UNDERSTANDING REACTIONS TO RESULTS OF A SELF-SAMPLING HPV TEST AMONG WHITE AND BLACK WOMEN INFREQUENTLY SCREENED FOR CERVICAL CANCER IN NORTH CAROLINA

By
Lavanya Gupta

A paper presented to the faculty of The University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Public Health in the Department of Maternal and Child Health.
Chapel Hill, N.C.

April 7, 2016

Approved by:

[redacted]

First Reader: [redacted]

[redacted]

Second Reader: [redacted]

ABSTRACT

Background

Over 4,000 women die from cervical cancer every year in the United States. Over half are due to lack of routine screening, which disproportionally affects racial/ethnic minority women. Home-based HPV self-testing may increase screening among hard to reach women. Little is known regarding women's reactions to receiving HPV self-test results on the phone, an important consideration in determining the feasibility of self-testing. This study's objective is to determine women's reactions to their HPV self-test results, and the delivery method, stratified by race/ethnicity.

Methods

Under-screened, low-income North Carolina women from 10 counties were recruited. A total of 202 women (78 White; 124 Black) collected and returned their self-test sample, and completed an acceptability questionnaire. Analyses examined reactions based on HPV self-test results at baseline and follow-up, and predictors of feeling afraid of what the HPV self-tests would say about their health.

Results

White women reported being more worried about getting cervical cancer compared to Black women. Women who received positive HPV self-test results self-reported being more likely to feel embarrassed, worried, depressed, and liking help understanding their results, than those HPV self-test negative. Women underestimated the need for help with interpreting their results. Women were more likely to report being afraid of what the self-test results would say about their health if they had lower educational attainment; were divorced, widowed, and separated; and self-reported history of genital warts.

Conclusions

These findings can inform cervical cancer messaging that emphasizes underserved populations' understanding of their heightened risk and the importance of screening.

INTRODUCTION

Invasive cervical cancer (ICC) is one of the most common cancers affecting women in the United States (US). In 2016, an estimated 12,990 women in the US will be diagnosed with ICC and 4,120 women will die from this largely preventable disease. (1) Over 50 percent of new ICC cases occur among women who have been screened infrequently or not at all. (2) Black and Hispanic/Latina women, particularly those who are elderly, uninsured, poor, or otherwise underserved, carry the heaviest burden of ICC. (3,4) Self-collection HPV tests that can be performed in a variety of settings including the home may be a potential strategy to reach racial/ethnic minority women who are less likely to participate in regular clinical screenings.

Virtually all ICC cases are caused by infection with high-risk oncogenic strains of the sexually transmitted human papillomavirus (HPV), but are preventable through vaccination and regular screening. (1,3,5) While access to routine screening has led to an overall decline in the morbidity and mortality attributable to ICC, Hispanic/Latina women are still less likely to have participate in routine screening and have a higher risk of cervical cancer compared to White and Black women. (1,3,4) US cancer statistics from 2012 report that Hispanic/Latina and Black women have the highest incidence of cervical cancer compared to all other races at 9.5 cases per 100,000 people and 9.0 cases per 100,000 people respectively, compared to 7.1 cases per 100,000 among White women. (6) Additionally, the 2012 death rates for cervical cancer for Hispanic/Latino and Black women are 2.7 per 100,000 people and 3.7 per 100,000 respectively, compared to 2.1 per 100,000 people for White women. (6) Along with a lower prevalence of screening, this disparity in mortality can also be attributed to later stage of diagnosis. (7)

Previously identified barriers to cervical cancer screening include a lack of continuum of health care due to include lack of health insurance and poor access to medical services. (3,8) Furthermore, minority race/ethnicity, low educational attainment, low income, limited health literacy regarding the benefits of screening, and age are well-documented barriers to screening. (3,6) Emotional barriers to screening include feelings of embarrassment or discomfort with pelvic examination, shame or fear of embarrassment by results, and confusing information about cervical cancer screening. (9) Existing literature also cites a lack of culturally appropriate care and perceived racism from health care providers as significant barriers to regular screening. (3,4) Hispanic/Latina women also report fatalism, stigma, and perceived lack of social support networks associated with cancer diagnoses as significant barriers. (4)

The Papanicolaou test or Pap smear, which uses a sample of cervical cells to detect cellular abnormalities, has been a universally endorsed method for screening cervical cancer. (10) However, due to the relatively low sensitivity of the Pap smear for the detection of high-grade precancerous cervical lesions, nearly one-third of new invasive cervical cancer cases may be attributed to false negative Pap results. (10) The US Food and Drug Administration (FDA) recently approved an HPV test as a primary cervical cancer screening option and can be offered in conjunction with a Pap smear. (11,12) The U.S. Preventive Services Task Force (USPSTF) currently recommends HPV testing in conjunction with pap smears every 5 years for women aged 30-65 to increase screening sensitivity and allow for longer intervals between screenings. (13)

Given the accuracy of the HPV test, there is interest among clinicians and researchers to use it as a primary screening method among under screened women. Self-

collection of cervico-vaginal samples for HPV testing as an initial screen for cervical cancer can be a viable option, with follow-up screening by Pap smear cytology or colposcopy for women found to be HPV positive via self-collection. (14–18) Self-collection has been shown to be nearly as sensitive as physician-based HPV testing and more sensitive (though less specific) than pap smears alone. (19,20) The self-test allows women to use a device in their home on their own to collect cervico-vaginal specimens for HPV testing, and may be a good way to reach vulnerable populations and increase initial cervical cancer screening in populations with limited resources and low cervical cancer screening rates by potentially overcoming logistic, emotional, financial, and stigma-related barriers to attending regular screenings.

While barriers to initial screening among under screened populations in the United States are well documented and existing literature indicates a generally high acceptability of a self-test in US and international populations, little is known about the emotional response to receiving results of screenings conducted using the self-test. (21) Limited research conducted on the psychosocial effects of cervical cancer screening results in clinical settings indicate that women with positive HPV test results experience feelings of distress, anxiety of having to disclose the results to their sexual partner, and embarrassment of having a sexually transmitted infection. (9,22–24) Psychosocial responses to screening, both before and after, are an important consideration as negative feelings may present a barrier to subsequent screening opportunities among under screened women. Furthermore, it raises questions regarding result delivery, especially to underserved racial/ethnic minority women, and if they are appropriately counseled

regarding the meaning of their results and the need for follow-up screenings in a culturally competent manner. (25)

Thus, we present data here to determine women's reactions to self-test results delivered by phone among low-income, under-screened women within the target age for HPV testing (30 years or older). Our aim was to determine how North Carolina women who are at high risk for cervical cancer, completed self-collection of cervico-vaginal samples with mailed kits and returned the samples by mail, react to their HPV self-test results and the delivery method, stratified by race/ethnicity.

