, data were extracted from existing systematic reviews. Co-variate data were extracted from the original studies in instances where this has not been recorded in a prior review. Data extraction was then completed for additional studies identified in the searches that have not been captured in prior reviews.

Synthesis

Narrative data synthesis was conducted to address the respective clinical questions. The following was carried out for all meta-analyses conducted:

- Meta-analyses were primarily conducted in R(Viechtbauer, 2010), using the {meta} (Team, 2023) or {metafor}(Schwarzer G, 2019), package. Where necessary, the variance for each study could be estimated from the reported confidence intervals using the conv.wald command in {metafor}.
- Forest plots were produced to investigate potential heterogeneity in meta-analyses. For each forest plot, studies were ordered by year to assess any temporal patterns.
- Outcomes were pooled separately by characteristics that were known to give inherently different results.
- Meta-regressions were conducted to assess whether certain characteristics had an (unknown) effect on outcomes and whether they explain any potential heterogeneity. Characteristics were added alone to the meta-regression with a significant effect being defined as a p-value for testing

its inclusion of less than 0.05. For characteristics that have a significant effect on the outcome, a respective subgroup forest plot will be produced. Characteristics were only tested if there was sufficient data and the data was in a quantitatively analysable format.

In addition, approaches to tailored quantitative analyses for each respective clinical question are outlined separately below.

Tailored Methodological Approaches for Individual Review Questions

[I] Accuracy of HPV testing in self-collected samples compared with health professional-collected samples

A prior review by Arbyn et al was used as a basis in addressing this question.(19)

Population	Individuals eligible for cervical screening		
Index Test	HPV testing on self-collected sample		
Comparator Test	HPV testing on healthcare professional-collected sample		
Reference Standard	Colposcopy +/- biopsy as indicated		
Co-variables (where available)	<ul style="list-style-type: none"> • Background risk of population • Screening history of population (e.g under-screened, never screened) • Clinical history of population (e.g HIV positive) • Testing methodology • Sampling method/kit • Storage medium • Home-based vs in-clinic self-sampling • Age; Socioeconomic status; Ethnicity 		
Outcomes (where available)	<ul style="list-style-type: none"> • Absolute sensitivity and specificity of HPV self-sampling for the detection of CIN2+ and CIN3+ of index and comparator tests • Relative sensitivity and specificity of HPV self-sampling for CIN2+ and CIN3+ of HPV self-sampling versus clinician-based sampling • False-positive and false-negative rates of HPV self-sampling versus clinician-based sampling • PPV and NPV of HPV self-sampling • Proportion of self-selected samples in which HPV status cannot be determined (e.g. insufficient sample, failed lab tests) • Proportion of women with a 'failed' test/sample who are asked to provide a second sample • Proportion of women with a positive test result who attend clinic for diagnostic investigations and treatment (including cytology follow-up) 		
Study designs	Cross-sectional studies, cohort studies, randomised controlled trials (RCTs), systematic reviews.		
Electronic databases	Database: <input checked="" type="checkbox"/> MEDLINE <input checked="" type="checkbox"/> CENTRAL <input checked="" type="checkbox"/> EMBASE <input checked="" type="checkbox"/> Clinical Trial Registry (ClinicalTrials.gov)	From: 1 st January 2018 (overlap with Arbyn et al. 2018)	To: March 2024

Analyses were conducted according to the methods recommended in the Cochrane Handbook for Systematic Review of Diagnostic Test Accuracy (utilising the supplementary material in Chapter

10).(24) For each study, 2x2 tables for self-sampling (self) and healthcare professional sampling (health) were either extracted or back-calculated from the absolute sensitivities and specificities (with variance calculated from 95% confidence intervals) for self and health. Using the {lme4} (Walker, 2015) package, a single model was defined that included both sensitivity and specificity for self and health, together, with separate variances for self and health. This model gave pooled estimates of absolute sensitivity and specificity for self and health. Using the {msm} (Jackson, 2011) package, the pooled absolute and relative difference between self and health for sensitivity and specificity could be calculated using the delta method (Ver Hoef, 2021) for calculating the confidence intervals. Absolute and relative differences were estimated separately for screening and colposcopy referral populations, and CIN2+ and CIN3+. Assay testing methodology and self-sampling device and setting were tested regarding affecting the outcome. These were tested by adding them to the model and then comparing models using the likelihood ratio test.

[II] *The level of concordance between HPV-DNA testing in self-collected samples and health professional collected samples in cervical screening non-attenders*

A prior review by Arbyn et al was used as a basis in addressing this question, with specific additional consideration of an updated review and meta-analysis on concordance between self-collected and clinician-collected samples for HPV testing.(19, 20)

Population	Individuals eligible for cervical screening		
Index test	HPV testing on self-collected specimens		
Comparator/reference standard	HPV testing on healthcare professional-collected specimens in index test subject		
Co-variables (where available)	<ul style="list-style-type: none"> • Background risk of population • Clinical history of population • Testing methodology • Sampling method/kit • Storage medium • Home-based vs in-clinic self-sampling • Age; Socioeconomic status; Ethnicity • Comorbidities captured by clinical history 		
Outcomes (where available)	<ul style="list-style-type: none"> • HPV status • Test positivity ratio • Percent positive agreement • Percent negative agreement • Cohen's Kappa statistic • Positive concordance • Negative concordance 		
Study designs	RCTs, cohort studies, systematic reviews		
Electronic databases	Database: <input checked="" type="checkbox"/> MEDLINE <input checked="" type="checkbox"/> CENTRAL <input checked="" type="checkbox"/> EMBASE <input checked="" type="checkbox"/> Clinical Trial Registry (ClinicalTrials.gov)	From: 1 st January 2018 (overlap with Arbyn et al. 2018)	To: March 2024

Test positivity rate ratio, overall agreement, positive agreement, negative agreement, kappa, positive concordance, and negative concordance were meta-analysed. Test positivity rate ratio was meta-analysed with {metafor} using a log transformation. Kappa was meta-analysed with {metafor} and

utilised the measure of overall agreement to estimate variance when applicable (Sun, 2011). The remaining outcomes were meta-analyses of proportions using the metaprop command in {meta}. Assay testing methodology, self-sampling setting, and self-sampling device were tested regarding influencing the outcomes.

[III] Uptake of cervical screening in screening non-attenders offered HPV self-sampling compared with those offered health professional sampling

A prior review by Arbyn et al was used as a basis in addressing this question.(19)

Population	Individuals eligible for cervical screening who did not participate in the standard cervical screening programme, did not respond to invitations to attend for clinician-based cervical screening, are under-screened		
Intervention	Invitation to HPV based cervical screening - self sampling: opt-in, mailed, door-to-door, opportunistic		
Comparator	Invitation to HPV based cervical screening - clinician/health professional sampling		
Co-variates (where available)	<ul style="list-style-type: none"> • Invitation strategy (including opt-in; opt-out; opportunistic) • Screening history • Time from invitation for clinician/health professional sampling • Clinical history of population • Sampling method (brush, swab, lavage) • Location of test (home vs clinic/primary care) • Use of reminders (e.g. SMS) • Age; Socioeconomic status; Ethnicity • Comorbidities 		
Outcomes (where available)	<ul style="list-style-type: none"> • Uptake of HPV based cervical screening (absolute response rate) • Relative response rate • Response difference • Adherence to follow-up among those with a positive test result • PPV for CIN2+ among those with a positive test that attended for follow-up • Proportion of self-sampling individuals with unsatisfactory test results, i.e HPV status cannot be determined (e.g. insufficient sample, failed lab tests) • Proportion of women with a 'failed' test/sample who are asked to provide a second sample • CIN2+ detection rate • Frequency of screening across rounds 		
Study designs	RCTs, cohort studies, systematic reviews		
Electronic databases	Database: <input checked="" type="checkbox"/> MEDLINE <input checked="" type="checkbox"/> CENTRAL <input checked="" type="checkbox"/> EMBASE <input checked="" type="checkbox"/> Clinical Trial Registry (ClinicalTrials.gov)	From: 1 st January 2018 (overlap with Arbyn et al. 2018)	To: March 2024

Absolute participation (self-sampling and control), unsatisfactory sample, adherence to follow-up, and CIN2+ detection were pooled using the metaprop command in {meta}. Participation difference and

relative participation were meta-analysed using the metabin command in {meta}. Absolute and relative participation outcomes were meta-analysed separately for per protocol/intention-to-treat analysis results and invitation scenario. Per protocol analysis included women who participated in the cervical cancer screening through an HPV DNA self-sampling arm only. Intention-to-treat analysis included also those who were invited for self-sampling but chose to have a clinician-collected sample instead. Self-sampling device, whether reminders were used, and time between invitation and healthcare professional sampling were tested regarding influencing the outcomes.

[IV] Acceptability of HPV self-sampling screening strategies to those that have not attended the regular cervical screening programme

A prior review by Nelson et al was utilised as the basis for addressing this question, with particular consideration of additional reviews by Yeh et al and Nishimura et al(21-23)

Population	Individuals eligible for cervical screening who do not attend for health professional testing		
Intervention	Invitation to HPV-based cervical screening - self-sampling		
Comparator	Invitation to HPV-based cervical screening - health professional sampling		
Co-variables (where available)	<ul style="list-style-type: none"> • Invitation strategy • Sampling method (brush, swab, lavage) • Screening history • Clinical history of population • Population subgroup (eg SES, ethnicity, LGBT+) 		
Outcomes (where available)	<p>Overall:</p> <ul style="list-style-type: none"> • Stated overall acceptability • Stated preference in compared with clinician-based screening • Stated preference for the setting of self-collection of sample • Stated willingness to repeat screening <p>Individual characteristics of acceptability/experience including:</p> <ul style="list-style-type: none"> • Logistic measures of acceptability (e.g convenience, accessibility) • Procedure-related measures of acceptability (e.g pain/physical discomfort, ease of use, confidence in result, self-efficacy to do the test) • Psychosocial measures of acceptability (e.g stigma, embarrassment, anxiety, fit with values) 		
Study designs	RCTs, cohort studies, feasibility studies, mixed methods studies, surveys and systematic reviews.		
Electronic databases	<p>Database:</p> <p><input checked="" type="checkbox"/> MEDLINE</p> <p><input type="checkbox"/> CENTRAL</p> <p><input checked="" type="checkbox"/> EMBASE</p> <p><input checked="" type="checkbox"/> Other (CINAHL, LILACS, SCOPUS, OpenGrey, ProQuest, Cochrane Library)</p> <p><input checked="" type="checkbox"/> Clinical Trial Registry (ClinicalTrials.gov)</p>	<p>From:</p> <p>1st December 2014 (overlap with Nelson et al. 2015)</p>	<p>To:</p> <p>March 2024</p>

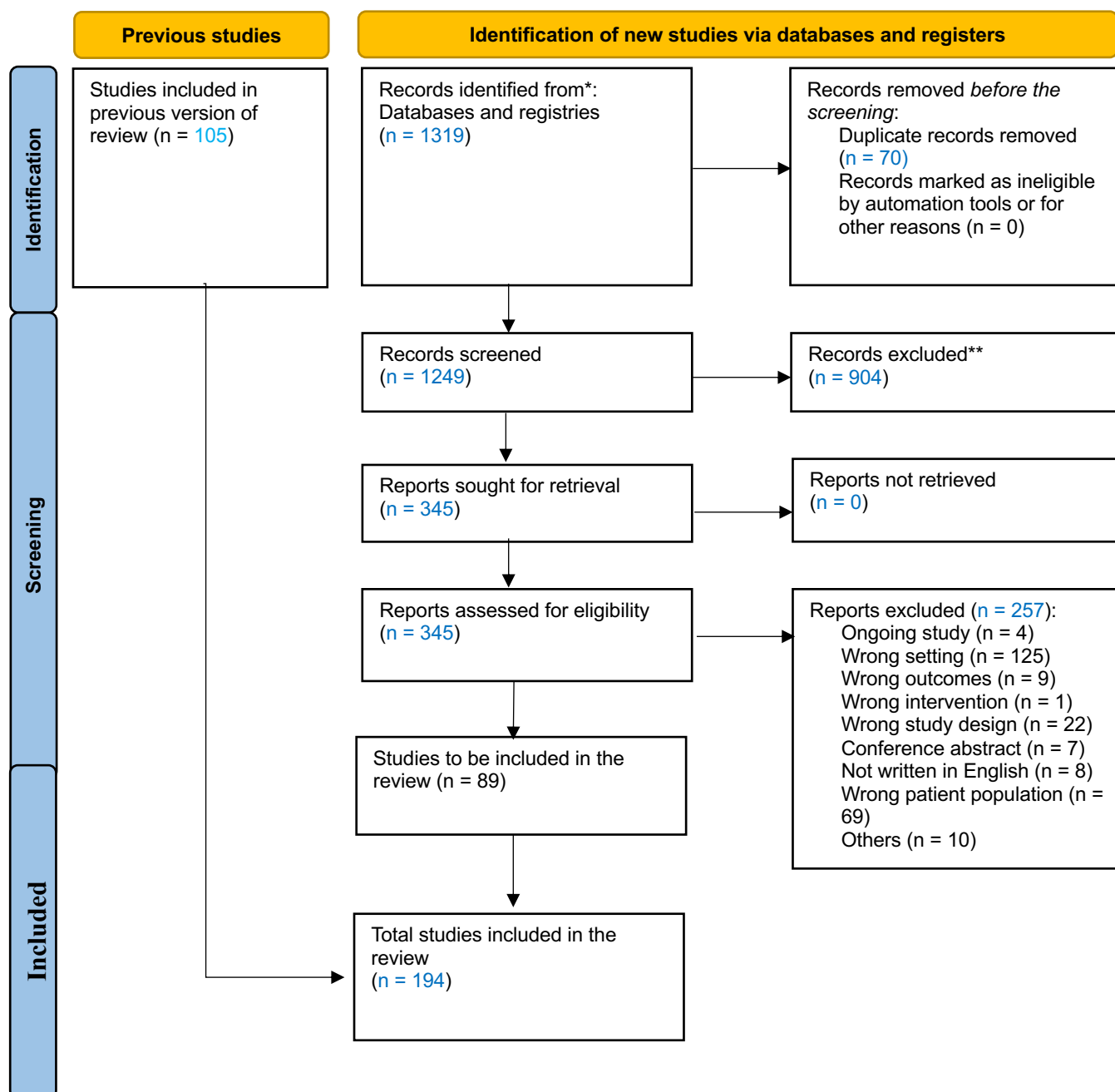
All outcomes were meta-analysed using the metaprop command in {meta}. Due to data availability, only self-sampling devices were tested regarding influencing the outcomes.

