Impact of Per Capita Income on the Effectiveness of School-Based Health Education Programs to Promote Cervical Cancer Screening Uptake in Southern Mozambique

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Abstract

Context: In the face of rising mortality rates from cervical cancer (CC) among women of reproductive age, a nationwide screening program based on visual inspection with acetic acid was introduced in Mozambique in 2009. Objective: The objective of the study is to examine the impact of per capita income on the effectiveness of school-based health education programs to promote the utilization of CC screening services. Materials and Methods: We conducted a cross-sectional study in 2013 involving 105 women randomly selected from households of different economic backgrounds. Marginal effect estimates derived from a logit model were used to explore the patterns in the effectiveness of school-based health education to promote CC screening uptake according to household per capita income, based on purchasing power parity. Results: We found a CC screening uptake of 16.1% (95% confidence interval [CI], 9.7%–24.6%) even though 64.6% (95% CI, 54.2%–74.1%) of women had heard of it. There are important economic differentials in the effectiveness of school-based health education to influence women’s decision to receive CC screening. Among women with primary school or less, the probability of accessing CC screening services increases with increasing income (P < 0.05). However, income significantly reduces the effect that school-based health education has on the probability of screening uptake among those women with more than 7 years of educational attainment (P = 0.02). Conclusion: These results show that CC screening programs in resource-constrained settings need approaches tailored to different segments of women with respect to education and income to achieve equitable improvement in the levels of screening uptake.

Keywords: Cancer screening, cervical cancer, economic inequalities, health education, human papillomavirus, Mozambique, Sub-Saharan Africa

INTRODUCTION

Recent estimates indicate that if effective and sustainable measures are not implemented, cervical cancer (CC) may become the next great epidemic of Southern Africa, where the disease represents the most common cancer, and the most common cause of cancer mortality among women of reproductive age.[1-3] CC contributes each year to the loss of 2.7 million years of life among women aged 25–64 years, with 89% of this loss occurring in low-income countries (LIC), compared to only 11% occurring in high-income countries (HIC).[3] Well-organized CC screening programs are indicated as having contributed to the reduction in mortality rates in HIC.[4,5] In many LIC, however, especially in Southern Africa, these programs are still suboptimal or nonexistent.[1,6]

In Mozambique, before 2009, CC screening was limited to a few urban hospitals with either routine gynecological services or through research projects that had access to pathology services that allowed for the provision of CC screening through Pap smear.[1,6] In December 2009, the Ministry of Health (MoH) introduced a national program of cervical (and breast) cancer screening based on visual inspection with acetic acid (VIA).[7] National guidelines first recommended that...
all women between 30 and 55 years of age were eligible for CC screening, however, due to existing perceptions that CC in Mozambique may be occurring among younger women, possibly in the context of a high HIV prevalence, the MoH expanded screening eligibility to all sexually active women. Despite this, the burden of CC in the country remains high, with 65 new cases and 49 deaths/100,000 women reported in 2012, compared to 32 new cases and 21 deaths per 100,000 women in 2008.

The previous studies conducted in Mozambique have indicated that (1) the late arrival of women in their disease course to the health facility for screening, (2) limited coverage of public health services, (3) unawareness of CC screening, and (4) irregular or no use at all of health facilities by women who feel healthy, remain barriers to a well-functioning CC screening program. Despite the growing body of evidence on factors impacting the use of CC screening services and on the effectiveness of school-based health education programs to improve the utilization of CC screening services, studies assessing the impact of per capita income on the effectiveness of these programs to influence women’s decision to do CC screening, while accounting for the effect of other equally important socioecological factors on the relationship between education and screening, remain scarce, particularly in LIC. Our paper explores the impact of per capita income on the effectiveness of school-based health education programs to promote CC screening uptake. We use educational attainment as a proxy of women’s exposure to school-based health education programs. Following the approach proposed by Gakidou et al., we define effective coverage of CC screening as the proportion of women reporting having done the screening in the 3 years preceding the survey and crude coverage of CC screening as the proportion of those reporting having ever done irrespective of the period when the screening occurred. Understanding the contribution of women’s income on the impact of school-based health education on women’s probabilities to get CC screening is important as this could help enable the development of effective, sustainable, and tailored interventions aimed at improving uptake of CC screening in women from economically disadvantaged backgrounds, a group who represent the most vulnerable population at risk of CC in Mozambique.