METHODS

Target population and sample

Between January 2010 and September 2011, recruitment of underserved women was conducted in 10 North Carolina counties (Wake, Durham, Harnett, Guilford, Wayne, Cumberland, Robeson, Richmond, Hoke and Scotland) via the distribution of flyers, referral of callers from the United Way 2-1-1 social assistance hotline, and newspaper and radio advertisements. Potential participants were screened for eligibility by calling a toll-free telephone hotline, staffed 24 hours per day by trained personnel from the American Sexual Health Association (ASHA). Women were eligible to participate if they (i) had not received a Pap smear in the previous 4 years, (ii) lived in North Carolina, (iii) were not pregnant, (iv) had not undergone a hysterectomy, (v) were between 30 and 65 years of age, and (vi) met one of the following income criteria: (a) had children that qualified for the federal school lunch program, (b) had Medicaid or Medicare Part B

insurance, or (c) were uninsured and living at or below 250% of the federal poverty level (determined by household income and size).

The initial sample included women who took and returned their self-samples, reported their race/ethnicity, and participated in the acceptability questionnaire (n=224). Only women who identified as non-Hispanic White or non-Hispanic Black were included in the final analysis (n=202). Women who identified as Hispanic (n=12), Asian (n=2), American Indian or Alaska Native (n=6), or mixed race/ethnicity (n=2), were not included; the study was not powered to include these races/ethnicities individually. A sensitivity analysis concluded that including these women in a third racial category called "other" did not significantly alter the results, and they were subsequently dropped from the sample (Figure 1).

Procedures

Eligible women were mailed a self-collection kit containing a brush for collecting a cervico-vaginal sample collection device, a vial of preservation media, simple 1-page illustrated instructions for collecting the sample, and a prepaid mailer to return their self-collected specimen for HPV testing. The package also contained a list with contact information of local clinics that perform low-cost or free Pap smears, and informed consent and HIPAA authorization forms for participants to complete and return. When results were available, the ASHA call center called participants to provide their HPV self-collection results. During this call, agents encouraged participants to obtain a clinic-based Pap smear; provided them with information where to obtain a free or low-cost Pap in their county; and administered a questionnaire to assess beliefs, knowledge, and acceptability of self-collection. After the study received notification of Pap smear

completion or after two months without notification, participants were contacted to complete a follow-up questionnaire. Study participants received grocery store gift cards: (i) $30 for returning the self-collection kit and completing the acceptability questionnaire, (ii) $10 for reporting completion of a Pap smear (either via provided postcard or verbally), (iii) and $5 for completing the follow-up questionnaire.

The study protocol was reviewed and approved by the University of North Carolina at Chapel Hill Institutional Review Board.

Measures

Self-collection sample: Participants collected cervico-vaginal samples using a Viba brush (Rovers Medical Devices, BV; Oss, The Netherlands) and placed the brush head in a 10-ml. vial of Scope mouthwash, previously determined to be a stable preservation medium. [16]). Specimens were de-identified, frozen, and shipped in weekly batches to the Cleveland Clinic laboratory (Cleveland, OH) for high-risk HPV infection testing using the Hybrid-Capture II HPV test (QIAGEN Corporation, Gaithersburg, MD).

Acceptability questionnaire (AQ): Questionnaire items focused on participants' perceptions of their experience completing HPV testing by self-collection (referred to as "self-test"), including the clarity of instructions, use of the brush, attitudes and/or concerns about the test, and returning the self-collection kit by mail (primary outcome of the study). Questions also gauged the quality of and attitudes towards the self-collection experience, as well as feelings regarding returning the self-collected sample by mail. In addition, the survey assessed participants' HPV knowledge, past medical and reproductive history, socio-demographic factors, and responses to receiving HPV results.

Follow-up questionnaire: In the follow-up questionnaire (FQ), women were asked whether and where they had undergone a Pap smear to follow-up on their HPV self-collection. Items addressed their experiences with the Pap smear (e.g., "How much pain, if any, did you have when you got the Pap smear?"), their past histories of cervical disease and its evaluation and treatment, their attitudes and concerns with Pap smears (e.g. "I worried that the Pap smear exam might not be clean" and "My husband or sexual partner did not want me to get a Pap smear") and their responses to their personal Pap smear results. The follow-up questionnaire also reassessed their responses to the HPV self-test results.