Results

Included Studies

Overall, 193 studies are included in this review. 105 studies from the review and 88 from the top-up search. From the search, 1319 studies were identified from databases and registries. 70 studies were duplicates. 904 studies were excluded based on title and abstract screening. 345 studies were assessed by full article screening in which 257 studies were excluded (*Figure 1*).

Figure 1: PRISMA Flow Chart for the Included Studies



[I] Accuracy of HPV testing in self-collected samples compared with health professional-collected samples

The accuracy question included 56 studies – 32 studies from the referenced reviews and 24 from the top-up search (*Table 1*). The studies were conducted in 21 different high-income countries, and the number of participants in the studies ranged from 41 to 13,004. The age of the included participants ranged from 15 to 80 years. The self-sampling devices reported in these studies were brush (22), swab (25), lavage (5) and tampon (1). The relative sensitivity/specificity reported in the detection of CIN2+ was reported in 46 studies. The assay used in these studies included PCR (28), HC2 (11) and some studies used more than two assays (11). The most frequently used storage medium was cell preserving (32).

In order to calculate the pooled estimates appropriately (as per the Cochrane Handbook), the raw 2x2 data table are required. The reference reviews only reported relative sensitivity and specificity for each study, which was not sufficient to back-calculate the requisite data. Furthermore, of all studies identified from the top-up search, eight did not have the necessary data (e.g. no comparator; no standard error). This has reduced the number of studies available for meta-analysis to 13 studies.

Pooled analysis showed that the sensitivity of self-sampling was lower than for healthcare professional sampling; however, it was not statistically significant (*Table 2*). Self-sampling device and setting did not give a significant effect on the absolute difference for colposcopy referral CIN2+ (LR test p-value = 0.143 and 0.984, respectively). Assay methods were all target-amplification methods regarding colposcopy referral CIN2+. Other groupings were not tested for test characteristic effects due to the small number of studies.

Table 1 **Characteristics of Studies on Test Accuracy of HPV Testing in Self-selected Samples**

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Belinson 2012 China	Primary screening	8556	Mean 38.9 Range 25-59	Not reported	Brush	Not specified	Cervista, MALDI-TOF	Cell-preserving	CIN2+ CIN3+
Girianelli 2006 Brazil	Primary Screening (high risk)	1777	Mean 39 Range: 25-59	Not reported	Brush	Not specified	HC2	Not reported	CIN2+
Holanda 2006 Brazil	Primary screening	878	Mean not given Range 15-69	Not reported	Brush	Not specified	HC2	Not reported	CIN2+
Zhao 2012 China	Primary screening	13004	Mean:37.9 Range not given	Not reported	Brush	Not specified		STM	CIN2+ CIN3+
Nieves 2013 Mexico	Primary screening	2049	Median 39 Range 30-50	Not reported	Brush	Not specified	HC2, APTIMA	Cell-preserving	CIN2+ CIN3+
Zhao 2013 China	Primary screening	7421	Mean not given Range 25-65	Not reported	Brush	Not specified	HC2, careHPV	CCM	CIN2+ CIN3+
Zhang 2014 China	Primary screening	806	Mean not given Range 16-54	Not reported	Brush	Not specified	HC2 & LA		CIN2+
Wright 2000 South Africa	Primary screening	1415	Median 39 Range 35-65	Not reported	Swab	Not specified	HC2	STM	CIN2+
Belinson 2001 China	Primary screening	1997	Mean 39.1 Range not given	Not reported	Swab	Not specified	hrHPV: HC2 Cyto: cPap	STM	CIN2+
Salmeron 20 Mexico	Primary screening	7856	Mean 42.5 Range not given	Not reported	Swab	Not specified	hrHPV: HC2 Cyto: cPap	STM	CIN2+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Szarewski 2007 UK	Primary screening	920	Median 29 (population 1) Median 41 (population 2)	Not reported	Swab	Not specified			CIN2+
Longatto-Filho 2012 Argentina, Brazil	Primary screening	12114	Mean 37 Range 14-67	Not reported	Tampon	Not specified	HC2	HPV: STM Clin Cyto: SurePath, Citoliq	CIN2+
Bhatla 2009 India	Primary screening (high risk)	546	Median 36 Range not give	Not reported	Brush	Not specified	HC2, PCR (PGMY09/11)	STM	CIN2+
Balasubramanian 2010 USA	Primary screening (high risk)	1665	Median 23 Range 18-50	Not reported	Swab	Not specified	HC2	STM	CIN2+
Hillemanns 1999 Germany	Colposcopy referral	247	Not specified	No reported	Brush	Not specified	HC2	“placed into a specimen collection tube”	CIN2+
Boggan 2015 Haiti	Primary screening	1845	Mean 41 Range 25-65	Not reported	Brush	Not specified	HC2	STM	CIN2+ CIN3+
Aiko 2017 Japan	Colposcopy referral	136	Mean not given Range 20-69	Not reported	Brush	Not specified	HC2		CIN2+ CIN3+
Jentschke 2013a Germany	Colposcopy referral	72	Mean 37 Range 16-68	Not reported	Lavage	Not specified	HC2	Self: buffered saline Clin: PreservCyt, Cervatec	CIN2+ CIN3+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Jentschke 2013b Germany	Colposcopy referral	42	Mean: 36 Range: 18-68	No reported	Lavage	Not specified	hrHPV: HC2 P16: p16INK4a ELISA	Self: buffered saline Clin: PreservCyt, Cervatec	CIN2+ CIN3+
Sellors 2000 Canada	Colposcopy referral	200	Mean 31.5 Range not given	Not reported	Swab	Not specified	HC2, PCR (L1 consensus)	Self: STM Clin brush: STM Clin swab: sterile phosphate buffered saline	CIN2+
Taylor 2011 South Africa	Participants from RCT who had undergone cryotherapy in the two screen-and-treat groups and all who were in the control group and did not undergo cryotherapy	2670	Mean 43 Range 35-65	Not reported	Swab	Not specified	HC2	STM	CIN2+
Stanczuk 2016 UK	Primary Screening	5318	Mean 41 Range 18-76	Not reported	Swab	Not specified	PCR	Cell preserving	CIN2+ CIN3+
Jentschke 2016 Germany	Colposcopy referral	136	Mean 36 Range 17-78	Not reported	Brush	Not specified	PCR	Cell preserving	CIN2+ CIN3+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Chen 2016a China	Colposcopy referral	197	Mean 39 Range 18-56	Not reported	Brush	Not specified	PCR	Not documented	CIN2+ CIN3+
Asciutto 2017 Sweden	Colposcopy referral	218	Mean 35 Range 19-71	Not reported	Swab	Not specified	PCR	Cell preserving	CIN2+
Leeman 2017 The Netherlands	Colposcopy referral	91	Mean not reported Range 18-60	Not reported	Brush	Not specified	PCR	Cell preserving	CIN2+ CIN3+
Hesselink 2014 The Netherlands	Primary Screening	894	Mean 41 Range 30-60	Not reported	Brush and Lavage	Not specified	PCR	Cell preserving	CIN2+
Dijkstra 2012 The Netherlands	Colposcopy referral	135	Median 34 Range not given	Not reported	Brush	Not specified	PCR	Cell preserving	CIN2+
van Baars 2012 The Netherlands	Colposcopy referral	134	Mean 40 Range 21-66	Not reported	Brush	Not specified	PCR	Self: FTA cartridge Clin: ThinPrep, SurePath	CIN2+ CIN3+
Nobbenhuis 2002 The Netherlands	Colposcopy referral	71	Mean 35 Range not given	Not reported	Lavage	Not specified	PCR	PBS	CIN2+
Brink 2006 The Netherlands	Colposcopy referral	96	Median 35 Range 18-59	Not reported	Lavage	Not specified	PCR	SurePath	CIN2+
Catarino 2017 Switzerland	Colposcopy referral	150	Median 32 Range 18-69	Not reported	Swab	Not specified	PCR	Cell preserving	CIN2+ CIN3+
Leinonen 2018 Norway	Other	240	Mean 38 Range 21-80	Not reported	Brush and Swab	Not specified	PCR	Cell preserving	CIN3+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Avian 2022 Italy	Primary screening	889	Mean not reported 30-39: 190 (21.4%); 40-49: 303 (34.1%); 50-59: 299 (33.6%); ≥ 60: 97 (10.9%)	Not reported	Swab	Clinical setting	PCR	Cell preserving	CIN2+
Cho 2020 Korea	Colposcopy referral	314	Median 40 Range not reported	Not reported	Brush	Clinical setting	PCR	Cell preserving	CIN2+
Edbald-Svensson 2018 Sweden	Colposcopy referral	63	Mean 42 Range 24–64	Not reported	Swab	Not specified	PCR	Cell preserving	CIN2+
El-Zein 2018 Canada	Colposcopy referral	1217	Not reported	Not reported	Swab	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+
El-Zein 2019 Canada	Colposcopy referral	700	Mean 37.7 Range not reported	Not reported	Swab	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+
Etrik 2021 Germany	Colposcopy referral	65	Median age 36 Range 24–76	Not reported	Swab and Brush	Home	PCR	Cell preserving	CIN2+
Igidbashian 2014 Italy	Primary screening	700	Mean 44.3 Range. Not reported	Not reported	Brush	Clinical setting	The Hybrid Capture II microplate method	Cell preserving	CIN2+
Klischke 2021 Germany	Colposcopy referral	70	Mean 37	Not reported	Brush	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+
Latsuzbaia 2022a Belgium	Colposcopy referral	485	Median 40 Range not reported	No reported	Brush	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Latsuzbaia 2023a Belgium	Colposcopy referral	483	Median 40 Range not reported	Not reported	Swab and Brush	Clinical setting	PCR and signal amplification	Cell preserving	CIN2+ CIN3+
Latsuzbaia 2022b Belgium	Colposcopy referral	486	Median 40 Range not reported	Not reported	Swab and Brush	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+
Latsuzbaia 2023b Belgium	Colposcopy referral	493	Not reported	Not reported	Swab and Brush	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+
Leinonen 2018 Norway	Colposcopy referral	Self sampling: Evalyn Brush=287; FLOQ swabs=286 Health professional sampling: 259	Not reported	Not reported	Swab and Brush	Home	PCR	Cell preserving	CIN3+
Mangold 2019 Germany	Colposcopy referral	208	Not reported	Not reported	Swab	Not specified	Signal amplification and PCR	Cell preserving	CIN2+
Martinelli 2023 Italy	Colposcopy referral	245	Median 38 Range not reported	Not reported	Swab	Clinical setting	PCR	Cell preserving	CIN2+
Martinelli 2024 Italy	Colposcopy referral	290	Median 40 Range not reported	Not reported	Swab	Clinical setting	PCR	BD HPV Self Collection Diluent	CIN2+ CIN3+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Naseri 2022 USA	Primary screening	106	Mean 31.0 Range not reported	Not reported	Swab	Clinical setting	Not reported	Cell preserving	CIN2+
Onuma 2020 Japan	(1) Outpatients with abnormal cytology and requiring colposcopy and biopsy and (2) NILM/HPV-positive patients in the Fukui Cervical Cancer Study	100	Mean 41.8 Range not given	Not reported	Brush	Clinical setting	Cobas 4800 system	Cell preserving	CIN2+
Ørnskov 2020 Denmark	Colposcopy referral	305	Median 34 Range 17-85	Not reported	Brush	Clinical setting	PCR	Cell preserving	CIN2+ CIN3+
Pasquier 2023 France	Primary screening	148	Mean 46 Range not reported	No reported	Swab	Clinical setting	Not reported	Cell preserving	CIN2+
Polman 2019 The Netherlands	Primary screening	Self sampling: 7643 Health professional sampling: 6282	Self sampling mean = 45.5 Clinician based sampling mean = 45.7 Range not given	No reported	Brush	Home	PCR	Cell preserving	CIN2+ CIN3+

Author, Year and Country	Population	Sample Size	Age (years)	Ethnicity	Device used	Setting	hrHPV Assay	Storage Medium	Outcomes Assessed
Rohner 2020a USA	Colposcopy referral	314	Median 36 Range not given	Non-Hispanic white: 38% Hispanic: 29% non-Hispanic Black: 26% Other racial identities: 6%	Brush	Clinical setting	PCR	Cell preserving	CIN2+
Rohner 2020b USA	Colposcopy referral	307	Median 36 Range not given	Hispanic: 29% Non-Hispanic white: 38% Non-Hispanic black: 26%; Other: 7%	Brush	Clinical setting	PCR	Cell preserving	CIN2+
Stanczuk 2022 UK	Primary screening	4617	Mean 41.3 Range not given	Not reported	Not specified	Not specified	Cobas 4800 PCR-based DNA test	ThinPrep (PreservCyt Solution Hologic, UK)	CIN2+ CIN3+

Table 2 Pooled Estimates for Absolute Accuracy Measures

Group	No. of studies	Sensitivity (95% CI)				Specificity (95% CI)			
		Self	Health	Absolute Difference	Relative Difference	Self	Health	Absolute Difference	Relative Difference
Colposcopy referral & CIN2+	11*	81.7 (70.9 to 89.0)	87.2 (80.3 to 91.9)	-5.5 (-16.2 to 5.2)	0.94 (0.82 to 1.07)	56.7 (41.3 to 70.9)	52.2 (44.2 to 60.1)	4.5 (-12.7 to 21.7)	1.09 (0.80 to 1.48)
Colposcopy referral & CIN3+	3	84.4 (37.0 to 98.0)	86.1 (56.3 to 96.7)	-1.7 (-36.4 to 33.1)	0.98 (0.65 to 1.48)	82.8 (43.1 to 96.8)	59.1 (40.5 to 75.4)	23.7 (-8.3 to 55.7)	1.40 (0.90 to 2.18)
Primary screening & CIN2+	2	87.4 (76.1 to 93.8)	91.6 (77.4 to 97.2)	-4.3 (-16.6 to 8.1)	0.95 (0.83 to 1.09)	93.9 (93.2 to 94.6)	94.1 (93.3 to 94.8)	-0.2 (-1.2 to 0.9)	1.00 (0.99 to 1.01)
Primary screening & CIN3+	1	95.1 (88.5 to 100.0)	95.8 (91.2 to 100.0)	N/A	N/A	93.4 (92.9 to 94)	93.5 (92.9 to 94.1)	N/A	N/A

Self = self-sampling; Health = health-professional sampling

* Cho (2022) and Klischke (2021) had separate results for two different assays, El-Zein (2018) had separate results for two different swabs.

[II] The level of concordance between HPV-DNA testing in self-collected samples and health professional collected samples in cervical screening non-attenders

The concordance question included 50 studies – 25 studies from the referenced reviews and 25 from the top-up search (*Table 3*). The studies were conducted in 16 different countries, and the number of participants in the studies ranged from 30 to 5,318. The age of the included participants ranged from 16 to 80 years. The self-sampling devices which were used included brush (22), swab (20), lavage (2) and others (5). The self-sampling was reported done mostly in the clinical setting (35), followed by at home (5). The most used assay was PCR (25).