**Materials and Methods**

This study was performed in KaMubukwana, a suburban district of Maputo city, the capital of Mozambique, with women from different socioeconomic backgrounds. The study consisted of 105 women and was powered to detect a 10% difference in CC screening uptake based on assumptions from similar studies. Participants were selected through simple probabilistic sampling. Households equaling the sample size were randomly selected by a computer program using the list of all households in the study site derived from local authorities, and from each of these households, the first eligible female, aged ≥15 years; (2) accepting to participate in the study by signing written consent; and (3) being a resident of the KaMubukwana district. Ethical clearance was obtained from the Institutional Committee for Bioethics in Health of the Faculty of Medicine (Eduardo Mondlane University) and Maputo Central Hospital, where the protocol is registered under the number CIBS/52013. Written informed consent was sought from the study participants prior to data collection, and confidentiality was maintained throughout the study. For participants <18 years old, we obtained written assent from the participant and written consent from their legal guardian.

The surveys were conducted between October and December 2013 by trained interviewers in either Portuguese or a national language in which the respondent was most at ease using. The questionnaire included questions on socioeconomic characteristics, CC screening uptake, reasons for not having done the screening, perception of risk, main sources of information on CC, CC knowledge, and reproductive history. The CC knowledge score was assessed based on twelve questions including awareness about CC, knowledge about CC screening, and knowledge on CC risk factors, adopted from previous studies. CC knowledge score and household per capita income were measured on a ratio scale while all other measures were dichotomized. Using 2013 purchasing power parity conversion factor from the World Bank, household per capita income in local currency (Mozambican Metical) was converted to the International dollar (international $).

We used logistic regression to model the effect of variables chosen using a stepwise selection procedure with a P value for the omission of 0.2. Based on the previous studies, we considered as control variables in our predictive model those which may be correlated with screening uptake but have also been associated with education and per capita income. These included age group, knowledge score, knowing someone ever screened for CC, number of sexual partners, and age at sexual debut. Likewise, to account for any differential effect on screening uptake due to education among women from economically disadvantaged backgrounds, we included an interaction term between education and income. The interaction term between knowing someone who had participated in CC screening and CC knowledge score was introduced to reflect the potential for variation in the effect of knowing someone who had undergone CC screening on the utilization of CC screening services across CC knowledge scores, reported in the previous studies. We fit two models, with model-2 including education, income, as well as CC knowledge score, whether the woman knows someone ever screened for CC, reproductive history, and the interactions. In model-1, we kept education, income, age and the interaction between education and income. The final model was selected on the basis of the area under the Receiver Operating Characteristics curve (AUC), Akaike’s Information Criterion (AIC), Bayesian Information Criterion (BIC), and Pearson’s goodness-of-fit statistic. To examine the patterns of the impact of household per capita income in local currency (Mozambican Metical) was converted to the International dollar (international $).
capita income on the probability of CC screening for women with defined levels of attained education, we derived marginal effects at representative values. We used a significance level of 5% in our hypothesis testing and R version 3.4.2 along with Stata/MP 14.2 for statistical analysis.[20,21]

**RESULTS**

Table 1 presents the characteristic of the study participants. The mean age was 30.3 ± 10.8 years and median per capita income was $66.96 (interquartile range: $50.00 to $138.39)/month. Approximately 87% of female participants worked outside the home and half of them had only 7 years of attained education or less. On the 12 question CC knowledge assessment, participants responded correctly on average to only 4.3 ± 2.3 questions despite 64.6% (95% confidence interval [CI], 54.2%–74.1%) of participants having heard of CC screening previously. Both effective and crude coverage levels of CC screening were low among the study population as only 16.1% (95% CI 9.7–24.6%) and 20.9% (95% CI 13.6–29.9%) had undergone screening for CC in the three years preceding the survey, or at least in some point in their lives, respectively. Fully 90.4% of participants indicated a lack of information about CC screening services as their main reason for not pursuing CC screening.

Despite having comparable AUC and AIC between our two models, model-2 was outperformed by model-1 in terms of both Pearson’s goodness-of-fit statistic and BIC, enabling us to acknowledge that model-1 fits better our data than model-2, as illustrated in Table 2. We, therefore, adopted model-1 to estimate the odds of CC screening uptake by educational attainment, per capita income, and the interaction between them, as well as the marginal effects of these factors on screening uptake, while accounting for age. Further, we made use of a mosaic plot with residual-based shading to visually assess our model-1 overall hypothesis of CC screening being independent of exposure to school-based health education and per capita income, given age group [Figure 1]. This showed that overall there is a strong relationship between these variables (P < 0.01).