Data analysis

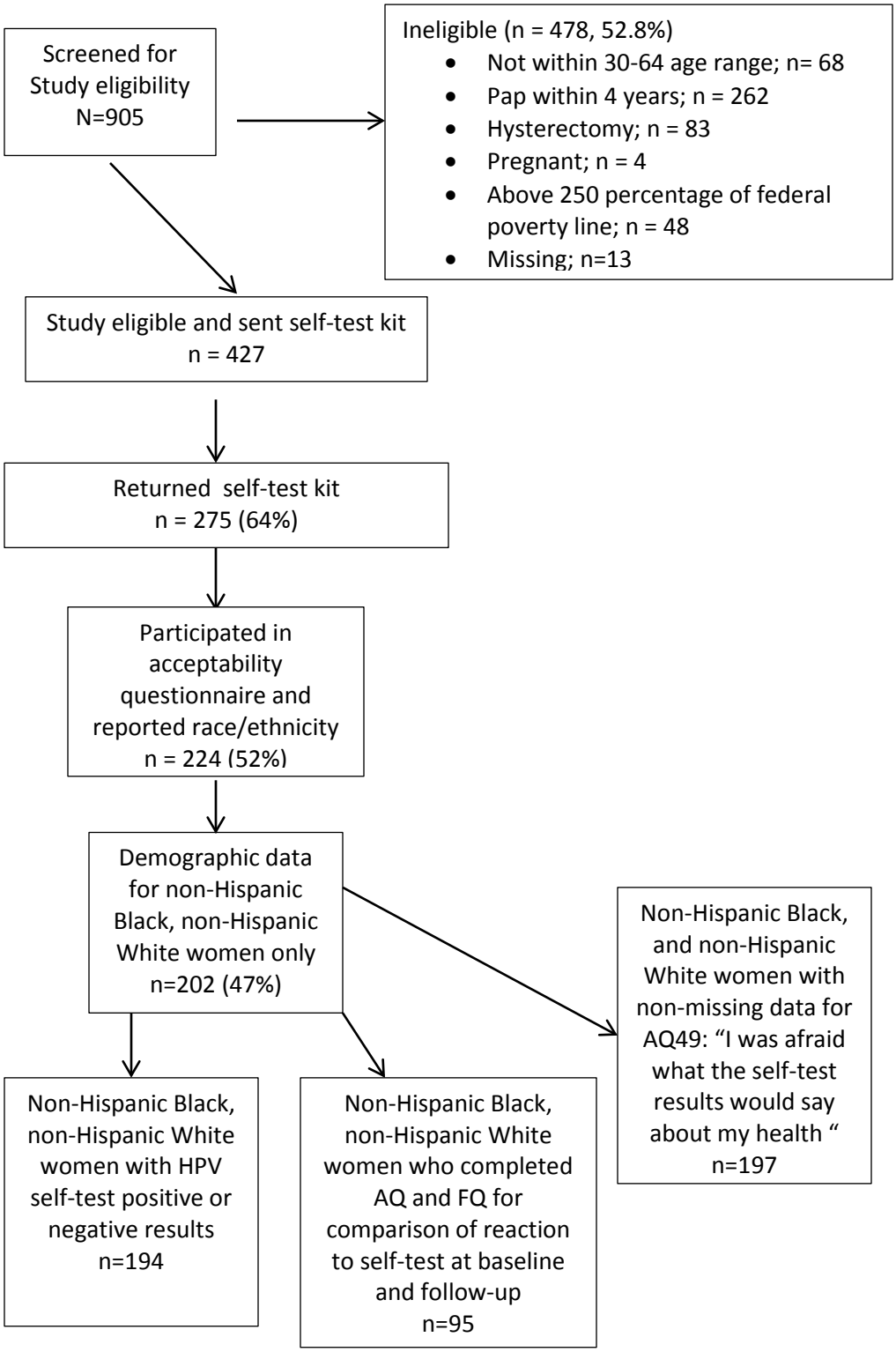
Demographic data, time since last Pap smear, and attitudes towards HPV and cervical cancer were assessed for 202 women. Initial reactions to self-test results and result delivery based on 12 selected questions from the AQ (10) and FQ (2). The AQ questions were analyzed for a total of 194 women who received either a positive (n=29) or negative (n=165) result; this included 73 White women and 121 Black women. The FQ questions were analyzed for women who completed both the AQ and FQ (n=93) and received either a positive (n=20) or negative (n=73) result; this included 35 White women and 58 Black women. A two-sided t-test was used to compare variation in the continuous variables and Pearson's chi-squared test was conducted to compare variation in categorical variables, by race (White and Black).

To assess changes in responses to the reaction-specific questions with time, responses to questions regarding result delivery that appeared in both the AQ (designated

as baseline) and FQ were analyzed (n= 95). Differences in reporting between baseline and follow-up were assessed using Pearson's chi-squared test.

The final portion of the analysis assessed demographic and health behavior predictors of women's concern regarding what their self-test results would say about their health. This question appeared in the AQ and offers additional context on the psychosocial impact of interpreting the self-test results (n=197). Twenty-two categorical variables from the acceptability questionnaire including race and age were included based on their mention in existing literature on cervical cancer risk. Participants who indicated that they strongly or moderately agreed that they were afraid of what the self-test results would say about their health were attributed a value of 1 while participants who indicated that they strongly or moderately disagreed were attributed a value of 0. Crude odds ratios with 95% confidence interval was calculated for each covariate, followed by odds ratios with 95% confidence intervals adjusted for race and age, two documented covariates of cervical cancer screening. All results were considered statistically significant at $p<0.05$. All analyses were conducted in Stata Statistical Software, Release 14.0 (Stata Corp, College Station, Texas, USA).

Figure 1: Final analysis sample - Acceptability of a mailed HPV[†] self-resting kit for use with high risk, low income women in North Carolina, 2011



[†]HPV=Human Papillomavirus, a sexually transmitted infection causing virtually all cervical cancer cases

RESULTS

Table 1: Demographic data for 202 infrequently screened women in North Carolina[†]

	Overall N (range/ %)	White	Black	P-value[‡]
N (%)	202	78 (38.6%)	124 (61.4%)	
Time Since Last Pap (years)				
Mean (SD)	5.9 (2.6)	6.3 (2.9)	5.6 (2.3)	0.07
Median (Range)	5 (4-13)	5 (4-13)	5 (4-11)	
Age (years)				
Mean (SD)	43.8 (8.3)	43.1 (8.1)	44.2 (8.5)	0.40
Median (Range)	44 (30-64)	44 (30-64)	44 (30-44)	
Number of live births				
Mean (SD)	2.4 (1.6)	2 (1.4)	2.6 (1.7)	0.02[§]
Median (Range)	2 (0-8)	2 (0-6)	2 (0-8)	
Education				
Less than GED or HS diploma	42 (20.8%)	19 (24.4%)	23 (18.5%)	
High school diploma/ GED	76 (37.1%)	22 (28.2%)	53 (43.73%)	0.21
Some college or more	75 (37.1%)	32 (41%)	43 (34.7%)	
Marital status				
Married or living as married	57 (28.2%)	28 (35.9%)	29 (23.4%)	
Divorced/ separated/ widowed	52 (25.7%)	21 (26.9%)	31 (25%)	0.1
Single never married	85 (42.1%)	28 (35.9%)	57 (46%)	
Annual household income (USD)				
<$10,000	87 (43.1%)	30 (38.5%)	57 (46%)	
$10,000-$20,000	70 (34.6%)	35 (44.9%)	35 (28.2%)	0.06
$20,000+	29 (14.4%)	10 (12.8%)	19 (15.3%)	
Urbanicity				
Rural	40 (19.8%)	21 (26.9%)	19 (15.3%)	0.04[§]
Urban	162 (80.2%)	57 (73.1%)	105 (84.7%)	
Insurance Status				
None	126 (62.4%)	50 (64.1%)	76 (61.3%)	
Medicaid	51 (25.6%)	18 (23.1%)	33 (26.6%)	0.39
Military/Blue Cross/Other	18 (8.9%)	9 (11.5%)	9 (7.3%)	
Religious preference				
No religion	21 (10.4%)	12 (15.4%)	9 (7.3%)	
Baptist	75(37.1%)	25 (32%)	50 (40.3%)	
Christian, non-Baptist	60 (29.7%)	27(34.6%)	33 (26.6%)	0.11
Other religion	8 (4%)	1 (1.3%)	7 (5.6%)	

[†]N=202 includes female participants who completed the acceptability questionnaire. Those identifying as Hispanic/Latina, Asian, American Indian/Alaska Native, or "other" were not included in analyses
SD=standard deviation from median value; GED= General Education Development certification
‡P-values based on 2-sided t-test for time since last pap and age; remaining p-values based on Pearson's Chi-squared test. All calculated using non-missing data only
[§] Statistically significant at α=0.05 comparing mean number of live births and urbanicity between White and Black women

Among 202 participating women (78 White; 124 Black), the median age was 44 years for both races (Table 1). The median time since last Pap was 5 years (range 4-13

years). Participating White women had a slightly lower mean number of live births (n=2) than Black women (n=2.6), p=0.02. Distribution of educational attainment, insurance status, and religious preference did not appear to notably differ between white and black participants. Black women were more likely to live in urban areas (84.7%) compared to White women (73.1%), p=0.04.