There were nine studies not included in the meta-analysis due to the lack of information (e.g. only gave kappa without respective variance, or only gave number of participants with a positive/negative result by self-sampling or healthcare professional, but not how many were agreed upon). This resulted in 28 studies with at least one concordance outcome that were included in the meta-analysis.

Table 3 Characteristics of Included Studies on Concordance between HPV-DNA Testing in Self and Health Professional Collected Samples

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Hillemann 1999 Germany	Not reported	247	Not specified	Not specified	Lavage	Clinical setting	PCR	Ethanol carbowax
Morrison 1992 USA	Colposcopy referral	25	Not specified	Not specified	Lavage	Clinical setting	PCR	Ethanol carbowax
Sellors 2000 Canada	Not reported	200	Mean 31.5 Range not given	Not specified	Swab	Clinical setting	Both HC2, PCR (L1 consensus)	Self: STM Clin brush: STM Clin swab: sterile phosphate- buffered saline
Nobbenhuis 2002 The Netherlands	Not reported	71	Mean 35 Range not given	Not specified	Brush	Clinical setting	PCR	PBS
Brink 2006 The Netherlands	Not reported	96	Median 35 Range 18-59	Not specified	Brush	Clinical setting	PCR	STM
Daponte 2006 Greece	Not reported	98	Not specified	Not specified	Brush	Clinical setting	PCR	PBS
Seo 2006 South Korea	Not reported	118	Mean 46.2	Not specified	Swab	Clinical setting	hrHPV DNA Chip	Not specified

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Szarewski 2007 UK	Not reported	920	Median 29 (pop 1) Median 41 (pop 2)	Not specified	Swab	Not specified	HC2	Not specified
Balasubramanian 2010 USA	High risk	1665	Median 23 Range 18-50	Not specified	Swab	Not specified	HC2	STM
Gustavsson 2011 Sweden	Not reported	50	Mean not reported Range 39-60	Not specified	Brush	Clinical setting	PCR	FTA cartridge
Twu 2011 Taiwan	Unscreened for ≥ 3 years	252	Median 42 Range 26-79	Not specified	Brush	Clinical setting	PCR	STM
Dijkstra 2012 The Netherlands	Not reported	135	Median 34 Range not given	Not specified	Brush	Clinical setting	PCR	PreservCyt
van Baars 2012 The Netherlands	Not reported	134	Mean 40 Range not given	Not specified	Brush	Clinical setting	PCR	FTA cartridge
Darlin 2013 Sweden	Not reported	108	Mean 34 Range not given	Not specified	Brush	Clinical setting	PCR	PreservCyt

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Geraets 2013 Spain	Not reported	182	Median 34 Range: 16-76	Not specified	Brush	Clinical setting	PCR	FTA cartridge
Jentschke 2013a Germany	Not reported	72	Mean 37 Range not given	Not specified	Lavage	Clinical setting	HC2 P16: p16INK4a ELISA	Buffered saline
Jentschke 2013b Germany	Not reported	49	Mean 36 Range not given	Not specified	Lavage	Clinical setting	HC2 P16: p16INK4a ELISA	Buffered saline
Chernesky 2014 Canada	Not reported	580	Mean 39 Range not given	Not specified	Brush	Clinical setting	APTIMA HPV	APTIMA SCT
Jentschke 2016 Germany	Not reported	136	Mean 36 Range not given	Not specified	Brush	Clinical setting	Abbott RealTime and hrHPV PCR	Dry, then transferred to PreservCyt
Stanczuk 2016 UK	Not reported	5,318	Mean 41 Range not given	Not specified	Swab	Not reported	Cobas 4800	PreservCyt
Aiko 2017 Japan	Not reported	136	Not specified	Not specified	Brush	Clinical setting	HC2	Not reported
Asciutto 2017 Sweden	Not reported	218	Mean 35 Range not given	Not specified	Swab	Clinical setting	Cobas 4800	Cobas PCR Female Swab Sample Kit

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Catarino 2017 Switzerland	Not reported	150	Mean 32 Range not given	Not specified	Swab	Clinical setting	Xpert HPV; part of clin sample also cobas 4800.	Dry samples
Leeman 2017 The Netherlands	Not reported	91	Not specified	Not specified	Brush	Clinical setting	SPF10-DEIA-LIPA25 & GP5+/6+-EIA-LMNX	Dry up to 3 months, then placed in vial with PreservCyt for shipment
Asciutto 2018 Sweden	Not reported	176	Mean 34 Range not given	Not specified	Swab	Clinical setting	APTIMA	APTIMA vaginal specimen collection kit
Leinonen 2018 Norway	Not reported	240	Mean 38 Range not given	Not specified	Brush	Home	Anyplex II HPV28; cobas 4800, Xpert HPV	Dry transport of self-collection devices to lab
Onuma 2020 Japan	(1) Outpatients with abnormal cytology and requiring colposcopy and biopsy and (2) NILM/HPV-positive patients in the Fukui Cervical Cancer Study	100	Mean 41.8 Range not given	Not specified	Brush	Clinical setting	PCR	ThinPrep vials
Avian 2022 Italy		889	Not specified	Not specified	Swab	Clinical setting	PCR	ThinPrep

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Woong Cho 2020 South Korea	Women referred to colposcopy for abnormal cytology	314	Median 40 Range not given	Not specified	Brush	Home	Aptima HPV assay (Hologic, Inc.)	Aptima sample transport media
Des Marais 2018 USA	Low income	193	Mean 45 Range 30–63	Black (25.7%), White (44.5%), Hispanic (25.7%), Others (4.2%)	Brush	Home	Aptima HPV assay (Hologic, Inc.)	Aptima sample transport media
Svensson 2018 Sweden		63	Mean 42 Range 24–64	Not specified	Qvintip	Clinical setting	PCR	Not reported
El-Zein 2018 Canada	Women referred for colposcopy	1076	Mean not Reported Range 21–74	Not specified	Swab	Clinical setting	PCR	PreservCyt
Ertik 2021 Germany	Patients referred to colposcopy clinics with abnormal results	65	Mean 36 Range, 24–76	Not specified	Swab, Brush	Home	PCR	ThinPrep PreservCyt
Gibert 2023 Spain	Women recruited from a colposcopy clinic	120	Median 46 Range 40–51	Spain 62.5%; Central and South America 21.7%; European and United Kingdom 7.5%, Others (8.3%)	Swab, Iune HPV sterile test cannula, brush, Mia by XytoTest	Clinical setting	PCR	PreservCyt, reTect TM Preservation and Transport Media

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Giubbi 2022 Italy	Women, referred to colposcopy	30	Mean 36.5 Range not given	Not specified	Swab	Clinical setting	PCR (Anyplex TM II HPV28 (Seegene); HPV28 (Seegene)); Papilloplex [®] High Risk HPV; (GeneFirst); HPV OncoPredict (Hiantis)	ThinPrep [®] PreservCyt [®] ; eNat [®]
Igidbashian 2014 Italy	Not reported	700	Mea: 44.3 Range not given	Not specified	Not reported	Clinical setting	Hybrid Capture (HC)	Not reported
Hong Kim 2021 South Korea	Women who had abnormal cervical smears or who were HPV-positive	151	Median 50 Range 21–65	Not specified	G+Kit [®] ; DocTool	Clinical setting	PCR	Not reported
Klischke 2021 Germany	Patients from the colposcopy clinic	70	Mean 37 Range not given	Not specified	Brush	Clinical setting	PCR	ThinPrep PreservCyt Solution
Leinonen 2018 Norway	Not reported	232	Mean 38 Range 21-80	Not specified	Evalyn [®] Brush FLOQSwabs Evalyn [®] Brush FLOQSwabs TM Evalyn [®] Brush FLOQSwabs TM	Clinical setting	PCR Anyplex TM II HPV28 Cobas [®] 4800 Xpert [®] HPV	PreservCyt

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Martinelli 2022 Italy	Women referred to colposcopy	64	Mean 38.4 Range not given	Not specified	Swab Colli-pee®- for first-void urine (FVU) sample	Not specified	BD Onclarity™ HPV Assay	PreservCyt Preservative urine conservation medium (UCM)
Martinelli 2024 Italy	Women who were referred to colposcopy	286	Median 40 Range not given	Not specified	Swab	Clinical sampling	Ist sample on VIPER; Second vaginal sample with VIPER; Second vaginal sample with COR	Dry samples
Naseri 2022 USA	Women with and without a history of high-risk HPV infection and with regular menses	106	Mean 31.0 Range not given	Asian 35.8%; Black 1.9%; Native Hawaiian/Other Pacific Islander 1.9%; White 48.1%, others 11.3%	Swab Q-Pad (Qvin™, Menlo Park, CA)	Clinical setting Home	Roche Cobas 4,800	Cobas media solution. Dry samples
Ngu 2022 Hong Kong	History of sexual activity and underserved population	121	Mean not reported Range 30-65	Not specified	Swab	Not reported	PCR	PreservCyt media
Onuma 2020 Japan	Referred patients with abnormal cytology or HPV infection	100	Mean 41.8 Range not reported	Not specified	Brush	Clinical setting	PCR	ThinPrep vials

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Rohner 2021 USA	Women attending colposcopy clinics with i) abnormal cytology results, ii) infection with HPV-16 or 18, iii) persistent infection with other hr-HPV genotypes, or iv) treatment for CIN2+	314	Median 36 Range not given	Non-Hispanic white 38%; Hispanic 29%; non-Hispanic black 26% and others 6%	Brush	Not reported	PCR	ThinPrep
Rohner 2020 USA	Women who were attending colposcopy clinics	307	Median 36 Range not given	Non-Hispanic white 38%; Hispanic white 29%; Non-Hispanic 26%; other (7%)	Not reported	Not reported	PCR (Urine sample)	Becton Dickinson (BD) molecular tube containing 0.2 ml of a proprietary preservative
Satake 2020 Japan	No details provided	300	Mean not reported Range 20-59	Not specified	Home Smear Set (ISK Co., Ltd., Tokyo, Japan)	Clinical setting	PCR	Cell fixation container (principal component is ethanol)
Saville 2020 Australia	Referral for colposcopy	292-296	Not reported	Not specified	Swab	Clinical setting	Cobas 4800; Cobas; Onclarity; GeneXpert; Anyplex II; Abbott	Not reported

Author, Year, Country	Population	Sample Size	Age (years)	Ethnicity	Device	Setting	hrHPV Assay	Storage medium
Terada 2022 Japan	Women attending hospital for abnormal cervical cytology	300	Mean not reported Range 21-50	Not specified	Brush Colli-pee®- for urine (FVU) sample	Not reported	PCR	PreservCyt
Tranberg 2020 Denmark	Women diagnosed with ASC-US.	150	Median 45 Range not given	Not specified	Not specified	Home	GENOMICA CLART® Cobas	Transportation tube with preservative media (Genelock, ASSAY ASSURE, Sierra Molecular, CA)
Stanczuk 2022 UK	Women eligible for cervical screening	4617	Mean 41.3 Range not given	Not specified	Not specified		Cobas 4800 PCR-based DNA test	ThinPrep (PreservCyt Solution, Holgic UK)

The pooled analysis showed that there was 87.1% overall agreement between self-sampling and healthcare professionals and a kappa value of 0.70 (Table 4).

Table 4 Pooled Estimates for Concordant Outcomes

Outcome	Subgroup**	No. of studies*	All results
Overall agreement (%)	All	25	87.1 (85.6 to 88.6)
	Clinical setting	18	86.1 (84.0 to 88.0)
	Home setting	4	90.0 (88.0 to 91.6)
Kappa	All	25	0.70 (0.67 to 0.73)
	Clinical setting	18	0.73 (0.70 to 0.76)
	Home setting	4	0.62 (0.57 to 0.67)
Test positivity rate ratio	All	12	0.97 (0.89 to 1.04)
	Swab & TA assay	3	1.03 (0.99 to 1.06)
	Lavage & TA assay	1	1.24 (1.10 to 1.40)
	Brush & TA assay	6	0.95 (0.90 to 1.00)
	Brush & SA assay	1	0.66 (0.56 to 0.77)
	Brush & RNA assay	1	0.98 (0.90 to 1.06)
Positive agreement (%)		17	85.5 (81.6 to 88.7)
Negative agreement (%)	All	17	82.3 (74.9 to 87.9)
	Clinical setting	13	86.8 (83.6 to 89.5)
	Home setting	1	52.3 (47.1 to 57.5)
Positive concordance (%)		13	77.0 (70.7 to 82.1)
Negative concordance (%)		13	74.6 (70.8 to 78.1)

* Many studies gave multiple results (e.g. different assays, devices)

** Only reported where the inclusion of the respective variable gave a significant (<0.05) result

Figure 2 and *Figure 3* show the results for overall agreement and kappa respectively. The included studies reported overall agreement ranging from 77% to 96% and kappa value ranging from 0.47 to 0.86. There was substantial heterogeneity amongst the studies.

Regarding overall agreement, test assay gave no significant effect ($p = 0.292$), while self-sampling device gave a borderline significant effect ($p = 0.046$). However, the only device that gave a significant result was ‘tampon’ which was only informed by one study. There was a statistically significant effect regarding clinical setting ($p = 0.008$) where overall agreement was higher for tests taken in a home setting (*Figure 4*). Regarding kappa, self-sampling device and test assay gave no significant effect ($p = 0.948$ and $p = 0.139$, respectively). There was a statistically significant effect regarding clinical setting ($p < 0.001$) where kappa was higher for tests taken in a clinical setting (*Figure 5*), which was in direct contrast to the result found for overall agreement.

Negative agreement was also affected by setting of the test ($p < 0.001$) and the test positivity rate ratio was jointly affected by self-sampling device and assay method ($p < 0.001$) (*Table 4*). Other outcomes were not affected by the other characteristics tested.