In our predictive logit model, the characteristic most significantly associated with CC screening uptake was education beyond primary school, which we found to improve remarkably the odds of CC screening among women from deprived households (odds ratio [OR] 71.63; 95% CI 2.60–1976.93; P = 0.01). For those women reporting only primary school level or less, we examined their odds of receiving CC screening based on one-dollar incremental increases in per capita income and found a weak association (OR 1.04; 95% CI: 1.01–1.08; P = 0.02) [Table 2]. For these women, a sizeable increase in per capita income is needed before income notably influences their odds of using CC screening services. A reflection of this pattern can be seen in Figure 2 where the relationship between income and the probability that a woman gets screened for CC is S-shaped for those with  

### Table 1: Selected demographic characteristics of the study participants

| Characteristic | Value |
|----------------|-------|
| Age, years\(^a\) | 27 (22;36) |
| Educational attainment | |
| Primary school or less | 52 (49.7) |
| Beyond primary school | 53 (50.5) |
| Per capita income per month in international $\(^b\) | 67.0 (50.0;138.4) |
| Marital status | |
| Married | 46 (43.8) |
| Single, widows, or divorced | 59 (56.2) |
| Occupation | |
| Housewife (including family subsistence work such as farming) | 14 (13.3) |
| Works outside the home (including students) | 91 (86.7) |
| Primary source of information on CC | |
| Health facility | 40 (38.5) |
| Outside source (mass media, social network, and school) | 64 (61.5) |
| Knows someone with CC | 19 (18.1) |
| Reproductive history and sexual behavior | |
| Age of sexual debut | 16.9±2.7 |
| Parity | 2.3±2.2 |
| Number of sexual partners | 1.5±1.0 |
| Consistent use of condom | 34 (32.4) |
| Perceptions about CC and screening | |
| Perception of personal risk of cancer | 34 (32.4) |
| Belief that CC screening procedure is very painful | 59 (56.2) |
| Knowledge score on CC\(^c\) | 4.3±2.3 |
| Awareness about CC | |
| Have you ever heard of CC? | 95 (90.5) |
| Is HPV the cause of CC? | 10 (9.5) |
| Can CC be prevented? | 45 (42.9) |
| Have you ever heard of HPV vaccine before today? | 5 (4.8) |
| Have you ever heard of CC screening? | 62 (64.6) |
| Knowledge about CC screening | |
| Screening tests can help prevent CC? | 31 (29.5) |
| Should healthy women do CC screening? | 53 (50.9) |
| Do you know a health facility that offers CC screening? | 9 (8.6) |
| Do you know of any method of screening for CC? | 51 (48.6) |
| Knowledge about risk factors for CC | |
| Is having multiple partners a risk factor for CC? | 63 (60.0) |
| Is early sexual debut a risk factor for CC? | 2 (1.9) |
| Is sexual intercourse without condom a risk factor for CC? | 71 (67.6) |
| Knows someone ever screened for CC | 29 (27.9) |
| Crude coverage of CC screening\(^d\) | |
| Women aged ≥15 years | 20.9 (13.6;29.9) |
| Women aged 30–49 years | 23.5 (9.3;37.8) |
| Effective coverage of CC screening\(^d\) | |
| Women aged ≥15 years | 16.1 (9.7;24.6) |
| Women aged 30–49 years | 14.7 (2.8;26.6) |