Table 2: Attitudes and beliefs of infrequently screened women (n=202) [†]

	Overall N=202 (%)	**White (n=78)**	**Black (n=124)**	**P-value** [‡]
How worried are you about getting HPV?				
Very/ moderately	46(22.8%)	17 (21.8%)	29 (23.4%)	
A little/ not at all	146 (72.3%)	57 (73.1%)	89 (71.8%)	0.80
How worried are you about getting cervical cancer?				
Very/ moderately	80 (39.6%)	41 (52.6%)	39 (41.4%)	
A little/ not at all	111 (55%)	34 (43.6%)	77 (62.1%)	0.004[§]
How much do you trust the self-test to give you accurate information about your risk for cervical cancer?				
Completely	83 (41.1%)	35(44.9%)	48 (38.7%)	
Moderately	82 (40.6%)	26(33.3%)	56(45.2%)	0.45
A little	13 (6.4%)	6 (7.7%)	7 (5.7%)	
Not at all	4 (2%)	1 (1.3%)	3 (2.4%)	
How often do you think an abnormal self-test result means a woman is at risk for cervical cancer?				
Always	18 (8.9%)	7 (9%)	11(8.9%)	
Most of the time	37 (18.3%)	17 (21.8%)	20 (16.1%)	0.83
Some of the time	76(37.6%)	28 (35.9%)	48 (38.7%)	
Rarely	20 (9.9%)	8 (10.3%)	12 (9.7%)	

[†]N=202 includes participants who completed the acceptability questionnaire. Those identifying as Hispanic/Latina, Asian, American Indian/Alaska Native, or other not included in analysis
HPV=Human papillomavirus, a sexually transmitted infection causing virtually all cervical cancer cases
[‡]P-values based Pearson's Chi-squared test. All calculated using non-missing data only
[§] Statistically significant at α=0.05 comparing worry about getting cervical cancer between White and Black women

Most women were slightly worried or not at all worried about getting HPV infection (73.1% White; 71.8% Black)(Table 2). White women reported being more very/moderately worried about getting cervical cancer (52.6%) as compared to Black women (41.4%), p=0.004. Most women completely (41.1%) or moderately (40.6%)

trusted that the self-test gave accurate information about their risk for cervical cancer, with no differences observed by race. Approximately 9% of women thought an abnormal self-test always means that they are at risk for cervical cancer, though most believed that it indicated this risk most (18.3%) or some of the time (37.6%), regardless of race.

Roughly half (49%) of the women strongly/moderately agreed that they were afraid of what the self-test results would say about their health, regardless of result or race (Table 3). 3.4% of women with a positive self-test result reported feeling embarrassed or ashamed by the results compared to no women with a negative result ($p<0.001$). Most women were not concerned that other people would hear their self-test results when they were delivered (93.3%); however a higher proportion of White women (65.8%) reported that they would share their self-test results, compared to Black women (44.6%), $p=0.04$. Women with positive self-test results were more likely to feel worried (34.5% positive, 1.2% negative; $p=<0.001$) and less likely to feel relieved (27.7 positive, 83% negative; $p< 0.001$) by their results. More women with positive self-test results (31%) reported needing more help with understanding the results, compared to women with negative results (2.4%), $p<0.01$. Most women (73.2%) strongly/somewhat agreed that receiving their results over the phone was more private than receiving them over the mail. 90.7% of women strongly/somewhat agreed that they felt comfortable getting the results by phone. 62.4% of women strongly/somewhat agreed that receiving their results over the phone was more private than talking with their doctor in person. At follow up, 90.3% of women reported understanding their self-test results. A higher proportion of women with positive self-test results (30%) reported that the results made them feel depressed compared to the women with negative self-test results (1.4%), $p>0.001$.

Table 3: Reaction to self-test results provide to participants over the phone, stratified by positive versus negative HPV results and by reported race (N=194) †

	Total (n, %) N=194	**Positive self-test result (n, %) n=29**	**Negative self-test result (n, %) n=165**	**P-value‡**	**White (n, %) n=73**	**Black (n,%) n=121**	**P-value‡**
I was afraid what the self-test results would say about my health							
Strongly/moderately agree	95 (49%)	14 (51.7%)	80 (48.5%)		40 (54.8%)	55 (45.5%)	
Strongly/moderately disagree	95 (49%)	14 (48.3%)	81 (49.1%)	0.68	32 (43.8%)	63 (52.%)	0.41
Do the results make you feel Embarrassed or ashamed							
Yes	1 (0.5%)	1 (3.4%)	0 (0%)		1 (1.4%)	0 (0%)	
No	156 (90.4%)	22 (76.9%)	134 (81.2%)	<0.001§	53 (74%)	102 (84.3%)	0.31
I was concerned that other people would hear my results							
Strongly/somewhat agree	11(3.8%)	1(3.5%)	10(6%)		6 (8.2%)	5 (4.1%)	
Strongly/somewhat disagree	181(93.3%)	28 (96.6%)	153(92.7%)	0.36	67 (91.8%)	114 (94.2%)	0.41
Do you think you will share your self-test results with anyone?							
Yes	102 (52.6%)	14 (48.3%)	88 (53.3%)		48 (65.8%)	54 (44.6%)	
Spouse or Sexual Partner	50 (25.8%)	6 (20.7%)	44 (26.7%)		25 (34.2%)	25 (20.7%)	
Parent	8 (4.1%)	0 (0%)	8 (4.8%)		3 (4.1%)	5 (4.1%)	
Sibling/Brother/Sister/ Other family member	20 (10.3%)	6 (20.7%)	14 (8.5%)		8 (11%)	12 (9.2%)	
Friend/Co-worker	15 (7.7%)	1 (3.4%)	14 (8.5%)	0.58	8 (11%)	7 (5.8%)	0.04§
Doctor	2 (1%)	1 (3.4%)	1 (0.6%)		0 (0%)	2 (1.6%)	
Other people with same self-test result	1 (0.5%)	0 (0%)	1 (0.6%)		0 (0%)	1 (0.8%)	
Not reported	7 (3.6%)	0 (0%)	7(4.2%)		4 (5.5%)	3 (2.5%)	
No	61 (31.4%)	10 (34.5%)	51 (30.9%)		12 (16.4%)	49 (40.5%)	