Figure 2 Overall Agreement

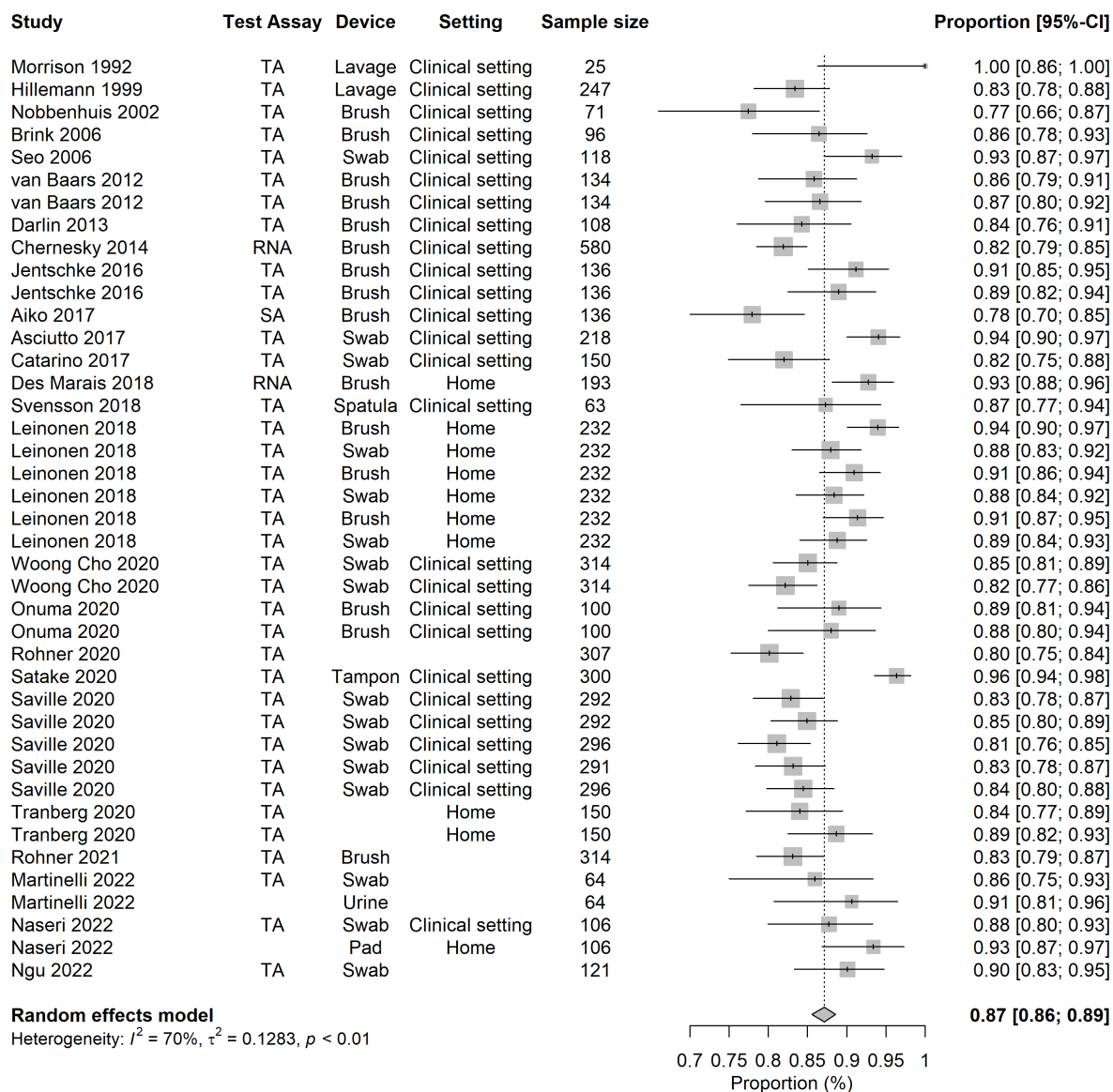


Figure 3 Forest plot for kappa

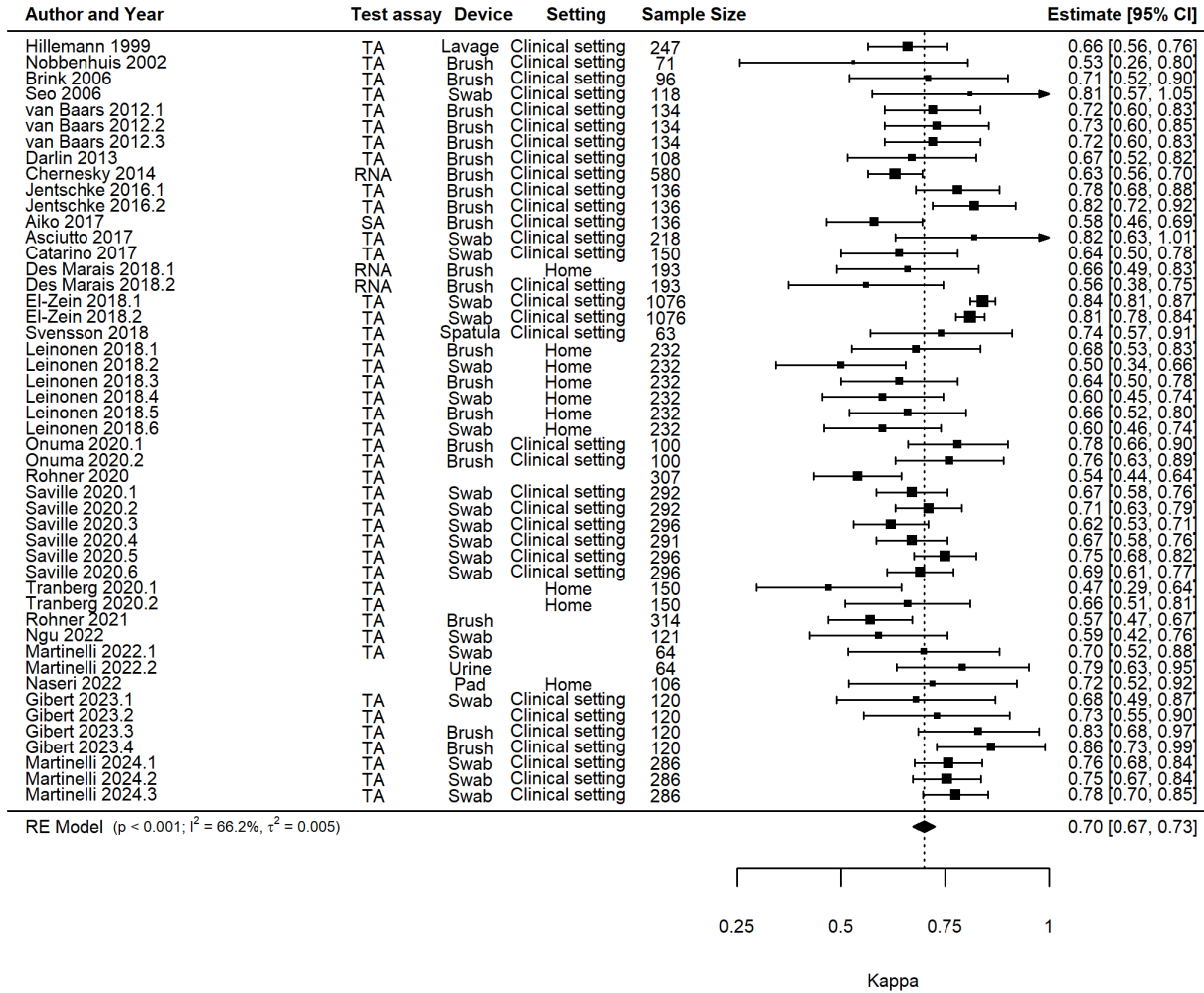


Figure 4 Overall Agreement across Settings

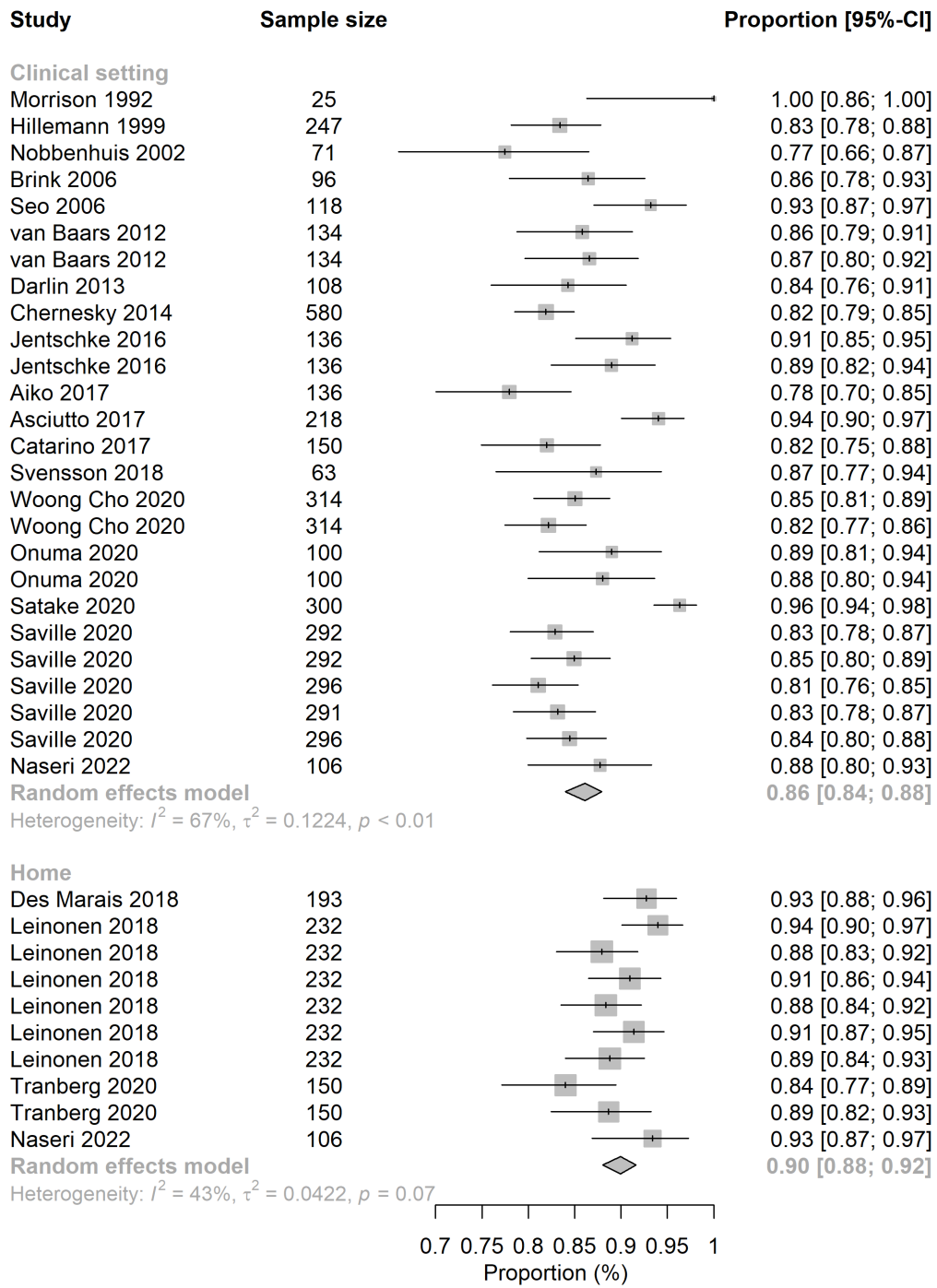
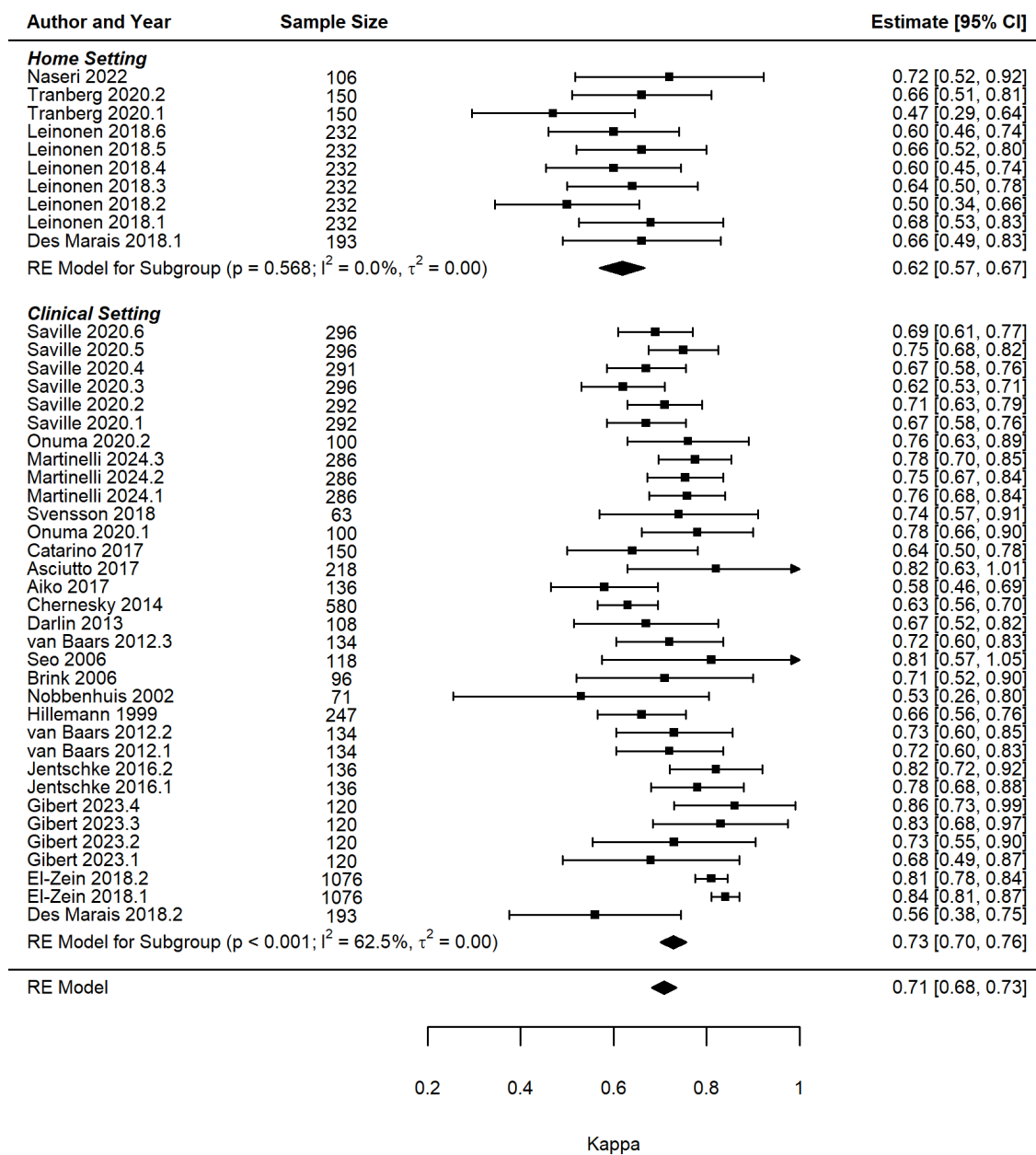


Figure 5 **Kappa by setting**



[III] Uptake of cervical screening in screening non-attenders offered HPV self-sampling compared with those offered health professional sampling