Contd...
only “primary school or less”. This indicates that increasing income has little effect on the probability of CC screening uptake among women with <8 years of schooling for extremely low, as well as extremely high, values of income. There is a midrange of per capita income ($70 to $150/month) where the effect of increasing income is notable, as can be seen by the slope of the curve across the income spectrum in Figure 2. We estimate that among women with <8 years of schooling and income within the $70–$150/month range, an increase of $10 in per capita income per month improves their probability of getting a CC screening test by at least 5%. Among those with the same educational attainment, but a per capita income per month below $70 or above $150, the increase in the probability of CC screening due to an additional $10 in monthly income is <5.0% [Table S1]. It is important to emphasize that the combined effect of education plus income is nevertheless less than the combination of their separate effects, as illustrated by the interaction parameter in Table 2. This shows that inclusion of the interaction term in our modeling framework was warranted and that the interaction between education and income explains significant variation in the uptake of CC screening. This parameter further reveals that the odds of CC screening uptake, per every one-dollar increase in income, for those participants with education beyond primary school, is 5% less than the odds for participants with primary school or less and a similar one-dollar incremental increase in income. Thus, while among women with only primary school or less and living with $2.30 to $5.00/day the odds of accessing CC screening services increases notably with increasing per capita income, among those with >7 years of education income significantly reduces the effect of education on the odds of CC screening uptake (OR 0.95; 95% CI 0.92–0.99; $P = 0.02$) [Figure 3 and Table S2].

**Table 1: Contd...**

| Characteristic | Value |
|----------------|-------|
| Reasons for nonattendance in CC screening | |
| Poor quality of and access to healthcare | 8 (9.6) |
| Low knowledge about CC screening service | 75 (90.4) |

Values given as mean±SD or n (%), unless otherwise stated.

**Table 2: Odds ratios of cervical cancer screening uptake with 95% confidence intervals**

| Logistic regression | Model 1 | Model 2 |
|---------------------|---------|---------|
| **Predictors** | | |
| Age (≤30 years) | 1.37 | 2.47 |
| | (0.36-5.22) | (0.64-28.43) |
| Education (beyond primary school) | 71.63 | 266.22 |
| | (2.60-1976.93) | (2.74-25,906.53) |
| Per capita income (international $) | 1.04 | 1.06 |
| | (1.01-1.08) | (1.01-1.11) |
| Knowledge score on CC | 0.69 | 0.4 |
| | (0.4-1.2) | (0.4-2.0) |
| Knows someone ever screened for CC | 0.13 | 0.13 |
| | (0.00-2.3) | (0.00-2.3) |
| Age at sexual debut (≥18 years) | 0.29 | 0.29 |
| | (0.04-2.3) | (0.04-2.3) |
| Sexual partners in 12 months (>3) | 7.28 | 7.28 |
| | (0.01-200) | (0.01-200) |
| Education x income | 0.95 | 0.93 |
| | (0.92-0.99) | (0.89-0.99) |
| Knows someone x knowledge score | 2.28 | 2.28 |
| | (0.82-6.39) | (0.82-6.39) |
| **Model performance** | | |
| AUC | 0.76 | 0.86 |
| | (0.63-0.90) | (0.73-0.99) |
| AIC | 65.40 | 64.84 |
| BIC | 76.31 | 86.58 |
| Pearson’s goodness of fit test (P value) | 0.81 | <0.01 |

$^aP≤0.01$, $^bP≤0.05$, $^cTest$ of equality of AUC suggests that the two models have a similar predictive ability ($P=0.10$).

The $P$ value is based on a Pearson test and indicates the overall significance of the deviations of observed from expected frequencies. Residuals >2 are individually significant at the 5% level. Details of the underlying log-linear model can be found in Table S3. Abbreviations: $: international dollar, Yrs: years.

**Figure 1:** Mosaic plot showing the distribution of cervical cancer screening uptake given per capita income, educational attainment, and age group. The $P$ value is based on a Pearson test and indicates the overall significance of the deviations of observed from expected frequencies. Residuals >2 are individually significant at the 5% level. Details of the underlying log-linear model can be found in Table S3. Abbreviations: $: international dollar, Yrs: years.
widely used in health services research. This method enables us to both quantify income and educational gradients in CC screening and explore the patterns of these inequalities in women with selected profiles, which subsequently gives us unique insights about the location and trends on the effect of health education on CC screening uptake across the income spectrum.

Our estimates highlight that women with economic hardship and low education face remarkable difficulties to use CC screening services in Mozambique, and most importantly that among those with higher income, exposure to school-based health education tends to negatively affect their uptake of CC screening. Thus, as their income increases, the most educated women become less likely to get a CC screening test, which may be a reflection of poor performance not only of school-based health education efforts in the country but also of the health system which impacts negatively its responsiveness to patients’ needs. While economically disadvantaged women may be willing to accept services with poor responsiveness, as their income and education improve, their demands on nonhealth enhancing aspects of care increases as well and these demands increasingly become influential for their decision to use CC screening services. Moreover, the finding that a relatively small increase in income among low-income women from a selected range of per capita income is associated with a material improvement in CC screening uptake among those with low education suggests that interventions linking cash transfers to service use could help improve the levels of CC screening uptake in LIC. Despite the growing body of evidence suggesting that conditional cash transfer programs can improve the utilization of health services such as maternity care, HIV/AIDS prevention, and tuberculosis treatment, the use of these approaches to improve CC screening uptake has not been reported to date.