Do the results make you feel worried?							
Yes	12 (6.2%)	10(34.5%)	2(1.2%)		5 (6.9%)	7 (5.8%)	
No	146(75.3%)	13 (44.8%)	133(80.6%)	<0.001§	52 (71.2%)	94 (77.7%)	0.60
Do the results make you feel relieved?							
Yes	145 (74.7%)	8 (27.6%)	137(83%)		51 (69.9%)	94 (77.7%)	0.90
No	20(10.3%)	14 (48.3%)	6 (3.6%)	<0.001§	7 (9.6%)	13 (10.7%)	
Would you like help understanding the results?							
Yes	13 (6.7%)	9 (31%)	4 (2.4%)		4 (5.5%)	9 (7.5%)	
No	137 (7.6%)	13 (44.8%)	124 (75.2%)	<0.001§	49 (67.1%)	88 (72.7%)	0.70
Receiving my results over the phone is more private than receiving the results by mail.							
Strongly / somewhat agree	142 (73.2%)	23 (79.3%)	119 (72.1%)		53 (72.6%)	89 (76.5%)	
Strongly / somewhat disagree	31 (16%)	3 (13.8%)	27 (16.4%)	0.52	9 (12.3%)	22 (18.2%)	0.33
I am comfortable getting self-test results by phone							
Strongly / somewhat agree	176 (90.7%)	29 (100%)	147 (89.1%)		65 (89%)	111 (91.7%)	
Strongly / somewhat disagree	5 (2.6%)	0 (0%)	5 (3%)	0.56	1 (1.4%)	6 (5%)	0.42
Receiving my results over the phone is more private than talking with my doctor about them							
Strongly / somewhat agree	121 (62.4%)	20 (67%)	101 (61.2%)		42 (57.5%)	79 (65.3%)	
Strongly / somewhat disagree	43 (22.1%)	3 (10.3%)	40 (24.2%)	0.30	15 (20.6%)	28 (23.1%)	0.77

From follow-up questionnaire*	Overall (N=93)	Positive self-test result (n, %) N=20	Negative self-test result (n, %) N=73	P-value[‡]	White (n, %) N=35	Black (n, %) N=58	P-value[‡]
I understood my self-test results							
Strongly / somewhat agree	84 (90.3%)	19 (95%)	65 (89%)		32 (91.4%)	52 (89.7%)	
Strongly / somewhat disagree	1 (1.1%)	1 (5%)	0(0%)	0.07	0 (0%)	1 (1.7%)	0.43
Did the self-test results make you feel depressed?							
Yes	7 (7.5%)	6 (30%)	1 (1.4%)		3 (8.6%)	4 (6.9%)	
No	76 (81.7%)	13 (65%)	63 (86.3%)	<0.001[§]	29 (82.8%)	47 (81%)	0.81

[†]AQ questions have M= 194 and includes all White and Black women who had either a positive or negative HPV self-test result. Indeterminate and missing results dropped from this analysis. FQ questions have N=93 and includes women who completed the FQ and meet the same criteria for AQ questions

[‡]P-values based on Pearson's Chi-squared test; calculated using non-missing data only

[§]Statistically significant at α=0.05

Table 4: Attitudes towards result delivery before results delivery and a median time of 1.5 months after delivery to 95 infrequently screened women in North Carolina[†]

Baseline	n (%)	**Follow-up**	n (%)	**P-value**‡
I am comfortable getting self-test results by phone		I felt comfortable getting my self-test results by phone.		
Strongly / somewhat agree	89 (93.7%)	Strongly / somewhat agree	83 (87.4%)	0.85
Strongly / somewhat disagree	2(2.1%)	Strongly / somewhat disagree	3 (3.1%)	
Receiving my results over the phone is more private than talking with my doctor about them		Receiving my results over the phone is more private than talking with my doctor about them.		0.07
Strongly / somewhat agree	60 (63.1%)	Strongly / somewhat agree	52 (54.7%)	
Strongly / somewhat disagree	22 (23.2%)	Strongly / somewhat disagree	31 (32.7%)	
Receiving my results over the phone is more private than receiving the results by mail.		Receiving my results over the phone is more private than receiving the results by mail.		
Strongly / somewhat agree	69 (72.6%)	Strongly / somewhat agree	62 (65.3%)	0.22
Strongly / somewhat disagree	19 (20%)	Strongly / somewhat disagree	17 (17.9%)	
Would you like more help understanding the results?		Since you got your self-test results did you want more help understanding your results?		
Yes	9(9.5%)	Yes	18 (19%)	0.01[§]
No	69 (72.6%)	No	67 (70.5%)	
Actual HPV Self-Test Results		Do you remember your HPV self-test results from this study?[‖]		
Abnormal (positive)	20 (21%)	Abnormal (positive)	16 (16.8 %)	
Negative	73 (76.4%)	Negative	65(68.4%)	<0.001[§]
Indeterminate	1(1.1%)	Indeterminate	1 (1.1%)	
		Don't know	4 (4.2%)	

[†]N=95 includes participants who were asked all follow up questionnaire items and identified as white or black

‡P-values based on Pearson's Chi-squared test; calculated using non-missing data only

[§] Statistically significant at α=0.05

[‖]Respondents who reported "don't know" or are missing received their self-test results

HPV=Human papillomavirus, a sexually transmitted infection causing virtually all cervical cancer cases

The median time between baseline and follow-up for the 95 women who completed both was 45 days, or 1.5 months (Table 4). The majority of women strongly/somewhat agreed being comfortable receiving HPV self-test results by phone at baseline (93.7%) and follow-up (87.4%). There was no significant variation over time among women who women strongly/somewhat agreed that receiving results over the

phone was more private than talking with their doctor in person (63.1% at baseline; 72.6% at follow- up), or that it was more private than receiving them in the mail (72.5% at baseline; 65% at follow-up). However, notably more women, reported wanting help understanding their results at follow-up (19%) as compared to baseline (9.5%), p<0.001. Most of these women had positive self-test results (Figure 2).