The uptake question included 38 studies – 26 articles from the basic review and 12 studies from the top-up articles. These studies were from 18 High-Income Countries. All studies included were for individuals who were non-attendeers of the regular screening including also those who have never screened. Due to the rapid nature of this review, we included only the studies that had a population of more than 1000 in both arms. The number of participants ranged from 529 to 57,717 in the self-sampling arm and 261 to 23,632 in the control arm. The age of the participants ranged from 20 to 69 years. All these studies used either opt-in (7), mail-to-all all (20), or a combination of these two self-sampling strategies (11). Thirteen studies reported to use of reminders for those overdue for screening. The sampling devices included brush (11), swab (13), leverage (4) and four (4) studies used more than one devise. Most of the studies reported both per protocol (PP) and intention to treat (ITT) analysis (30) (*Table 5*)

Table 5 **Characteristics of Included Studies for Uptake Question**

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
Bais 2007 New Zealand	Under screened	Intervention 2,352 Comparator 272	Range 30- 50	Mail to all	No	6 months	Brush	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Gok 2010 The Netherlands	Under screened	Intervention 26,886 Comparator 277	Range 30- 60	Mail-to- all		12months	Lavage	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Giorgi- Rossi 2011		Intervention Mail-to-all: 616; Opt-in: 622 Comparator Mail-to-all: 619; Opt-in: 616	Range 35- 65	Mail-to- all; Opt-in	No	3 months	Brush	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Piana, 2011 France	Under screened	Intervention 4,400 Comparator 4,934	Range 35- 69	Mail-to- all	No	Not documented	Not documented	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
Szarewski 2011 UK	Under screened	1,500 in both intervention and comparator	Range 25- 64	Mail-to- all	No	6 months	Swab	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Virtanen 2011 Finland	Under screened	Intervention 2,397 Comparator 6,302	Range 30- 60	Mail-to- all	No	Not documented	Lavage	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Wikstrom 2011 Sweden	Under screened	Intervention 2,000 Comparator 2,060	Range 39- 60	Mail-to- all	Yes	12 months	Swab	PP &ITT	Response rates; adherence to follow-up; CIN+ 2 detection
Gok 2012 The Netherlands	Under screened	Intervention 25,561 Comparator 261	Range 30- 60	Mail-to- all	No	12 months	Brush	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Darlin 2013 Sweden	Under screened	Intervention 1000 Comparator 500	Range 32- 65	Mail-to- all	Yes	Not documented	Not documented	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
									detection
Sancho- Garnier 2013 France	Under screened	Intervention 8,829 Comparator 9,901	Range 35- 69	Mail-to- all	No	Not documented	Swab	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Broberg 2014 Sweden	Never screened; Under screened	Intervention 800 Comparator 4000	Range 30- 62	Opt-in	Yes	Not documented	Swab	PP &ITT	Response rates; adherence to follow-up; CIN+ 2 detection
Haguenoer 2014 France	Under screened	Intervention 1,999 Comparator Cytology 2,000 No intervention 1,999	Range 30- 65	Mail-to- all	No	9m; 12m	Swab	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Cadman 2015 UK	Under screened	3000 in both arm	Range 25- 65	Mail-to- all	No	3 months	Swab	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Giorgi- Rossi	Under screened	Intervention Mail-to-all:	Range 30- 64	Mail-to- all; Opt-in	No	3 months	Lavage	PP &ITT	Response rates; adherence to

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
2015 Italy		4,516; Opt-in: 4,513 Comparator Mail-to-all: 1,998; Opt-in: 3,014							follow-up; insufficient sample; CIN+ 2 detection
Enerly 2016 Norway	Under screened	Intervention 800 Comparator 2,593	Range 26- 69	Mail-to- all	No	Not documented	Lavage (Delphi screener) / Evalyn brush (randomized)	PP &ITT	Response rates; adherence to follow-up; insufficient sample
Sultana 2016 Australia	Never screened; Under screened	Intervention 14,153 (7,075 un-screened; 7,078 under- screened) Comparator 2,025 (1,014 un- screened; 1,011 under- screened)	Range 30- 69	Mail-to- all	No	6 months	Swab	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Kitchener 2017 UK	Under screened	Intervention Mail-to-all: 1,141 (32 GPs); Opt-in: 1,290 (66 GPs)	Mean 20 (Grampian) Mean 25 (Manchest er))	Mail-to- all; Opt-in	No	3m, 6m, 12m, 18m	Lavage (Delphi Screener)/ Evalyn Brush	PP &ITT	Response rates.

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
		Comparator 3,782 (101 GPs)							
Kellen 2018 Belgium	Under screened	Intervention Mail-to-all: 9,118; Opt-in: 9,098. Comparator Reminder letter: 8,830; No reminder: 8,849	Range 30- 64	Mail-to- all; Opt-in	Yes	12m	Qvintip	PP &ITT	Response rates.
Tranberg 2018 Denmark	Never screened; Under screened	Intervention Mail-to-all: 3,265; Opt-in: 3,264. Comparator 3,262	Range 30- 64	Mail-to- all; Opt-in	Yes	6 months	Brush	PP &ITT	Response rates; adherence to follow; CIN+ detection
Ivanus 2018 Slovenia	Under screened	Intervention Mail-to-all: 9,556; Opt-in: 14,400 Comparator 2600	Range 34- 64	Mail-to- all; Opt-in	No	12 months	Mail-to-all: Qvintip (Swab), HerSwab (Swab) and Delphi Screener (Lavage). Opt-in: Qvintip	PP &ITT	Response rates; adherence to follow-up

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
Elfström 2019 Sweden	Under screened	Intervention Mail-to-all: 2,000; Opt-in: 2,000 Comparator 2000	Range 33 - 60	Mail-to- all; Opt-in	No	3 months	Swab	PP &ITT	Response rates; CIN+ detection
Jalili 2019 Canada	Under screened	Intervention 529 Comparator 523	Range 30 - 65	Mail-to- all	Yes	6 months	Swab	PP &ITT	Response rates
Winer 2019 USA	Under screened	Intervention 9,960 Comparator 9,891	30 - 64	Mail-to- all	No	6months	Not documented	PP &ITT	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Lilliecreutz 2020 Sweden	Under screened	Intervention 3,068 Comparator 3,538	Range 30 - 64	Mail-to- all	Yes	6 months	Swab	PP &ITT	Response rates; adherence to follow-up; CIN+ detection
Brewer 2021 New Zealand	Never screened; Under screened	Intervention Mail-to-all: 1467; Opt-in: 1574	Range 30- 69	Mail-to- all; Opt-in	No	3 months	Swab	PP &ITT	Response rates; follow up; insufficient sample

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
		Comparator 512							
Veerus 2021 Estonia	Never screened; Under screened	Intervention Mail-to-all: 4000 Opt-in: 8000 Comparator Not started	Range 37- 62	Mail-to- all; Opt-in	No	Not documented	Qvintip and Evalyn brush	Not reported	Not reported
Gunvor Aasbø 2022 Norway	Never screened; Under screened	2000 in both arms	Mean 54.3	Mail-to- all; Opt-in	Yes	Not documented	Brush	PP & TT	Response rates; adherence to follow-up; CIN2+ detection
Fujita 2022 Japan	Never screened; Under screened	Intervention 7,340 Comparator 7,782	Range 30- 59	Opt-in	Yes	Not documented	Brush	Not reported	Response rates; insufficient sample
Ejegod 2022 Denmark	Never screened; Under screened	Intervention 57,717 Comparator Not reported	Range 27- 65	Opt-in	Yes	Not documented	Brush	PP & ITT	Response rates; adherence to follow-up
Ngo 2024	Never screened; Under	Intervention 800	Range 50– 65	Mail-to- all	Yes	Not documented	Brush	PP & ITT	Response rates’ insufficient sample;

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
Czech Republic	screened	Comparator 764							dherence to follow-up
Nishimura 2023 Japan	Never screened; Under screened	Intervention 7,653 No Comparator	Range 20- 50	Opt in	Not reported	Not documented	Brush	ITT	Response rates' adherence to follow-up; CIN2+
Sultana 2022 Australia	Never screened; Under screened	Intervention 12,572 Comparator Not reported	Range 30- 69	Mail-to- all	No	2 years	Swab	Not reported	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Taro 2024 Japan	Never screened; Under screened	Intervention 3489 Comparator Not reported	30-39	Opt-in	Not reported	Not documented	Brush	PP & ITT	Response rates, Adherence to follow-up; CIN2+
Virtanen 2014 Finland	Under screened, never screened	Intervention 4536 Comparator Not reported	Range 25- 67	Mail-to- all	Not reported	Not documented	Lavage	Not reported	Response rates; adherence to follow-up; CIN2+
Winer 2023 USA	Never screened; Under screened; Routinely screened	Intervention Due for screening 12,928; Overdue for screening 8279; Unknown	Mean 45.9	Opt in; Mail-to- all	Yes	Due for screening ≤ 3 months; Overdue for screening (co-testing	Swab	ITT	Response rates; adherence to follow-up

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
	Due for screening: White 73.4%; Asian 12.4%; Black or African American 4.9%; others 9.3% Overdue: White 73.6%; Asian 11.5%; Black or African American 5.2%; others 9.7%	screening history 9942 Comparator 12,142				>5.25years ago, Papanicolaou testing alone >3.25 years ago, or no Papanicolaou testing with continuous enrolment ≥3.25 years, unknown enrolment ≥6 months and <3.25 years, no recorded screening)			
Winer 2022 USA	Never screened; Under screened. White	Intervention 9843 Comparator 9891	Mean 50.1	Mail-to- all	Not reported	Enrolled for 3 years and 5 months or more, and with no Papanicolaou	Not reported	ITT	Response rates

Author, Year, Country	Population	Sample Size	Age (years)	Invitation Strategy	Reminder	Time from Invitation to collected sample	Self- sampling device	Per protocol (PP) or Intention to Treat (ITT) Analysis	Outcomes Reported
	71.6%, did not specify others' percentage					test within 3 years and 5 months			
Auvinen 2022 Finland		Intervention 5350 Comparator Not reported	Range 25- 69	Opt-in.	Not reported	No documented	Aptima Multitest sampling kit	Not documented	Response rates; adherence to follow-up; insufficient sample; CIN+ 2 detection
Lam 2017 Denmark	Under- screened, never screened	23,632 same in both arms	Range 27 - 65	Opt-in	Yes	8 weeks	Brush	PP and ITT	Response rates

NB: Response rates: if the study reported any of the following absolute response rate, relative response rate, response difference. Adherence to follow-up: if the study reported on adherence to follow-up of individuals who receive positive screening results. Insufficient sample: proportion of individuals with unsatisfactory test results i.e HPV status could not be determined

Seven studies were not included in the meta-analysis as, fairer comparisons, only those that reported uptake for both the self-sampling and control arms were included leaving 30 studies. *Table 6* shows the percentage of women having a hrHPV test done with a self-sample, separately for those who received a self-sampling kit mailed to their home (mail-to-all) and those having to request a self-sampling kit (opt-in). Overall, the participation rate is higher amongst self-sampling compared with controls.

Table 6 Absolute and Relative participation in self-sampling and/versus control arms

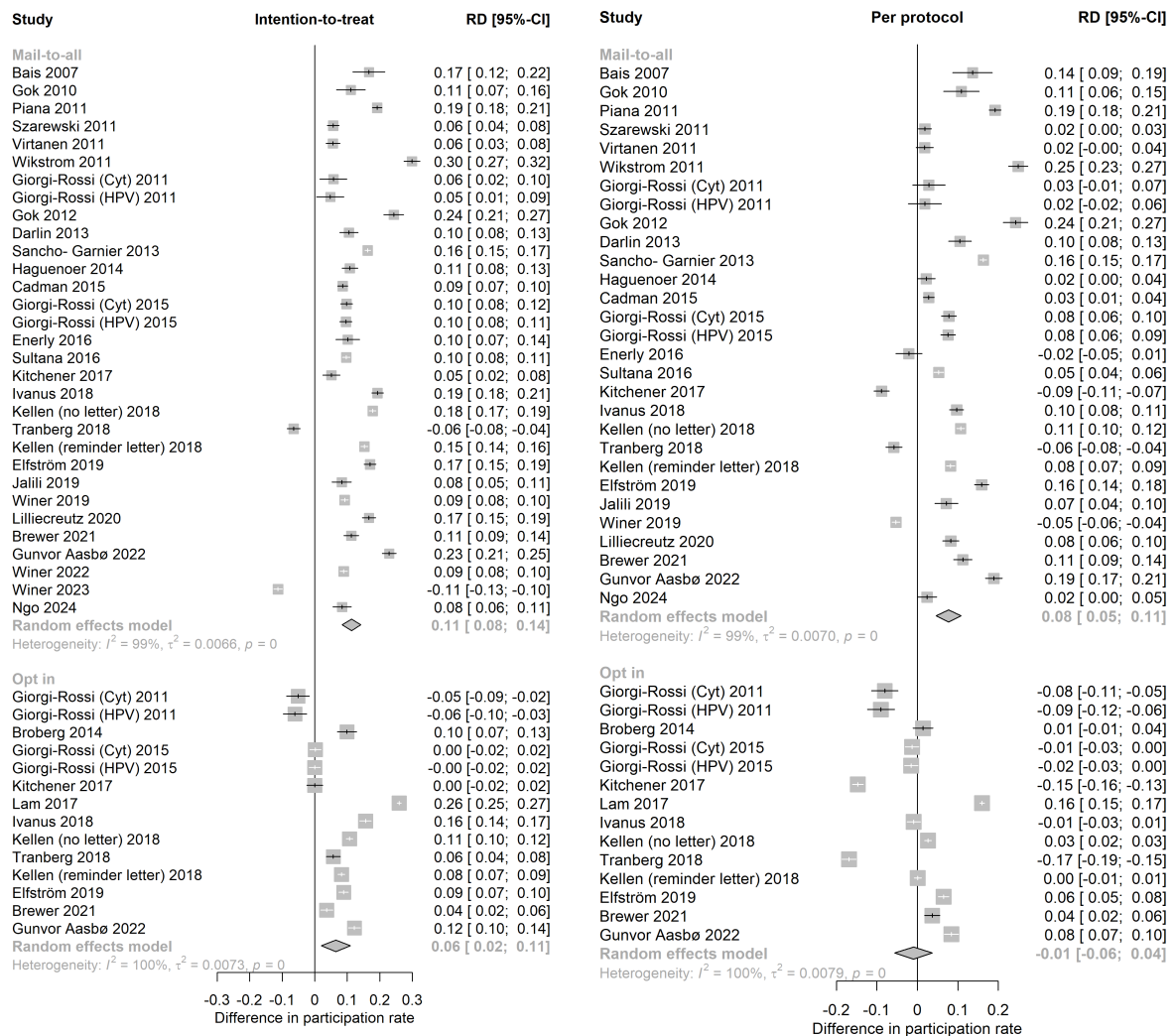
Invitation scenario	No. of studies	Absolute participation		Participation difference % (95% CI)	Relative participation (95% CI)
		Self-sampling % (95% CI)	Control % (95% CI)		
Per protocol					
Mail-to-all	26*	17.7 (15.0 to 20.8)	9.1 (6.9 to 12.0)	7.7 (4.7 to 10.8)	1.94 (1.48 to 2.55)
Opt-in	11*	9.1 (6.7 to 12.2)	9.2 (6.1 to 13.5)	-0.9 (-5.6 to 3.7)	0.99 (0.57 to 1.75)
Intention-to-treat					
Mail-to-all	28*	23.0 (20.2 to 26.0)	10.0 (7.4 to 13.2)	11.3 (8.4 to 14.2)	2.34 (1.87 to 2.93)
Opt-in	11*	16.0 (12.1 to 20.8)	9.2 (6.1 to 13.5)	6.5 (2.0 to 11.0)	1.76 (1.18 to 2.62)

* Giorgi-Rossi (2011) & Giorgi-Rossi (2015) had two control groups (one with cytology, and another with HPV testing). Kellen (2018) also had two control groups (with and without recall letters)

The difference in participation between those who were in the self-sampling arms and those in the control arms is shown in *Figure 6*. The type of control arm was specifically reported for 23 studies (i.e. they specified it being an invitation to cytology or HPV, rather than simply stating ‘standard invite’). Under the intention-to-treat analysis, the absolute difference in participation increases by 9.2% (95%CI; 1.6% to 16.7%) when the control arm is an invite for cytology compared to an invite for HPV (no significant difference was found under the per protocol analysis).