The low levels of CC screening among our study population are consistent with the findings of previous studies in LIC. An analysis of population-based surveys conducted in 2008 to examine the coverage of CC screening in 57 countries found that the average effective coverage of CC screening was 19% in LIC, compared to 63% in HIC. In addition, this report revealed large between-country and within-country inequalities in CC screening coverage across SSA, with levels of effective coverage ranging from < 1% in Ethiopia to < 20% in Mauritius. Mozambique was not included in this analysis as the national CC screening program based on VIA was introduced a year later. Our analysis is, therefore, the first study in Mozambique, since the introduction of the program, to examine the effective coverage of CC screening. Because women living in Maputo have more access to health facilities relative to those living in other regions of the country, we expect the levels of effective coverage of CC screening to be notably <16% in other, more impoverished, districts in the country.

Our analysis allows detailed estimation of the interaction between the effects of health education and per capita income on CC screening and helps identify inequalities of different segments of society with regard to screening uptake. The finding suggesting that education and income influence each other negatively on CC screening uptake is new and could guide the design and implementation of health education programs and future research in the field. This pattern in the effectiveness of health education on CC screening has never been reported so far as most studies assessing this relationship assume that health education efforts are equally effective across all income subgroups, or do not take account of income

Figure 2: Predictive margins of cervical cancer screening uptake at representative values of educational attainment and per capita income. The dashed vertical line represents median household per capita income per month based on purchasing power parity. Individual predicted probabilities are available in Table S1. Abbreviations: CC: cervical cancer, International $: international dollar

Figure 3: Effect of educational attainment on the probability of cervical cancer screening uptake among women from different economic backgrounds with 95% confidence intervals. The dashed vertical line represents median household per capita income per month based on purchasing power parity. Details about change in predictive margins at representative values of income from the baseline education level are available in Table S2. Abbreviations: CC: cervical cancer, International $: international dollar
at all.\textsuperscript{[10,15,16,26,29,30]} The interaction term in our modeling framework enabled us to examine the variation of the effectiveness of education to influence a women’s decision to participate in screening due to the influence of income. While the pattern of this relationship among the most deprived women is in-line with previous evidence showing that women exposed to health education programs are on average more likely to undergo CC screening procedures,\textsuperscript{[10,18,30]} our estimates reveal that the contribution of income on the impact of health education on CC screening uptake is an essential determinant of inequalities on CC screening. Therefore, unless there is empirical evidence of homogeneity in the effect estimates across the income spectrum, the effectiveness of health education programs aimed at promoting CC screening should be assessed for each relevant segment of women’s income. It is nevertheless important to acknowledge limitations. First, our estimates are subject to recall bias. Second, the per capita income data may be subject to recall bias. Third, the precision of our estimates is notably affected by our dataset size. Increased precision in the future studies may be accomplished using nationally representative health surveys which however currently do not include measures about CC screening and HPV vaccine as well as household per capita income.

**Conclusion**

We have shown that educational curriculum enhancements are a remarkable avenue for interventions aimed at increasing utilization of CC screening services among the most deprived women, but not among those from less deprived or relatively affluent households to whom health system responsiveness seems to be the most important driver of their decision to use CC screening services. Further, our results suggest that for women with a low exposure to school-based health education, a sizeable increase in their per capita income is needed to see an impactful change in their accessing of CC screening services. This finding is of considerable practical value in the identification of the most-at-risk-populations for CC, which is a cornerstone for priority-setting and resource allocation, particularly in resource-constrained settings such as Mozambique.

**Supplementary material**

Further details about predictive margins of CC screening uptake at representative values of educational attainment and per capita income as well as differences in adjusted probabilities of CC screening uptake from the baseline educational level are provided in Tables S1 and S2, respectively. Table S3 provides details regarding the log-linear model underlying the mosaic plot statistics.

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**Conflicts of interest**

There are no conflicts of interest.

