Self-collected Pap smears may provide an acceptable and effective method of cervical cancer screening

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Abstract

Background and aims: The role of the Papanicolou (Pap) smear in the early detection and prevention of cervical cancer is well established. However, many women fail to undertake the test because of embarrassment or other reasons. To address this problem, we evaluated the feasibility of implementing self-sampling of cervical cytology as an alternative to clinician-collected Pap smears and compared it with the gold standard of colposcopy in terms of specificity.

Materials and methods: A prospective preliminary study of 40 women recruited from the colposcopy clinic of a tertiary referral hospital was undertaken. Participants were instructed in the technique of self-sampling and asked to collect their own Pap smears. Colposcopic examinations were performed and biopsies taken, if indicated. Clinician-collected Pap smears were performed 4 weeks later. Pairwise agreement was calculated between the outcomes of self-collected, colposcopic, and clinician-collected samples using the weighted $\kappa$ statistic.

Results: Self-collected Pap smear had a high level of acceptability among the women, all of whom were able to collect adequate tissue. The agreement of self-collected Pap smears with colposcopic assessment was no worse than that of clinician-collected Pap smears (Cohen's $\kappa$ statistic 0.54 [95% CI, 0.27-0.82]; cf 0.49 [0.2-0.78], respectively). The specificity of self-collected Pap smears was almost identical to that of clinician-collected samples (specificity: 86% vs 81%, respectively). Direct comparison between patient and clinician collected Pap smears showed fair agreement ($\kappa$ statistic 0.38 [0.07-0.68]). There were no adverse events in either group.

Conclusions: Self-collection of Pap smears is an effective and acceptable alternative to clinician-collected samples and may provide a strategy for improving compliance with cervical testing programs.

KEYWORDS
cervical cancer, colposcopy, Pap smear, screening, self-collected test

1 | INTRODUCTION

Despite the established place of Papanicolou (Pap) smears in the prevention and early detection of cervical cancer, uptake of national cervical cytology programs remains a concern (the 2-year participation rate for the National Cervical Screening Program [NCSP] in 2009-2010 was 57.4% of women in the target age group).\textsuperscript{1,2} Reasons given by women for failing to attend for smears conducted by practitioners include embarrassment,\textsuperscript{3} physical discomfort,\textsuperscript{4} the invasive nature of the pelvic examination, inconvenience, and, in remote communities, personal associations with the health practitioner.\textsuperscript{5-7} To overcome these barriers, a more acceptable method of cervical screening is needed. Studies have previously shown that in other settings, self-sampling is associated with better participation rates in screening programs\textsuperscript{8-12} and lower levels of dissatisfaction.

Current National Health and Medical Research Council guidelines\textsuperscript{13,14} continue to recommend cervical cytology as the primary screening tool for cervical cancers, with the role of human
Papillomavirus (HPV) testing predominantly limited to verification of cure after treatment of high-grade abnormalities. Australian guidelines recently changed: HPV as primary screening has been introduced, and self-sampling is recommended for non-responding women. The relevance of self-sampling for liquid-based cytology, allowing for further tests if required, is now even higher, because there is a need of cytology triage for women who are HPV positive after self-sampling.\(^{1,12,15}\) Previously, most studies on self-sampling of cervical screening have only been done for detection of HPV.\(^{16-21}\) If it was shown to be sufficiently reliable, self-sampling for assessment of cervical cytology could provide a useful adjunct to existing screening methods.\(^{1,12,22,23}\)

We, therefore, conducted a pilot study to evaluate the use of self-sampling of cervical cytology, in which we compared the reliability of this technique with the sampling by a clinician and compared both to the “gold standard” of sampling under direct colposcopic examination.

## METHODS

The study was performed at the Colposcopic Outpatients Clinic at The Queen Elizabeth Hospital, South Australia, a tertiary public teaching hospital, between May 2009 and March 2010. The data analysis was done in 2012.

Participants were between the ages of 20 to 69, with a median age of 38.4, presenting for a colposcopic consultation, and who responded to posters placed in the waiting room. Exclusion criteria were pregnancy, known malignancy, history of cervical glandular abnormalities, previous hysterectomy, and a physical impairment sufficient to prevent the patient from conducting the procedure. Written consent was obtained from the participants. The study was approved by the Human Research Ethics Committee at The Queen Elizabeth Hospital.

The women were informed about the method of self-collection with the help of a diagram on their initial visits. Women were guided to find cervix using the following instructions:

1. In the toilet, put 1 foot on top of the closed toilet seat and bend forward.
2. Insert the index finger of the nondominant hand in the vagina to feel cervix—which feels like the tip of a nose.
3. Once you feel the tip, insert the Cytobroom with dominant hand along the finger till you reach the cervix and rotate it twice.
4. Remove the Cytobroom, and put the tip into the ThinPrep jar provided.