The time between the invite and a health professional taking the sample may affect the participation difference under intention-to-treat (difference in participation percentage increases by 1.1% (95% CI: 0.4% to 1.8%) per month); however, 12 studies were omitted from the regression due to data availability. Self-sampling devices (4 studies omitted) and whether reminders were used (two studies omitted) did not affect the participation difference.

Figure 6 Difference in Participation Rate between Self-sampling and Control



The pooled proportion of unsatisfactory samples taken by the self-sampling group, their adherence to follow-up, and the CIN2+ detection per 1000 women invited are show in *Table 7*. Due to only two studies reporting such information for control arms, pooled relative rates could not be estimated.

Table 7 Sample adequacy, adherence, and CIN2+ detection rates

Parameter	No. of studies	Absolute proportion self-sampling (% unless other specified) (95% CI)
Unsatisfactory sample	20	0.9 (0.6 to 1.2)
Adherence to follow-up	29	80.5 (72.2 to 86.7)
CIN2+ detection (per thousand women screened)	25	11.6 (8.4 to 16.0)

[IV] Acceptability of HPV self-sampling screening strategies to those that have not attended the regular cervical screening programme

The acceptability question had 54 articles: 22 studies from the review and 32 from the post-review top-up search. The studies were from 20 different countries. The participants ranged from 31 – 9,484 with the age range from 14 – 69. The basic review did not include population details such as screening history, ethnicity and SES. Some of the post-review studies included this population details. The review also did not include the self-sampling invitation strategy. Some of the studies included invitation strategies. Two studies included a combination of opt-in and mail to all strategy and one study had a combination of community mobilization and opt-in strategy. Three studies (3) used a mail-to-all strategy, two (2) self-sampling offered at the clinical setting and two (2) studies reported using community outreach and mobilization strategies. The self-sampling devices included in the studies are brushed (11), swab (18), lavage (4), tampon (1) and more than one device in 4 studies. The basic review also did not include the outcomes of individual characteristics of acceptability (logistics, procedural and physiological). The acceptability was reported for overall acceptability and stated preference for self-sampling over healthcare professionals. However, some of the top-up studies include the individual characteristics of acceptability and overall acceptability (*Table 8*).

Table 8 **Characteristics of Included Studies for Acceptability of HPV Self-sampling Screening Strategies**

Author, Year, Country	Population	Sample size	Age (years)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
Anhang 2005 USA		172	25%: 25-35; 10%: >55	Not specified	Swab	Preferences	Not reported
Barbee 2010 USA		245	6%: 18-25; 94%: ≥25		Tampon	Preference	
Castell 2014 Germany		108	Range 20-69		Lavage	Overall acceptability; preference	
Catarino Jr 2014 Switzerland		158	Mean 43.6		Swab	Overall acceptability; preference	
Cerigo 2011 Canada		92	Mean 33.2 Range 18-69		Swab	Preference	
Chen 2014 Taiwan		297	Range 18-65		Unable to determine		
Dannecker 2004 Germany		333	Mean 45		Brush	Overall acceptability; preference	
Delere 2011 Germany		156	Range 20-30		Lavage		
Haguenoer		722	Range 20-		Swab		

Author, Year, Country	Population	Sample size	Age (years)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
2014 France			65				
Harper 2002 USA		67	Mean 37.7		Dacron Swab and Tampon		
Igidbashian 2011 Italy		194	Mean 39.6 Range 19- 72		Brush and Delphi screener (Lavage)	Overall acceptability; preference	
Jones 2012 USA		197	Median 45		Lavage		
Kahn 2005 USA		120	Mean 17.8 Range 14- 21		Swab	Preference	
Litton 2013 USA		516	≥30		Not reported		
Montealegre 2014 USA		100	Median 38		Cytology Broom	Acceptability	
Nelson 2014 USA		67	Median 24 Range 21- 30		Swab	Preference	
Ortiz Puerto Rico		100	Mean 26.4 Range 18- 34		Dacron Swab, CytoBrush	Preference	
Rossi 2011		147	Range 25- 64		Not reported	Preference	

Author, Year, Country	Population	Sample size	Age (years)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
Italy							
Van Baars 2012							
The Netherlands		127	Median 40		Brush	Overall acceptability; preference	
Virtanen 2014	Finish 93%; Swedish 2.2%; Other 4.8%	909	Range 30-64		Lavage		Procedural and psychosocial
Waller 2006			Mean 34.2		Swab		
UK		902				Preference	
Wikstrom 200			Range 35-55				
Sweden		94			Qvintip	Preference	
Adcock 2019	Maori (100%)					Overall acceptability; preference	Procedural and psychosocial
New Zealand		397	≥25				
Anderson 2017	Low income: Black (55%), White (35%), Other (10%)		Median 44 Range 30-64		Brush	Overall acceptability; preference	Logistic and procedural
USA		227					
Andersson 2021		43 cases, 479 control (controls are not long-term non-attenders hence results are only reported for cases)					
Sweden			Case Mean 44.5		Swab	Overall acceptability	Logistic and procedural
Brewer 2019	Pacific (55.4), Maori (21.4), Asian (16.1), other (7.1)	56 (herSwab N=51, Delphi Screener 8, Cobas CT/NG	Median 39.5 Range 20-	Opt-in; Mail-to-all	Swabs and Delphi Screener (Rovers Medical Devices)	Overall acceptability; preference	Logistic, procedural and psychosocial
New Zealand							

Author, Year, Country	Population	Sample size	Age (years)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
		Swab 7)	61				
Bromhead 2021	Māori, Pacific and Asian	58	Median 45 Range 30-68		Swab	Preference	Logistic, procedural and psychosocial
Chaw 2022 Brunei	Malay 93.0%, Chinese 4.1%, Other 0.31%	97	Median 41	Offer in the healthcare setting	Brush	Preference	Logistic, procedural and psychosocial
Catarino 2015 Switzerland	European (39.8%), Swiss (17.7%), Asian (7.0%), African (9.5%), Latin American (36.7%), Others (7.0%)	158	Mean 43.6		Swab	Overall acceptability; preference	Procedural
Chou 2015 Taiwan		282	Mean 48.1	Mail-to-all	Brush	Overall acceptability	Procedural
Bosgraaf 2014 The Netherlands		9484	Range 29-63		Lavage and brush	Preference	Logistic and psychosocial
Crosby 2016 USA	A highly impoverished and geographically isolated population of medically underserved Black women residing in the Mississippi Delta	88	Mean 46.5	Community outreach and mobilization	Swab	Preference	Procedural
Crosby 2015 USA (rural Appalachian)	Rural, economically disadvantaged area: White (93.8%), Black (2.8%), and others (3.4)	400	Mean 40.2	Community outreach and mobilization	Swab	Preference	procedural
Datta 2020	Never screeners: Canada (62%), United	Never 53, Under screeners 89	21 -65 (Inclusion			Overall acceptability	

Author, Year, Country	Population	Sample size	Age (years) criteria)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
Canada	States/Europe (9%), other countries (28%); Under screeners: Canada (90%), United States/Europe (4%), other countries (6%)						
Des Marais 2018 USA	Low-income women: White (45%), Black (26%), Hispanic (26%), Other races (4%)	193	Median age 45 Range 30-63		Brush	Overall acceptability; preference	Procedural
Fujita 2023 Japan		1,192	Mean 44.1		Brush		Logistic and psychosocial
Galbraith 2014 USA	Low-income status women: Non-Hispanic Black (55%), White (33%), Other (13%)	199	Range 30-65		Brush	Overall acceptability; preference	Procedural
Ilangovan 2016 USA	Women in Safety Net institutions: Latinas (74.4%), Haitian (25.6%)	180 (those who completed the questionnaire for self-sampling were 121)	Mean 52	Offered in the healthcare setting	Preventive Oncology International/ National Institute of Health self-sampler	Preference	Logistic, procedural, and psychosocial
Karjalainen 2016 Finland		67 (39 lavage, 28 Brush)			Lavage and Brush		Logistic, procedural, and psychosocial
Kilfoyle 2018 USA	Low-income women: White (35%), Black (56%), and others (9%)	221 (the acceptance was reported for 100)	Median 44 Range 30–64			Overall acceptability; preference	Procedural, and psychosocial
Malon 2020	White (88.8%), Black/African American	120	Range 30-64	Mail-to-all	Swab	Preference	Logistic, procedural, and

Author, Year, Country	Population	Sample size	Age (years)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
USA	(0.9%), Asian/Pacific Islander (5.2%), others (4.3%), and unknown (0.9%)						psychosocial
Molokwu 2018				Community outreach and mobilization			
USA		202	Mean 46.4			Preference	
Ngu 2022	Chinese (52.3%), Philippine (38.9%), Asian-not specified (4.4%), and unknown (5%)	321	Range 30-65 range	Community outreach and mobilization and opt-in	Swab	Overall acceptability; preference	Logistic, procedural, and psychosocial
Parker 2022	Low income enrolled in the safety net: Mexico (39.5%), United States (20.6%), Central America (20.6%), South America (1.7%), Asia (0.9%), Europe (1.3%) and other (0.9%)	153	Mean 47.2	Mail-to-all	Swab		Logistic and psychosocial
Race 2016			Mean 53.6			Overall acceptability; preference	
Canada		70	Range 51.2-56.0		Swab		
Reiter 2019							
USA (Appalachian)	White, non-Hispanic (98%) and others (2%)	79	Mean 46.4		Brush	Preference	Logistic and psychosocial
Sherman 2022	Maori (28.7%), Pasifika (27.9%), and Asian (43.4%)	376	Mean 46.5		Swab	Preference	Logistic, procedural and psychosocial
New Zealand							
Smith 2022	Low income	227	Median 42		Brush	Overall	

Author, Year, Country	Population	Sample size	Age (years)	Invitation Strategy	Self-sampling device used	Outcomes	
						Acceptability	Individual characteristics of acceptability
USA			Range 30-65			acceptability	
Sultana 2015			30-69 (inclusion criteria)				Logistic, procedural and psychosocial
Australia		746			Swab	Preference	
Veerus 2021			Range 37-62 range	Opt-in; Mail-to-all	Qvintip and Evalyn brush	Preference	procedural and psychosocial
Estonia		1857					
Zhu 2022	North American Aboriginal (2.5%), Other North American (43.9%), European (31.3%), Asian (17.6%), and other (4.8%)	524	Mean 47.9			Overall acceptability	
Canada							
Levinson 2016							
USA	White (59%), Black (41%)	35	Median 38			Preference	
Vanderpool 2014							
USA (Appalachian)	Low income Caucasian (100%)	31	Mean 38.5		Brush	Overall acceptability	

All 49 studies were included across the meta-analyses, but studies rarely had data for all the outcomes presented (e.g. some only presented data regarding reasons for (dis)liking self-sampling). Data for outcomes regarding reasons for preference was not extractable from the reference review. The pooled estimates for the acceptability outcomes are shown in *Table 9*. It found that 91% of women are generally accepting of self-sampling, with 74.4% and 59.5% stating preference of doing it at home and doing it themselves rather than a healthcare setting/professional respectively.

Table 9 Pooled Analysis for Acceptability Outcomes

Outcome	Subgroup ^s	No. of studies	Pooled proportion (%) (95% CI)
General acceptability of self-sampling		21 ^{*%}	91.0% (85.3% to 94.6%)
Preference for self-sampling over healthcare professional sampling		25	59.5% (46.0% to 71.7%)
Preference for self-sampling at home over healthcare setting	All	7	74.4% (63.8% to 82.7%)
	Swab	3	83.3% (74.7% to 89.4%)
	Brush	2	68.2% (62.9% to 73.0%)
	Multiple	1	50.2% (49.2% to 51.2%)
Stated willingness to repeat cervical screening	All	15	91.3% (87.2% to 94.2%)
	Swab	5	87.0% (82.4% to 90.5%)
	Brush	5	95.0% (90.5% to 97.5%)
	Tampon	1	96.7% (91.5% to 98.8%)
	Multiple	2	79.7% (52.4% to 93.3%)
Stated that self-sampling is convenient		15 ^{*‡}	87.0% (77.9% to 92.7%)
Stated that self-sampling is accessible		1	19.5% (10.5% to 33.9%)
Screened individuals felt confident in the result of self-sampling	All	7 [‡]	74.1% (57.3% to 85.8%)
	Brush	3	84.0% (69.6% to 92.3%)
	Lavage	2	86.3% (73.9% to 93.3%)
	Swab	2	51.3% (35.5% to 66.7%)
Screened individuals reported self-efficacy in conducting self-sampling themselves		11 [‡]	88.4% (78.7% to 94.0%)
Stated that self-sampling led to pain or discomfort		22 ^{*‡}	18.5% (11.7% to 28.0%)
Stated that self-sampling caused embarrassment		13 [‡]	12.1% (3.8% to 32.5%)
Stated that self-sampling caused anxiety		4 [‡]	35.2% (2.8% to 91.1%)
Stated that self-sampling did not fit with values		2 [*]	59.9% (8.1% to 96.2%)

‘Multiple’ refers to studies where multiple devices were considered with results aggregated together

^s Only reported where the inclusion of the respective variable gave a significant (<0.05) result

* Brewer (2019) had separate results for swab and lavage

% Datta (2020) had separate results for those never screened and those under-screened

‡ Karjalainen (2016) had separate results for lavage and brush

Figure 6 and Figure 7 illustrate high heterogeneity regarding the general acceptability of self-sampling and its preference over healthcare professionals respectively. Figure 6 seems to show consistently high proportions of general acceptability in earlier years, with wide variation in later years. Sampling device was not found to affect general acceptability or preference for self-sampling ($p = 0.118$ and 0.799 , respectively).