**Author contributions**

FA conceived of and designed the research, led data collection, conducted statistical analysis, drafted the manuscript, drafted the supplementary material of the manuscript, discussed the results and contributed to the revision of the final manuscript. TM, AM, JS reviewed the manuscript, supported interpretation and policy contextualization, discussed the results and contributed to the revision of the final manuscript. All authors read and approved the final manuscript.

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| Variables | Highest educational level | Estimate | 95% CI |
|-----------|---------------------------|----------|--------|
| Per capita income, international $ | | | |
| 250 | Primary school or less | 0.996† | 0.972-1.020 |
| 260 | Primary school or less | 0.999† | 0.999-1.000 |
| 270 | Primary school or less | 0.999† | 0.999-1.000 |
| 280 | Primary school or less | 0.999† | 0.999-1.000 |
| 290 | Primary school or less | 0.999† | 0.999-1.000 |
| 300 | Primary school or less | 0.999† | 0.999-1.000 |
| 310 | Primary school or less | 0.999† | 0.999-1.000 |
| 320 | Primary school or less | 0.999† | 0.999-1.000 |
| 330 | Primary school or less | 0.999† | 0.999-1.000 |
| 340 | Primary school or less | 0.999† | 0.999-1.000 |
| 350 | Primary school or less | 0.999† | 0.999-1.000 |
| 360 | Primary school or less | 0.999† | 0.999-1.000 |
| 370 | Primary school or less | 0.999† | 0.999-1.000 |
| 380 | Primary school or less | 0.999† | 0.999-1.000 |
| 390 | Primary school or less | 0.999† | 0.999-1.000 |
| 400 | Primary school or less | 0.999† | 0.999-1.000 |
| 410 | Primary school or less | 0.999† | 0.999-1.000 |
| 420 | Primary school or less | 0.999† | 0.999-1.000 |
| 430 | Primary school or less | 0.999† | 0.999-1.000 |
| 440 | Primary school or less | 0.999† | 0.999-1.000 |
| 450 | Primary school or less | 0.999† | 0.999-1.000 |
| 460 | Primary school or less | 0.999† | 0.999-1.000 |
| 470 | Primary school or less | 0.999† | 0.999-1.000 |
| 480 | Primary school or less | 0.999† | 0.999-1.000 |
| 490 | Primary school or less | 0.999† | 0.999-1.000 |
| 500 | Primary school or less | 0.999† | 0.999-1.000 |
| 500 | Primary school or less | 0.999† | 0.999-1.000 |

| Table S1: Predictive margins of cervical cancer screening uptake at representative values of educational attainment and per capita income |
|-----------------|-----------------|--------|
| Variables | Highest educational level | Estimate | 95% CI |
| Per capita income, international $ | | | |
| 0 | Beyond primary school | 0.379a | 0.052-0.706 |
| 10 | Primary school or less | 0.009 | 0.007-0.012 |
| 10 | Primary school or less | 0.013 | 0.001-0.024 |
| 20 | Beyond primary school | 0.372b | 0.061-0.683 |
| 30 | Primary school or less | 0.019 | 0.002-0.067 |
| 30 | Primary school or less | 0.029 | 0.000-0.107 |
| 40 | Beyond primary school | 0.365a | 0.070-0.660 |
| 50 | Primary school or less | 0.029 | 0.000-0.086 |
| 50 | Primary school or less | 0.035 | 0.000-0.638 |
| 60 | Beyond primary school | 0.092 | 0.000-0.016 |
| 70 | Primary school or less | 0.039 | 0.000-0.079 |
| 80 | Primary school or less | 0.042 | 0.000-0.030 |
| 90 | Beyond primary school | 0.035 | 0.000-0.087 |
| 100 | Primary school or less | 0.036 | 0.000-0.087 |
| 110 | Beyond primary school | 0.043 | 0.000-0.070 |
| 120 | Primary school or less | 0.037 | 0.000-0.112 |
| 130 | Beyond primary school | 0.054 | 0.000-0.105 |
| 140 | Primary school or less | 0.039 | 0.000-0.112 |
| 150 | Beyond primary school | 0.039 | 0.000-0.105 |
| 160 | Primary school or less | 0.037 | 0.000-0.112 |
| 170 | Beyond primary school | 0.043 | 0.000-0.070 |
| 180 | Primary school or less | 0.036 | 0.000-0.070 |
| 190 | Beyond primary school | 0.041 | 0.000-0.099 |
| 200 | Primary school or less | 0.039 | 0.000-0.112 |
| 210 | Beyond primary school | 0.039 | 0.000-0.112 |
| 220 | Primary school or less | 0.037 | 0.000-0.112 |
| 230 | Beyond primary school | 0.043 | 0.000-0.070 |
| 240 | Primary school or less | 0.037 | 0.000-0.112 |