Figure 2: Comparing women's need for help understanding their HPV self-test results at baseline and follow-up

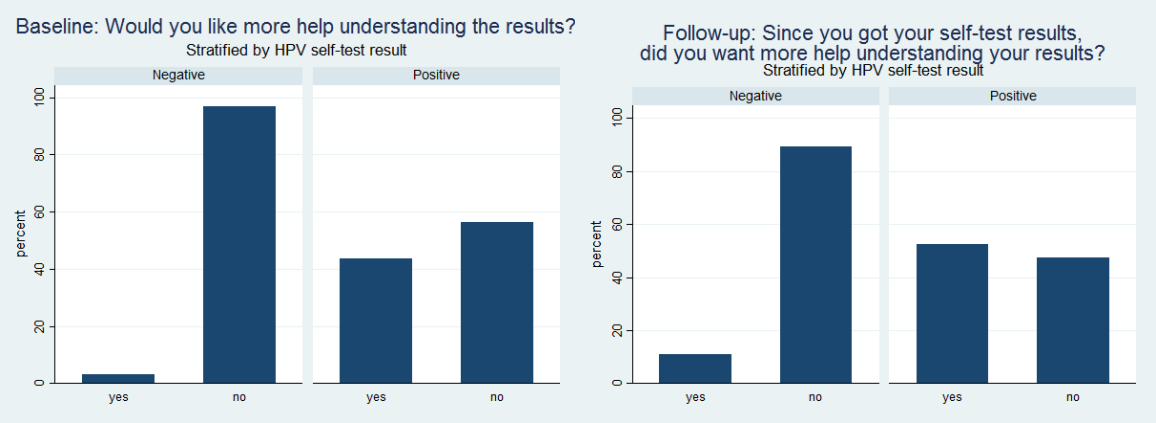


Table 5: Predictors of strongly or moderately agreeing, "I was afraid what the self-test results would say about my health" (N=197) [†]

Characteristic	n (% women who strongly or moderately agreed with the statement that "I was afraid what the self-test results would say about my health")	Crude Odds ratios (95% Confidence Intervals)[‡]	Adjusted Odds Ratios (by age and race) (95% Confidence Intervals)[‡]
Age (years)			
30-39	32(47.8%)	REF	REF
40-49	37 (50.7%)	1.12 (0.58, 2.18)	1.11 (0.57, 2.15)
50+	30 (52.6%)	1.22 (0.60, 2.46)	1.25 (0.61, 2.54)
Race			
White	42 (55.3%)	REF	REF
African American	57 (47.1%)	0.72 (0.41, 1.28)	0.71 (0.40, 1.27)
Annual household income (USD)			
<$10,000	44 (51.8%)	1.07 (0.63, 1.99)	1.17 (0.66, 2.11)
$10,000 or greater	48(49%)	REF	REF
Education			
Less than GED or HS diploma	27 (65.9%)	2.89 (1.31, 6.40)	2.92 (1.32, 6.50)
High school diploma, GED	38 (52.1%)	1.62 (0.85, 3.12)	1.73 (0.89, 3.36)
Some college or more	30(40%)	REF	REF
Marital status			
Married or living as married	19 (39.6%)	REF	REF
Divorced/ separated/ widowed	39 (61.9%)	2.48 (1.15, 5.36)	2.37 (1.08, 5.19)
Single never married	37 (48%)	1.41(0.68, 2.93)	1.49 (0.69, 3.1
Time since last Pap (years)			
4-9	56 (47.9%)	REF	REF
≥10 or Never	18 (62.1%)	1.78 (0.77, 4.10)	2.69 (0.73, 3.92)
>4 but Unspecified Duration	25 (49%)	1.05 (0.63, 1.32)	1.09 (0.56. 2.10)
Urbanicity			
Rural	24 (63.2%)	1.92(0.92, 3.98)	1.85 (0.89, 3.87)
Urban	75(47.2%)	REF	REF
Smoking			
Smoker	53 (51.5%)	1.11(0.64, 1.94)	1.03 (0.58, 1.84)
Non-smoker	45 (48.9%)	REF	REF

Internet use			
Daily/Weekly	41(58.6%)	REF	REF
Less often than that	54 (45%)	0.58 (0.32, 1.05)	0.58 (0.32, 1.07)
Religious preference			
No religion	11 (57.9%)	1.23 (0.44, 3.42)	1.01 (0.35, 2.91)
Baptist	39(52.7%)	REF	REF
Christian, non-Baptist	26 (43.3%)	0.69 (0.35, 1.36)	0.61 (0.30, 1.24)
Other religion	5 (50%)	0.90 (0.21. 3.86)	1.02 (0.23, 3.46
Insurance			
Insured	68(54%)	REF	REF
Non-insured	30 (42.9%)	1.56(0.87, 2.82)	1.56 (0.86, 2.81)
Insurance			
None	68(54.4%)	1.49 (0.77, 2.88)	1.44 (0.74, 2.80)
Medicaid	22 (44%)	REF	REF
Military/Blue Cross/Other	7(41.8%)	0.89 (0.45, 2.72)	0.78 (0.25, 2.45)
Age at First Intercourse			
< 16	30(50.9%)	REF	REF
≥ 16	50 (55.6%)	1.03 (0.54, 1.96)	0.91 (0.46, 1.80
Number of live births			
0/1	28 (49.1%)	REF	REF
2	28 (54.9%)	1.26 (0.59, 2.69)	1.32 (0.61, 2.84)
3+	40 (47.6%)	0.94 (0.48.1.84)	1.01 (0.51, 2.01)
Need help reading written health materials			
Never	80 (47.9%)	REF	REF
Rarely / Sometimes/ Often / Always	18 (62.1%)	1.78 (0.79, 3.99)	1.60 (0.7 3.69)
Current use of contraception			
Yes	38 (59.4%)	REF	REF
No	23(44.2%)	0.54 (0.26,1.14)	0.51 (0.24, 1.09)
Not needed (No sexual partner / post-menopausal)	17 (48.6%)	0.64(0.28, 1.48)	0.55 (0.23, 1.29)
Completely comfortable using tampon			
Yes	35 (47.9%)	REF	REF
No	57 (52.3%)	0.84 (0.46, 1.52)	0.83 (0.46, 1.52)
Self-reported history of abnormal Pap			
Never	33 (47.8)%	REF	REF
Once	14 (58.3%)	1.53 (0.59, 3.90)	1.45 (0.56, 3.77)
Two or more times	13 (41.9%)	0.76 (0.33, 1.73)	0.71 (0.29, 1.72)
Self-reported history of HPV infection or cervical disease			
No	92 (50%)	REF	REF
Yes	5 (50%)	1.00 (0.28, 3.57)	0.87 (0.23, 3.20)