High heterogeneity continued to be seen among the lesser reported acceptability outcomes. Self-sampling device was tested for potential effects, for which only preferences for home setting, willingness to repeat, and individuals feeling confident of the results gave a significant result (Table 9). There were insufficient data in a consistent format for ethnicity or age to be considered in a quantitative manner.

Figure 6 General Acceptability of Self-sampling

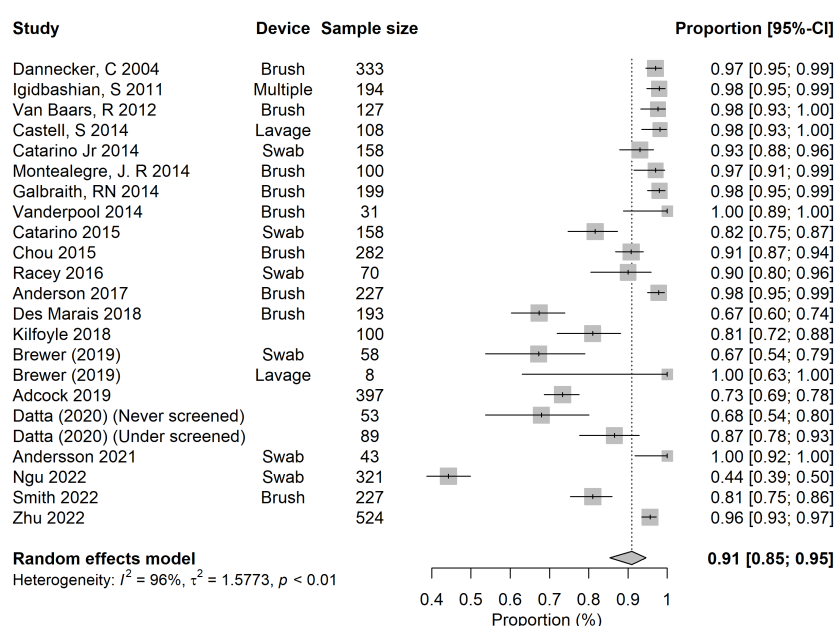
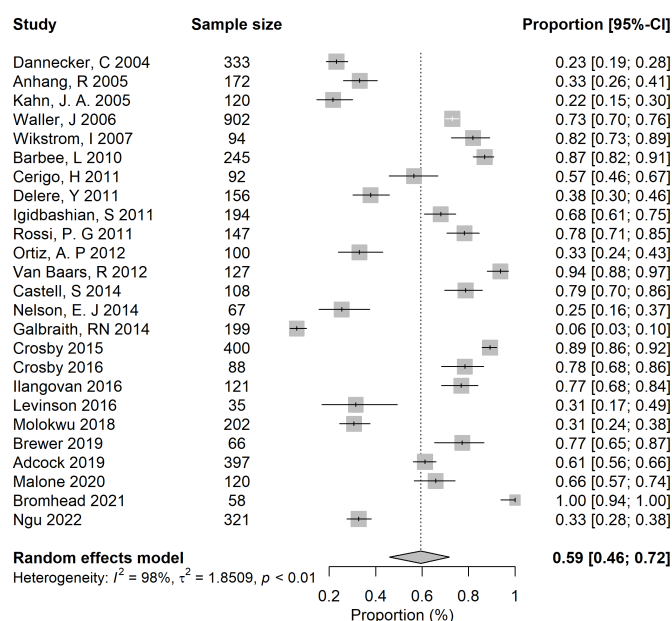


Figure 7 Women Preferring Self-sampling to Healthcare Professional Sampling

Preference for self-sampling at home over healthcare setting differed across self-sampling device and invitation strategy. *Figure 8* and *Figure 9* shows that the preference for a home setting was higher for swabs and higher when offered in a healthcare setting respectively ($p < 0.001$ and $p = 0.020$ respectively). It was not possible to analyse device and invitation strategy together due to the lack of data.

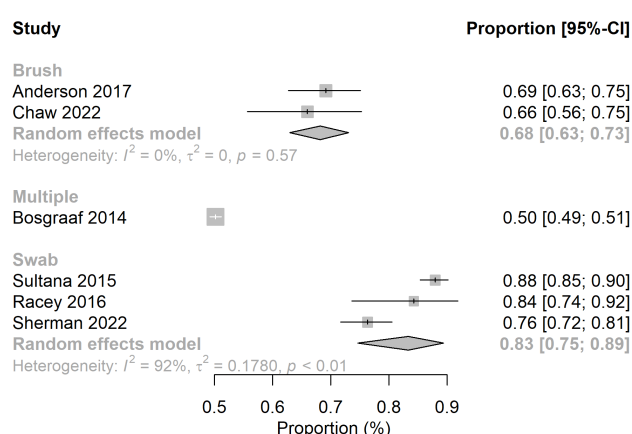
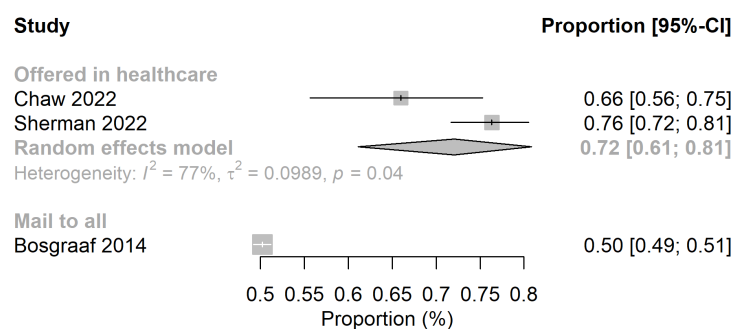
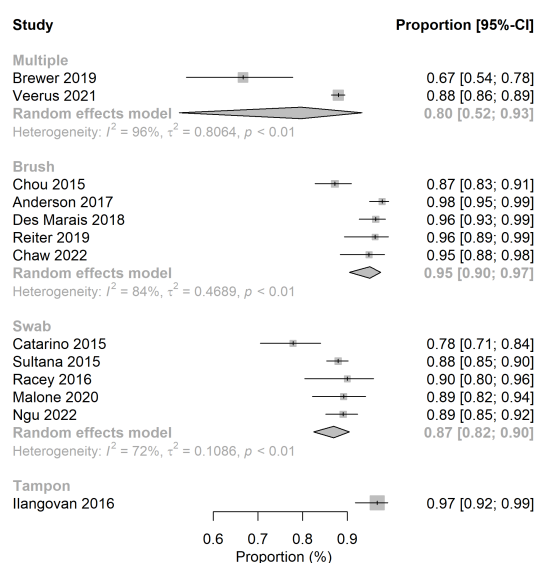
Figure 8 Stated Preference for Self-sampling at Home versus Healthcare Setting According to Sample Device

Figure 9 Stated Preference for Self-sampling at Home versus Healthcare Setting According to Invitation Strategy



Willingness to repeat cervical screened differed across the self-sampling device. *Figure 10* shows that the willingness was higher for brushes and tampons compared with swabs ($p = 0.007$ for inclusion of sampling deviance as covariate). There was not sufficient data, or in a consistent format, for ethnicity or age to be considered in a quantitative manner.

Figure 10 Stated Willingness to Repeat Cervical Screening



Discussion

- What is the accuracy of HPV testing in self-collected samples compared with health professional collected samples, and does this vary according to patient and test characteristics?

The pooled absolute sensitivity of hrHPV assays for CIN2+ and CIN3+ were lower for self-sampling than for health professional sampling, for both colposcopy referral and primary screening. In contrast, the pooled absolute specificity of hrHPV assays for CIN2+ was greater for self-sampling than for health professional sampling for colposcopy referral, but not for primary screening. However, the differences observed were not statistically significant. These findings are consistent with those reported in the source review (Abryn et al 2018).

- In cervical screening non-attenders, what is the level of concordance between HPV-DNA testing in self-collected samples and clinician/health professional collected samples, and does this vary according to patient and test characteristics?

Our meta-analysis showed 87.1% agreement and a kappa value of 0.70 between self-sampling and healthcare professionals. The level of overall agreement was found to be higher among home setting than clinical setting; however, this was in direct contrast to that was observed with the kappa measure. The negative agreement and test positivity ratio differed across the self-sampling devices. The negative agreement also differed on the self-sampling settings and test positivity ratio differed across the self-sampling test assay. These findings are consistent with the findings from Abyn et al 2020 which reported pooled estimates of agreement of 88.7% and the kappa of 0.72. In our subgroup analysis, the overall agreement was higher in the target amplification-based DNA assay compared to other assays. In Abryn's analysis, the test positivity ratio did not change between the signal amplification assay and target amplification assay (Abyn 2020). However, in this analysis, it was recommended that test positivity ratios may not be appropriate for predicting the clinical sensitivity of SA tests of self -vs clinician-collected samples (Abyn, 2020).

- What is the uptake of cervical screening in screening non-attenders offered HPV self-sampling compared with those offered health professional sampling, and does this vary according to patient and test characteristics?

The pooled participation was higher in the mail-to-all self-sampling strategies compared to control. This was also observed when comparing opt-in strategy with control in the intention-to-treat analysis; however, no statistically significant difference was observed in the per protocol analysis. Overall, the absolute participation rate was greater in the intention-to-treat analysis than the per protocol analysis.

These findings are consistent with the reference review (Costa S et al 2022). The high uptake of self-sampling when performed with the involvement of the clinician has also been seen in the recent UK study when offering self-sampling opportunistically was found to have more than five times (65.5%) increase in the uptake compared to mail-to-all self-sampling strategy (12.9%) (Lim et al, 2024, Lim et al 2017). Despite the mail-to-all screening strategies increasing uptake for non-attendees, it may be more costly because the kits are sent to all, and the majority do not return the kit as our pooled participation was only 17.7% (per protocol analysis).

The percentage of unsatisfactory samples was very low 0.9 (95%CI; 0.6 to 1.2) while adherence to follow-up was 80.5 (95%CI 72.2 to 86.7) which encourages the applicability of this method. The small percentage of the unsatisfactory sample is an important advocacy tool for women with fear of participating in self-sampling because of doubting its results and self-efficacy in performing it which is the greatest reported barrier to self-sampling (Nelson et al 2014). One of the challenges of self-sampling is loss of follow-up, however, this level of adherence assures the linkage of those with positive results to further assessment for identification of precancer and cancer.

- Are HPV self-sampling screening strategies acceptable to those that have not attended the regular cervical screening programme, and does this vary according to patient and test characteristics?

Our review found that cervical cancer screening non-attendees generally accept self-sampling (91%) and a high proportion willing to repeat cervical screening (91.3%). While 74.4% expressed preference for self-sampling at home over healthcare setting, a lower proportion (59.5%) stated a preference for self-sampling over healthcare professional sampling. Overall, 87% found self-sampling to be convenient. The reference review reported pooled reasons for preferring self-sampling were ease of use (91%), not embarrassing (91%), privacy (88%), comfort performing self-sampling (88%), ability to do it oneself (69%) and convenience (65%). The most reported pooled reason for disliking was the uncertainty of doing it correctly (21%), pain or physical uncomfortable (10%), anxiety (15%) and not wanting to touch themselves (6%) (Nelson et al 2014). Our meta-analysis found that self-sampling led to pain or discomfort (18.5%), caused embarrassment (12.1%), caused anxiety (35.2%) and did not fit with their values (59.9%).

Like the accuracy section, data was limited regarding reasons for liking/disliking self-sampling in this study for non-attenders. As before, the data is available for studies that were newly extracted but were not available for the existing review we utilized it to aid the timeliness of this review. As such, we have emailed the review authors asking if they are willing to share their data and will then hopefully have a more complete set of data to analyse.

Strength and Limitations

This is a comprehensive rapid review of the existing literature in HPV self-sampling for cervical cancer screening. There are limitations to this analysis. Firstly, the amount of data available for this analysis was limited. Due to the rapid nature of the review, many study results were extracted from an existing study(ies). Unfortunately, only the relative sensitivity and specificities were reported in the review(s) we utilized for the accuracy question, which could not be used to back-calculate the necessary 2x2 tables. Secondly, the statistical methods used to calculate the pooled estimate for the accuracy question do not consider the 'paired' nature of the studies (i.e. the fact that it was the same women in the 'self' and the 'health' arms for each study). However, we believe that the consequence, if there is any, of not taking this into account means the estimates above (95% CI) may be slightly conservative. Finally, the assessment of subgroups was not possible due to limited data from the study from the reference review and the study not analysing the outcome at the subgroup level. There was not sufficient data, or a consistent format, for ethnicity or age to be considered quantitatively. Participation is often reduced in some patient populations, including those in minority ethnic groups, those of low socio-economic status, and transgender and non-binary people with a cervix.

In Context of the YouScreen Study

The YouScreen Study was a feasibility clinical trial embedded within the English Cervical Screening Programme to estimate the impact of offering self-sampling to non-attenders in practice. Self-sampling kits were offered opportunistically in-person in GP primary care and offered systematically via direct mailout. In the opportunistic offering of sampling arm, 65.5% returned self-samples compared with 12.9% in the systematically direct mailout arm. Our rapid review did not find studies that offered opportunistic self-sampling kit in GP primary care, but our data on mail-to-all self-sampling reported similar participation rates (17.7% to 23%). YouScreen showed self-sampling resulted in a 22% increase and 12% increase in non-attenders screened per month from the per protocol and intention-to-treat analysis, respectively. Our meta-analysis of the literature also reported an increase in uptake, but the effect was more modest.

Conclusion

Self-sampling is a feasible strategy for reaching non-attendees in and should be considered in the national screening program to reach the non-attendees, especially on using the PCR-based assay. However, before this is done, understanding the cost-effectiveness, logistics and compliance of the strategies is important to understand country-specific strategies for reaching the non-attendees.