Colposcopic examinations were then performed by the clinician/investigator and biopsies were taken, if indicated.

The women were then asked to attend a review appointment 4 weeks later to discuss the results and to undergo a conventional Pap smear, performed by their regular attending clinicians. At this visit, the sample was collected by introducing a cervicobroom into the endocervix. The self-collected and the physician-collected specimens were sent for analysis to the same laboratory on the day of collection.

A pathologist, blinded to the method of collection, reviewed the cervical cytology. The results of the cervical cytology collected, and both reports, were reviewed by the investigators following the review, to ascertain the extent of agreement or disagreement between the results of the patient-collected Pap smear with that collected by the clinician. Squamous abnormalities were classified according to the Australian modified Bethesda AMBS 2004 into the following 4 categories: “negative,” “low grade squamous intraepithelial lesion” (LSIL), “high grade squamous intraepithelial lesion” (HSIL), and “squamous carcinoma.” Any abnormality confirmed by colposcopy was managed according to NHRMC Guidelines.\(^{13}\)

Pairwise agreement between the numbers of abnormalities identified by self-collected, colposcopic, and clinician-collected samples, and 95% confidence intervals were computed. Chance-corrected agreement was assessed by weighted κ statistics.\(^{24}\) A κ value of above 0.8 was taken to indicate “very good agreement”; between 0.6 and 0.8, “reasonable agreement”; 0.4 and 0.6, “moderate agreement”; 0.2 and 0.4, “fair agreement”; and less than 0.2, “poor agreement.”\(^{25}\) Calculations were performed using SAS version 9.3.

## RESULTS

A total of 40 women participated in the study. One woman was excluded because of non-attendance at the follow-up visit, resulting in a final sample size of 39. The median age was 38.4 years, with the range being 20 to 69. A relevant abnormality was reported in 16 out of 39 cases (13 LSIL; 3 HSIL) for the self-collected Pap smears, in 10 out of 39 cases (6 LSIL; 4 HSIL) for clinician-collected smears, and in 17 of 39 cases (13 LSIL; 4 HSIL) after colposcopy. A summary of the results is shown in Table 1, and pairwise comparisons are presented in Table 2. Importantly, no high-grade abnormality identified from clinician-collected or colposcopic samples was missed by the self-collected sampling.

The overall agreement between detection of any abnormality of the self-collected Pap smear with that collected by a clinician was “fair” κ = 0.38 (95% CI, 0.07-0.68). The number of patients rated as negative for any cytological abnormality was 25 after self-sampling and 26 following clinician-collected Pap smears.

With colposcopy taken as the gold standard, specificity, positive predicted value, and negative predictive values of both clinician- and self-collected Pap smears were calculated. Comparison of clinician-collected Pap smears with colposcopy showed a κ statistic of 0.49, indicating “moderate” agreement (CI, 0.20-0.78), with specificity being 81%. The comparison of self-collected paper smears with the same gold standard, on the other hand, showed a κ statistic of 0.54, indicating “moderate” agreement (CI, 0.27-0.82). Specificity of the patient-collected Pap smear was 86.4%.

### TABLE 1

| Specimen Collected | Patient-Reported Abnormality | Clinician-Reported Abnormality | Colposcopic Abnormality |
|--------------------|-----------------------------|------------------------------|------------------------|
| Normal             | 23                          | 29                           | 22                     |
| LSIL               | 13                          | 6                            | 13                     |
| HSIL               | 3                           | 4                            | 4                      |
| Total              | 39                          | 39                           | 39                     |

Abbreviations: HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion.
In the past, cervical sampling was considered adequate if endocervical cells were detected; however, a definition of “adequate sample” remains elusive. More recent research has shown that the absence of endocervical cells is not necessarily associated with a higher risk of cervical abnormality. In our study, endocervical sampling might have a role to play in this process.

The proven effectiveness of the cervical screening smear program, combined with the nonparticipation rate of around 40%, suggests the need for novel methods to increase screening coverage. This study suggests that self-sampling might have a role to play in this process. All the participants in this study found the technique of self-sampling acceptable, comfortable, and easy to learn. Many women may prefer a test that can be performed by the woman herself, if necessary in the privacy of her own home.

For our study, we used cervibroom, a standard brush used in gynecology clinics. There have been few other devices like solopap, dacronswabs, and digene conical collection used for this test as well. The cervibroom is already used for pap smears and comes at no extra cost; it is also easy to use. The most important difference is that with cervibroom-collected samples, a liquid-based cytology slide can be made if required. All of these facts make it potentially a better device to use. It is also true that the difference in HPV prevalence between the self-collected and clinician-collected sampling was not significantly different from 0, regardless of the sampling devices and diagnostic methods used.