Self-reported history of genital warts			
No	87 (47.5%)	REF	REF
Yes	10 (83.3%)	5.52 (1.18, 25.88)	5.45 (1.16, 25.67)
Self-reported history of sexually transmitted infections			
No	65 (48.2%)	REF	REF
Yes	31 (52.5%)	1.19 (0.65, 2.20)	1.24 (0.66, 2.31)

[†]Non-missing data for this question, excluding those who responded and 'do not know', or race other than White/Black)

[‡] Odds ratios calculated based on non-missing data only

HPV=Human papillomavirus, a sexually transmitted infection causing virtually all cervical cancer cases

[§]HPV knowledge index=score calculated based on number of correctly answered questions out of 5 total questions about HPV

Predictors of strongly or moderately agreeing that the women were afraid of what the self-tests results would say about their health are depicted in table 5 and include 197 women who answered this question in the AQ (Table 5). The majority of variables were not found to be statistically significant predictors, even when adjusted for age and race. However, women with less than a GED or high school diploma had 2.92 times the odds of strongly or moderately agreeing that they were afraid of what the self-test results would say about their health than women with some college education or more when adjusted for age and race (CI: 1.32, 6.5). Women who were divorced, separated, or widowed had 2.37 times the odds of strongly or moderately agreeing that they were afraid of what the self-test results would say about their health than women who were married or living as married, adjusted for age and race (CI: 1.08, 5.19). Furthermore, women who reported having genital warts had 5.45 times the odds of strongly or moderately agreeing with that they were afraid of what the self-test results would say about their health than women who did not, adjusted for age and race (CI: 1.16, 25.67).

DISCUSSION

Among over 200 infrequently screened women in North Carolina, White women reported being more concerned about getting cervical cancer and more willing to share their HPV self-test results with others as compared to Black women. Regardless of race, women who received positive self-test results were more likely to feel embarrassed, worried, and depressed by their results. Conversely, women who received negative self-test results were more likely to feel relieved by their results. Another key finding is that the women underestimated the need for help with interpreting their self-test results, particularly those with a positive result. Women were more likely to report being afraid of what the self-test results would say about their health if they had lower educational attainment; were divorced, widowed, and separated; and self-reported history of genital warts.

Our findings that feelings of embarrassment, worry, and depression are not uncommon among women with positive self-test results were consistent with previous cervical cancer screening studies. Two studies on psychosocial impacts of abnormal Pap smears and positive HPV test results three European countries and the UK respectively showed that women reported initial feelings anxiety, panic and stress after being told their results over the phone. (23,24) More than half of the women in the European study had lingering feelings of worry or depression after discussing their test results and follow-up treatment after speaking with their gynecologist. (23) Additionally, the UK study findings support that women with visible genital warts were more likely to have negative psychosocial responses to positive results. (24) However, unlike our findings, data from a UK-based qualitative study on the social and psychological impact of HPV

testing showed that women were highly anxious about disclosing their results to family or close friends due to stigma associated with an STI such as HPV. (9) It is important to note that these studies did not specifically target typically hard to reach and racial minority women. Future studies of this nature should continue to focus on result delivery in these populations to better understand their reactions and how women can be counseled on their results in a culturally appropriate and respectful manner.

Confusion in interpreting cervical cancer screening results is a noted challenge, (9,22) particularly among underserved women. This may indicate a lack of counseling when women first receive their results, or a poor understanding of the information they receive. Addressing confusion regarding HPV self-test results is critical to its effectiveness; the low specificity of this test necessitates the follow up a positive result with a Pap smear and/or colposcopy in order to detect the presence of pre-cancerous cervical lesions or invasive cancer. Women must be able to understand their results in order to receive the appropriate follow-up care.

This study highlights that women, especially those with positive results, may not immediately realize that they need help understanding their results, and result delivery should include referral to information sources that they can access for further clarification as needed. Women participating in this study were given a pamphlet with additional information regarding self-test results, and had access to a 24-hour toll-free hotline number that was staffed by trained personnel from ASHA. The increase in women who reported wanting help interpreting their results at follow-up may also be associated with the delivery method. While the majority of women reported that receiving their results over the phone was more comfortable and private than speaking with a doctor in person,

it is possible that this delivery method limited the opportunity to ask questions or offer points of clarification since it was not possible for the women or the ASHA staff to pick up on visual cues of confusion. Furthermore, the women may have been less willing to ask clarifying questions over the phone than in person, an aspect that was not explicitly examined in this study.

This study had a number of strengths. First, this study is the first we know of on feasibility of mailed HPV self-test screening among high-risk women in the United States. Many US-based studies on self-test acceptability are clinic-based and asked about hypothetical acceptability of an at-home self-test, did not have the scope for understanding of reaction to results in this context. Second, the acceptability questionnaire used in this study considered a variety of potential confounders, including those identified in existing literature. Additionally, the eligibility criteria controlled for income, appropriate age for HPV tests (30-65), concurrent pregnancy, and hysterectomy, allowing for a more homogenous study sample. Furthermore, the study focused on North Carolina counties with relatively high incidences of cervical cancer, demonstrating the need for this research in this geographic area.

While this study had a relatively high enrollment and self-test return rate as compared to other cervical cancer screening studies targeting under-screened women, (26,27) it was not powered to include Hispanic/Latina women or analyze a large number of covariates relating to reactions to the HPV self-test. Second, there was a significant drop in complete data between the AQ and the FQ, as a large number of women did not complete the FQ after starting it. While loss to follow up is a common challenge, future studies of this nature should take measures to ensure that those who are reached for

follow up are able to complete it. A third limitation of this study is that not all questions pertaining to reactions to the HPV self-test results were included in both the AQ and FQ, making it difficult to fully assess the psychosocial impact of the results over time or the quality of the questions themselves. A future study of this nature should aim for more consistency between the baselines and follow up questionnaires. Ultimately, larger studies with a more nationally representative population are needed to support the evidence base for the findings of this study.