References

1. Lim A, Deats K, Gambell J, Lawrence A, Lei J, Mairead L, et al. Opportunistic Offering of Self-Sampling to Non-Attendees within the English Cervical Screening Programme: A Pragmatic, Multicentre, Implementation Feasibility Trial with Randomly Allocated Cluster Intervention Start Dates (Youscreen). *The Lancet*(preprint). 2023.
2. Choi S, Ismail A, Pappas-Gogos G, Boussios S. HPV and Cervical Cancer: A Review of Epidemiology and Screening Uptake in the UK. *Pathogens*. 2023;12(2).
3. Okunade KS. Human papillomavirus and cervical cancer. *J Obstet Gynaecol*. 2020;40(5):602-8.
4. Bedell SL, Goldstein LS, Goldstein AR, Goldstein AT. Cervical Cancer Screening: Past, Present, and Future. *Sex Med Rev*. 2020;8(1):28-37.
5. Di Gennaro G, Licata F, Trovato A, Bianco A. Does self-sampling for human papilloma virus testing have the potential to increase cervical cancer screening? An updated meta-analysis of observational studies and randomized clinical trials. *Front Public Health*. 2022;10:1003461.
6. Aimagambetova G, Atageldiyeva K, Marat A, Suleimenova A, Issa T, Raman S, et al. Comparison of diagnostic accuracy and acceptability of self-sampling devices for human Papillomavirus detection: A systematic review. *Prev Med Rep*. 2024;38:102590.
7. Costa S, Verberckmoes B, Castle PE, Arbyn M. Offering HPV self-sampling kits: an updated meta-analysis of the effectiveness of strategies to increase participation in cervical cancer screening. *Br J Cancer*. 2023;128(5):805-13.
8. Sechi I, Muresu N, Puci MV, Saderi L, Del Rio A, Cossu A, et al. Preliminary Results of Feasibility and Acceptability of Self-Collection for Cervical Screening in Italian Women. *Pathogens*. 2023;12(9).
9. Berner AM, Connolly DJ, Pinnell I, Wolton A, MacNaughton A, Challen C, et al. Attitudes of transgender men and non-binary people to cervical screening: a cross-sectional mixed-methods study in the UK. *Br J Gen Pract*. 2021;71(709):e614-e25.
10. Sy F, Greuel M, Winkler V, Bussmann H, Barnighausen T, Deckert A. Accuracy of HPV testing on self-collected and clinician-collected samples for different screening strategies in African settings: A systematic review and meta-analysis. *Gynecol Oncol*. 2022;166(2):358-68.
11. Pourette D, Cripps A, Guerrien M, Despres C, Opigez E, Bardou M, et al. Assessing the Acceptability of Home-Based HPV Self-Sampling: A Qualitative Study on Cervical Cancer Screening Conducted in Reunion Island Prior to the RESISTE Trial. *Cancers (Basel)*. 2022;14(6).
12. Garritty C, Tricco AC, Smith M, Pollock D, Kamel C, King VJ, et al. Rapid Reviews Methods Series: Involving patient and public partners, healthcare providers and policymakers as knowledge users. *BMJ Evid Based Med*. 2024;29(1):55-61.
13. Gartlehner G, Nussbaumer-Streit B, Kahwati L, Viswanathan M, King VJ, Qaseem A, et al. Rapid Reviews Methods Series: Guidance on assessing the certainty of evidence. *BMJ Evid Based Med*. 2024;29(6):50-4.
14. Klerings I, Robalino S, Booth A, Escobar-Liquitay CM, Sommer I, Gartlehner G, et al. Rapid Reviews Methods Series: Guidance on literature search. *BMJ Evid Based Med*. 2023;28(6):412-7.
15. Nussbaumer-Streit B, Sommer I, Hamel C, Devane D, Noel-Storr A, Puljak L, et al. Rapid reviews methods series: Guidance on team considerations, study selection, data extraction and risk of bias assessment. *BMJ Evid Based Med*. 2023;28(6):418-23.
16. Garritty C, Hamel C, Trivella M, Gartlehner G, Nussbaumer-Streit B, Devane D, et al. Updated recommendations for the Cochrane rapid review methods guidance for rapid reviews of effectiveness. *BMJ*. 2024;384:e076335.
17. Cochrane. Cochrane Rapid Review Protocol Template. 26th February 2024.
18. Arevalo-Rodriguez I, Baxter S, Steingart KR, Tricco AC, Nussbaumer-Streit B, Kaunelis D, et al. How to develop rapid reviews of diagnostic tests according to experts: A qualitative exploration of researcher views. *Cochrane Evidence Synthesis and Methods*. 2023;1(2).
19. Arbyn M, Smith SB, Temin S, Sultana F, Castle P, Collaboration on S-S, et al. Detecting cervical precancer and reaching underscreened women by using HPV testing on self samples: updated meta-analyses. *BMJ*. 2018;363:k4823.

20. Arbyn M, Castle PE, Schiffman M, Wentzensen N, Heckman-Stoddard B, Sahasrabudde VV. Meta-analysis of agreement/concordance statistics in studies comparing self- vs clinician-collected samples for HPV testing in cervical cancer screening. *Int J Cancer*. 2022;151(2):308-12.
21. Nelson EJ, Maynard BR, Loux T, Fatla J, Gordon R, Arnold LD. The acceptability of self-sampled screening for HPV DNA: a systematic review and meta-analysis. *Sex Transm Infect*. 2017;93(1):56-61.
22. Yeh PT, Kennedy CE, de Vuyst H, Narasimhan M. Self-sampling for human papillomavirus (HPV) testing: a systematic review and meta-analysis. *BMJ Glob Health*. 2019;4(3):e001351.
23. Nishimura H, Yeh PT, Oguntade H, Kennedy CE, Narasimhan M. HPV self-sampling for cervical cancer screening: a systematic review of values and preferences. *BMJ Glob Health*. 2021;6(5).
24. Deeks JB, PM.; Leeftang, MM.; Takwoingi, Y. (editors). *Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy*. : Cochrane; 2023 [cited 2023].
25. Cerullo E, Sutton AJ, Jones HE, Wu O, Quinn TJ, Cooper NJ. MetaBayesDTA: codeless Bayesian meta-analysis of test accuracy, with or without a gold standard. *BMC Med Res Methodol*. 2023;23(1):127.
26. Freeman SC, Kerby CR, Patel A, Cooper NJ, Quinn T, Sutton AJ. Development of an interactive web-based tool to conduct and interrogate meta-analysis of diagnostic test accuracy studies: MetaDTA. *BMC Med Res Methodol*. 2019;19(1):81.

Appendix

Search Strategies

Clinical Accuracy (per Arbyn et al.)(19)

Database	Search
PubMed	<p>#1: Cervix OR cervico* OR cervica*</p> <p>#2: Cancer OR carcinoma OR neoplas* OR dysplas* OR CIN[tw] OR CINII*[tw] OR CIN2*[tw] OR CINIII*[tw] OR CIN3[tw] OR SIL[tw] OR SIL OR HSIL[tw] OR H-SIL OR LSIL[tw] OR L-SIL OR OR “low grade” OR low-grade OR mild OR equivocal OR borderline.</p> <p>#3: #1 AND #2.</p> <p>#4: HPV OR "Human Papillomavirus DNA Tests"[Mesh] OR “human papillomavirus” OR papillomavir* OR viral OR virus</p> <p>#5: self-collection OR “self collection” OR self-sampling OR self-collect* OR self-sampl* OR self OR "Self- Examination"[Mesh]</p> <p>#6: #4 AND #5</p> <p>#7: #3 AND #6</p> <p>#8: Publication Date from January 2018 to March 2024.</p> <p>#9: #7 AND #8</p>
Embase	<p>#1: 'cervix'/exp OR cervix OR cervico* OR cervica*</p> <p>#2: 'cancer'/exp OR cancer OR 'carcinoma'/exp OR carcinoma OR neoplas* OR dysplas* OR cin OR 'cin2' OR 'cin3' OR sil OR hsil OR h+sil OR lsil OR l+sil OR 'low grade' OR low+grade OR mild OR equivocal OR 'borderline'/exp OR borderline</p> <p>#3: 'hpv'/exp OR hpv OR 'human papillomavirus'/exp OR 'human papillomavirus' OR papillomavir* OR viral OR 'virus'/exp OR virus</p> <p>#4: self+collection OR 'self collection' OR self+sampling OR 'self-sampling' OR self+collect* OR self+sampl* OR 'self'/exp OR self</p> <p>#5: #1 AND #2 AND #3 AND #4</p> <p>With the following limits:</p> <ul style="list-style-type: none"> - Map to preferred terminology (with spell check) - Also search as free text - Include sub-terms/derivatives (explosion search)
Cochrane Library	<p>#1: Cervix or cervico* or cervica*</p> <p>#2: Cancer or carcinoma or neoplas* or dysplas* or CIN or CIN2 or CIN3 or SIL or SIL or HSIL or H-SIL or LSIL or L-SIL or "low</p>

	<p>grade" or low-grade or mild or equivocal or borderline.</p> <p>#3: HPV or "human papillomavirus" or papillomavir* or viral or virus</p> <p>#4: self-collection or "self collection" or self-sampling or "self-sampling" or self-collect* or self-sampl* or self</p> <p>With the following limits:</p> <ul style="list-style-type: none"> • Cochrane reviews (reviews + protocols) • Other reviews • Search for word variations
--	--

Strategies to increase population coverage of cervical screening (Albyn et al.)(19)

Database	Search
PubMed	(Cervix OR cervical) AND (HPV OR papillomavirus) AND (self-sampling OR self sampling OR self-collection OR self collection) AND (screening OR coverage OR participation OR knowledge OR acceptance)

Acceptability
(per Nelson et al)(21)

Database	Search
ProQuest Dissertations and Theses	(Prefer* OR feasib* OR accept* OR barrier OR cost OR attitude) AND (HPV OR "Human papillomavirus") AND (self-collect* OR self-sampl* OR self-screen*)
PubMed	((("human papillomavirus"[All Fields] OR HPV[All Fields]) AND (accept[All Fields] OR prefer[All Fields] OR ("attitude"[MeSH Terms] OR "attitude"[All Fields]) OR barrier[All Fields] OR fesi[All Fields] OR ("economics"[Subheading] OR "economics"[All Fields] OR "cost"[All Fields] OR "costs and cost analysis"[MeSH Terms] OR ("costs"[All Fields] AND "cost"[All Fields] AND "analysis"[All Fields]) OR "costs and cost analysis"[All Fields]))) AND (self-collection[All Fields] OR self-collect[All Fields] OR self-sampling[All Fields] OR self-sample[All Fields] OR self-screen[All Fields]))
SCOPUS	(TITLE-ABS-KEY ("human papillomavirus" OR hpv) AND TITLE-ABS-KEY (accept OR prefer OR attitude OR barrier OR feasib OR cost) AND TITLE- ABS-KEY (self-collection OR self-collect OR self-sampling OR self-sample OR self-screen))
Web of Science	TOPIC: ("human papillomavirus" OR HPV) AND TOPIC: (accept OR prefer OR attitude OR barrier OR cost OR feasib) AND TOPIC: (self-collection OR self-collect OR self-

	sampling OR self-sample OR self-screen) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI.
OpenGrey	(HPV OR "Human papillomavirus") AND (collect* OR Sampl* OR screen*) HPV OR "Human papillomavirus"
Cochrane Database of Systematic Reviews	HPV OR "Human papillomavirus"

(per Yeh et al. and Nishimura et al)(22, 23)

Database	Search
PubMed	<p>("human papillomavirus"[tiab] OR HPV[tiab] OR "cervical"[tiab] OR "cervix"[tiab]) AND</p> <p>("self-test" [tiab] OR "self-testing" [tiab] OR "home-based test"[tiab] OR "home-based testing"[tiab] OR "home test"[tiab] OR "home testing"[tiab] OR "clinic-based test"[tiab] OR "clinic-based testing"[tiab] OR "community-based test"[tiab] OR "pharmacy-based test"[tiab] OR "self-administer"[tiab] OR "self-sampling"[tiab] OR "self-collecting"[tiab] OR "self-collected"[tiab] OR "self-collection"[tiab] OR "self- versus provider-collected"[tiab] OR "self- and provider-collected"[tiab] OR "self-versus physician- collected"[tiab] OR "self- and physician-collected"[tiab] OR "self care"[Mesh] OR self- administration[Mesh] OR "self assessment"[Mesh])</p>
CINAHL	<p>(TI "human papillomavirus" OR TI HPV OR TI cervical OR TI cervix OR AB "human papillomavirus" OR AB HPV OR AB cervical OR AB cervix)</p> <p>AND</p> <p>(TI "self-test" OR AB "self-test" OR TI "self-testing" OR AB "self-testing" OR TI "home-based test" OR AB "home-based test" OR TI "home-based testing" OR AB "home-based testing" OR TI "home test" OR AB "home test" OR TI "home testing" OR AB "home testing" OR TI "clinic-based test" OR AB "clinic-based test" OR TI "clinic-based testing" OR AB "clinic-based testing" OR TI "community-based test" OR AB "community-based test" OR TI "pharmacy-based test" OR AB "pharmacy-based test" OR TI "self-administer" OR AB "self-administer" OR TI "self-sampled" OR AB "self-sampled" OR TI "self-sample" OR AB "self-sample" OR TI "self-sampling" OR AB "self-sampling" OR TI "self-collecting" OR AB "self-collecting" OR TI "self-collected" OR AB "self-collected" OR TI "self-collection" OR AB "self-collection" OR TI "self- versus provider-</p>

	collected" OR AB "self- versus provider-collected" OR TI "self- and provider- collected" OR AB "self- and provider-collected" OR TI "self- versus physician-collected" OR AB "self- versus physician-collected" OR TI "self- and physician-collected" OR AB "self- and physician-collected")
Embase	('human papillomavirus':ab,ti OR HPV:ab,ti OR cervical:ab,ti OR cervix:ab,ti) AND ('self-test':ab,ti OR 'self-testing':ab,ti OR 'home-based test':ab,ti OR 'home-based testing':ab,ti OR 'home test':ab,ti OR 'home testing':ab,ti OR 'clinic-based test':ab,ti OR 'clinic-based testing':ab,ti OR 'community-based test':ab,ti OR 'pharmacy-based test':ab,ti OR 'self-administer':ab,ti OR 'self- sampled':ab,ti OR 'self-sample':ab,ti OR 'self-sampling':ab,ti OR 'self-collecting':ab,ti OR 'self- collected':ab,ti OR 'self-collection':ab,ti OR 'self- versus provider-collected':ab,ti OR 'self- and provider-collected':ab,ti OR 'self- versus physician-collected':ab,ti OR 'self- and physician-collected':ab,ti)
LILACS	("human papillomavirus" OR HPV OR cervical OR cervix) [words] AND ("self-test" OR "self-testing" OR "home-based test" OR "home-based testing" OR "home test" OR "home testing" OR "clinic-based test" OR "clinic-based testing" OR "community-based test" OR "pharmacy-based test" OR "self-administer" OR "self-sampling" OR "self-collecting" OR "self-collected" OR "self-collection" OR "self- versus provider-collected" OR "self- and provider-collected" OR "self- versus physician-collected" OR "self- and physician-collected") [words]