Our findings show that the agreement of the results of self-sampling with the gold standard of colposcopically guided sampling is no worse than that of physician sampling. In addition, the specificity for the detection of abnormalities of self-sampling and clinician sampling are very similar. Accordingly—at least in the cases of women otherwise disinclined to undergo sampling at all—self-sampling would seem to be an acceptable and effective alternative that might be recommended. This technique might offer an effective alternative approach for at least some of the women who do not presently comply with the NCSP.

### TABLE 2: Detailed pairwise comparison of outcomes of patient- and clinician-collected smears with colposcopy impression

| Patient No. | Patient- Collected Smear | Clinician-Collected Smear | Colposcopy |
|-------------|--------------------------|---------------------------|------------|
| 1           | LSIL                     | N                         | NAD        |
| 2           | N                        | N                         | NAD        |
| 3           | N                        | N                         | NAD        |
| 4           | PLSIL                    | N                         | NAD        |
| 5           | PHSIL                    | N                         | HSIL       |
| 6           | LSIL                     | N                         | NAD        |
| 7           | N                        | N                         | Meno clinic not done |
| 8           | N                        | N                         | NAD        |
| 9           | PLSIL                    | LSIL                      | LSIL       |
| 10          | N                        | N                         | NAD        |
| 11          | N                        | LSIL                      | N          |
| 12          | LSIL                     | PHLSIL                    | LSIL       |
| 13          | N                        | N                         | LSIL       |
| 14          | N                        | N                         | NAD        |
| 15          | N                        | N                         | LSIL       |
| 16          | PLSIL                    | PLSIL                     | LSIL       |
| 17          | LSIL                     | LSIL                      | LSIL       |
| 18          | LSIL                     | N                         | HPV        |
| 19          | N                        | N                         | Self was first ever pap not done |
| 20          | PHSIL                    | N                         | HSIL       |
| 21          | N                        | N                         | N          |
| 22          | N                        | N                         | Overdue for pap not done |
| 23          | N                        | HSIL                      | LSIL       |
| 24          | N                        | LSIL                      | HSIL       |
| 25          | PLSIL                    | N                         | NAD        |
| 26          | N                        | N                         | Not done   |
| 27          | PLSIL                    | N                         | NAD        |
| 28          | N                        | N                         | NAD        |
| 29          | N                        | HSIL                      | NAD        |
| 30          | N                        | N                         | NAD        |
| 31          | N                        | N                         | Not done   |
| 32          | LSIL                     | N                         | LSIL       |
| 33          | N                        | N                         | NAD        |
| 34          | LSIL                     | PLSIL                     | LSIL       |
| 35          | N                        | N                         |            |
| 36          | N                        | HSIL                      | LSIL       |
| 37          | PHSIL                    | N                         | HSIL       |
| 38          | N                        | N                         | LSIL       |
| 39          | LSIL                     | N                         | LSIL       |

Abbreviations: HPV, human papillomavirus; HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion.
The single significant difference between the 2 techniques—the lower presence of endocervical cells in the self-collected samples—is a potential cause for concern, because it suggests that many of these samples might not have included cells from the transformation zones.\(^2\) This is to be expected, simply because of the more limited precision associated with self-insertion of the cervibrush. However, there is uncertainty about the importance of obtaining endocervical cells to ensure an adequate sample for diagnostic purposes.\(^26\) Indeed, at least 1 study\(^27\) has shown no statistical significance in detection of high-grade abnormalities in patient samples containing an endocervical in comparison with those that do not. More recent research\(^26\)–\(^32\),\(^38\),\(^39\) has shown that the absence of endocervical cells is not necessarily associated with a higher risk of cervical abnormality.

This study has several limitations: It is small in size, the participants were women from a single urban center rather than from a variety of social and geographical backgrounds, and all had presented because of a prior commitment to undergoing Pap smears. Further, per our study design, the clinically collected specimen was collected 4 weeks after both the self-test and the colposcopy (and biopsy). As sensitivity of a test performed after biopsy can be lower because of, for instance, healing, we could not compare sensitivity in our study. Future studies, with larger sample sizes, should address this in the future. In any case, the Pap smear per se has low sensitivity.\(^19\) Lastly, we did not directly test the hypothesis that women who otherwise fail to participate in screening programs might find self-sampling an acceptable alternative.

In spite of these limitations, the favorable results of this study are promising and support further work to assess the place of cervical self-sampling in the future prevention of cervical cancer in Australia. It is possible that this technique will prove a useful addition to existing strategies and contribute to increasing the participation rate in cervical screening and, therefore, to the further reduction of rates of cervical cancer.

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CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

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