Findings from this study can inform cervical cancer messaging to underserved populations by emphasizing and promoting their understanding of their heightened risk and the importance of screening. Given this study supports existing data that feelings of embarrassment, worry and depression are common among participants with positive HPV self-test results, result delivery should include counseling that addresses such psychosocial effects and their need for follow-up screening. Furthermore, the counseling should include referral to educational resources that women can access at any time to better understand or remind themselves of the meaning and implications of their results. As the first mailed HPV screening study among high-risk women in the United States, it underscores several emerging psychosocial considerations of result delivery and receipt that must be addressed in all components of cervical cancer screening outreach in a culturally appropriate and competent manner.

References

1. American Cancer Society: Cancer Facts and Figures 2016. Atlanta, GA: American Cancer Society, 2016

2. Spence AR, Goggin P, Franco EL. Process of care failures in invasive cervical cancer : Systematic review and meta-analysis. Prev Med. 2007;45:93–106.

3. Bazargan M, Ph D, Bazargan SH, Ph D, Farooq M, Baker RS, et al. Correlates of cervical cancer screening among underserved Hispanic and African-American women. Prev Med 2010; 39(2004):465–473.

4. Watts L, Joseph N, Velazquez A, Gonzalez M, Munro E, Muzikansky A, et al. Understanding barriers to cervical cancer screening among Hispanic women. Am J Obstet Gynecol. 2009;201:199.e1-8.

5. Smith JS, Lindsay L, Hoots B, Keys J, Franceschi S, Winer R, et al. Human papillomavirus type distribution in invasive cervical cancer and high-grade cervical lesions : A meta-analysis update. Int J Cancer. 2007;632:621–632.

6. Centers for Disease Control and Prevention. Cervical Cancer Statistics. Updated 20 August 2015.

7. Downs LS, Smith JS, Scarinci I, Flowers L, Parham G. The disparity of cervical cancer in diverse populations. Gynaecol Oncol. 2008;109:22–30.

8. CDC. Cancer screening—U.S., 2010. MMWR Morb Mortal Wkly Rep, 61 (3) (2012), pp. 41–45

9. Bukowska-durawa A, Luszczynska A. Cervical cancer screening and psychosocial barriers perceived by patients . A systematic review. Contemp Oncol (Pozn) 2014; 18:153-159.

10. National Institutes of Health. Cervical Cancer. National Institutes of Health; October 2010. Avaialable from: http://report.nih.gov/nihfactsheets/viewfactsheet.aspx?csid=76

11. Reiter PL, Mcree AL. Cervical cancer screening (Pap testing) behaviours and acceptability of human papillomavirus self-testing among lesbian and bisexual women aged 21 – 26 years in the USA. J Fam Plann Reprod Health Care. 2014;0:1–6.

12. Arbyn M, Verdoodt F, Snijders PJF, Verhoef VMJ, Suonio E, Dillner L, et al. Accuracy of human papillomavirus testing on self-collected versus clinician-collected samples : a meta-analysis. Lancet Oncol.. 2014;15:172–183.

13. U.S. Preventive Services Task Force. *Screening for cervical cancer*. http://www.uspreventiveservicestaskforce.org/uspstf/uspscerv.htm. Updated July 2015.

14. Dzuba IG, Díaz EY, Allen B, et al. The acceptability of self-collected samples for HPV testing vs. the pap test as alternatives in cervical cancer screening. *J Womens Health Gend Based*. 2002;11:265-275.

15. Racey CS, Withrow DR, Gesink D. Self-collected HPV Testing Improves Participation in Cervical Cancer Screening: A Systematic Review and Meta-analysis. Can J Public Health. 2013;104: e159–e166.

16. Montealegre JR, Landgren RM, Anderson ML, Hoxhaj S, Williams S, Robinson DJ, et al. Acceptability of self-sample human papillomavirus testing among medically underserved women visiting the emergency department. Gynecol Oncol. 2015;138:317–322.

17. Richman AR, Brewer NT, Liebman AK, Rinas AC, Smith JS. Optimising human papillomavirus self-testing for high risk women. Sex Transm Infect. 2011; 87:118–123.

18. Taylor S, Wang C, Wright TC, Denny L, Kuhn L. A comparison of human papillomavirus testing of clinician-collected and self-collected samples during follow-up after screen-and-treat. Int J Cancer. 2011;129:879–886.

19. Petignat P, Dl F, Bruchim I, Dianuro C De, Petignat P, Faltin DL, et al. Franco EL, Coutlee F.Are self-collected samples comparable to physician-collected cervical specimens for human papillomavirus DNA testing ? A systematic review and meta-analysis. Gynecol Oncol. 2007; 105: 530-535.

20. Snijders PJF, Verhoef VMJ, Arbyn M, Ogilvie G, Minozzi S, Banzi R, et al. High-risk HPV testing on self-sampled versus clinican-collected specimens : A review on the clinical accuracy and impact on population attendance in cervical cancer screening. Int J Cancer 2013; 132: 2223-2236.

21. Cuzick J, Arbyn M, Sankaranarayanan R, Tsu V, Ronco G, Mayrand M, et al. Overview of Human Papillomavirus-Based and Other Novel Options for Cervical Cancer Screening in Developed and Developing Countries. Vaccine 2008; 26S:K29-K41.

22. Mccaffery K, Waller J, Nazroo J, Wardle J. Social and psychological impact of HPV testing in cervical screening: a qualitative study. Sex Transm Infect 2006; 82:169–175.

23. Monsonego J, Cortes J, Pereira D, Jorge AF, Klein P. Psychological impact , support and information needs for women with an abnormal Pap smear :

comparative results of a questionnaire in three European countries. BMC Womens Health 2011;11:18.

24. Mccaffery K, Waller J, Forrest S, Cadman L, Szarewski A. Testing positive for human papillomavirus in routine cervical screening : examination of psychosocial impact. Br J Obstet Gynaecol 2004;111:1437–1443.

25. Erwin DO, Johnson VA, Trevino M, Duke K, Feliciano L, Jandorf L. A Comparison of African American and Latina Social Networks as Indicators for Culturally Tailoring a Breast and Cervical Cancer Education Intervention. Cancer Supplement 2006; 2: 368–377.

26. Sacho-Garner H, Tamalet C, Halfon P, Leandri FX, Retraite L Le, Djoufelkit K, et al. HPV self-sampling or the Pap-smear : A randomized study among cervical screening nonattenders from lower socioeconomic groups in France. Int J Cancer 2013; 133: 2681–2687.

27. Racey CS, Gesink DC, Burchell AN, Trivers S, Wong T, Rebbapragada A. Randomized Intervention of Self-Collected Sampling for Human Papillomavirus Testing in under-screened rural women: uptake of screening and acceptability. J Womens Health 2015;00:1–9.