**Notes:**
- †P<0.05, ‡P<0.01, §P<0.001. MER: Marginal effects at representative values, International $: International dollar, CI: Confidence interval

**Contd...**
Table S2: Differences in adjusted probabilities of cervical cancer screening uptake from the baseline educational level

| Variable | Differences in adjusted probabilities | 95% CI |
|----------|--------------------------------------|--------|
| Per capita income, international $ | Estimate |  |
| 0        | 0.370a | 0.042-0.698 |
| 10       | 0.360a | 0.047-0.672 |
| 20       | 0.346c | 0.048-0.644 |
| 30       | 0.330c | 0.045-0.615 |
| 40       | 0.301c | 0.018-0.569 |
| 50       | 0.282c | 0.016-0.548 |
| 60       | 0.247  | -0.014-0.508 |
| 70       | 0.200  | -0.061-0.460 |
| 80       | 0.138  | -0.133-0.409 |
| 90       | 0.061  | -0.239-0.361 |
| 100      | -0.031 | -0.383-0.321 |
| 110      | -0.135 | -0.553-0.283 |
| 120      | -0.243 | -0.720-0.233 |
| 130      | -0.348 | -0.853-0.158 |
| 140      | -0.441 | -0.939-0.056 |
| 150      | -0.520c| -0.976-0.063 |
| 160      | -0.583c| -0.981-0.184 |
| 170      | -0.631c| -0.968-0.291 |
| 180      | -0.667c| -0.950-0.383 |
| 190      | -0.694c| -0.937-0.450 |
| 200      | -0.714c| -0.930-0.500 |
| 210      | -0.729c| -0.931-0.528 |
| 220      | -0.741c| -0.937-0.546 |
| 230      | -0.751c| -0.946-0.557 |
| 240      | -0.760c| -0.957-0.562 |
| 250      | -0.766c| -0.968-0.565 |
| 260      | -0.773c| -0.980-0.566 |
| 270      | -0.779c| -0.991-0.566 |
| 280      | -0.784c| -1.003-0.565 |
| 290      | -0.789c| -1.014-0.564 |
| 300      | -0.794c| -1.026-0.563 |
| 310      | -0.800c| -1.036-0.562 |
| 320      | -0.804c| -1.047-0.560 |
| 330      | -0.808c| -1.057-0.559 |
| 340      | -0.813c| -1.067-0.558 |
| 350      | -0.817c| -1.077-0.557 |
| 360      | -0.821c| -1.087-0.556 |
| 370      | -0.825c| -1.096-0.555 |
| 380      | -0.830c| -1.104-0.555 |
| 390      | -0.834c| -1.112-0.554 |
| 400      | -0.837c| -1.121-0.554 |
| 410      | -0.841c| -1.128-0.554 |
| 420      | -0.845c| -1.136-0.554 |
| 430      | -0.849c| -1.143-0.555 |
| 440      | -0.853c| -1.150-0.555 |
| 450      | -0.856c| -1.156-0.556 |
| 460      | -0.860c| -1.162-0.557 |
| 470      | -0.863c| -1.168-0.558 |

Table S2: Contd...

| Variable | Differences in adjusted probabilities | 95% CI |
|----------|--------------------------------------|--------|
| Per capita income, international $ | Estimate |  |
| 480      | -0.866c| -1.173-0.559 |
| 490      | -0.870c| -1.178-0.561 |
| 500      | -0.873c| -1.183-0.562 |

Table S3: Statistics derived from the log-linear model (screening, income, education, age) underlying the test of independence between cervical cancer screening uptake, per capita income, educational attainment, and age group

| Statistics | $\chi^2$ | Degrees of freedom | $P$ |
|------------|----------|--------------------|-----|
| LRS        | 41.83498 | 18                 | 0.001166105 |
| Pearson    | 37.55121 | 18                 | 0.004438751 |

The $P$ value provided in the mosaic plot is based on Pearson. LRS: Likelihood ratio statistic, Screening: CC screening