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Inequities in cervical cancer screening among Colombian women: A multilevel analysis of a nationwide survey

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ABSTRACT

Objectives: To identify factors associated with whether women in Colombia have had a Pap test, evaluate differences in risk factors between rural and urban residence, and evaluate the contextual effect of the lack of education on having ever had a Pap test.
Method: Data used were from the 2010 Colombian National Demographic and Health Survey; 40,392 women reported whether they have had a Pap test. A multilevel mixed logistic regression model was developed with random intercepts to account for clustering by neighbourhood and municipality. The model evaluated whether having a rural/urban area of residence modified the effect of identified risk factors and if the prevalence of no education at the neighbourhood level acted as a contextual effect.
Results: Most women (87.3%) reported having at least one Pap test. Women from lower socioeconomic quintiles ($p = 0.002$), who were unemployed ($p < 0.001$), and whose final health decisions depended on others ($p < 0.001$) were less likely to have had a Pap test. Women with children were more likely to have had the test ($p < 0.001$), and the effects of education ($p = 0.03$), type of health insurance ($p = 0.01$), age ($p < 0.001$), and region ($p < 0.001$) varied with having a rural/urban area of residence. Women living in rural areas (specifically younger ones, with no health insurance, living in the Atlantic and Amazon-Orinoquía regions, and with no education) were less likely to have had a Pap test when compared to those living in urban areas. Furthermore, women living in a neighbourhood with a higher prevalence of no education were less likely to have ever had a Pap test ($p = 0.005$).
Conclusions: In Colombia, the probability of having had a Pap test is associated with personal attributes, area of residence, and prevalence of no education in the neighbourhood. Efforts to improve access to cervical cancer screening should focus on disadvantaged women with limited education, low socioeconomic status, and no health insurance or subsidised insurance, especially those in rural/isolated areas.

1. Introduction

Although cervical cancer (CC) is considered a preventable disease [1,2], worldwide it is ranked third for incident cancer cases and fourth for cancer-related mortality [3–5]. In South America, CC is the second most incident cancer and first for cancer mortality among women between 15 and 44 years [5]. In Colombia, CC is the second most common cancer [6] and has a proportional mortality of 12%, making it the second most common cause of cancer mortality [7].

The Pap smear, or Pap test, is used globally to screen for pre-cancerous lesions of the cervix [8]. Hence, failure to have a Pap test has been considered a risk factor for CC [9]. The Colombian recommendations for CC screening state that women between 25 and 69 years (or younger who have experienced intercourse) should have free access to Pap testing; however, a Colombian committee of experts advised starting CC screening at 21 years of

Abbreviations: AIC, Akaike's Information Criterion; CC, cervical cancer; NDHS, National Demographic and Health Survey; ROC, receiver operating characteristic; SGSSS, *Sistema General de Seguridad Social en Salud* (General Social Security System in Health); UOR, unadjusted odds ratio; VPC, variance partition coefficient.

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age [10]. The recommended frequency of Pap testing in Colombia is 1-1-3 which means if two consecutive annual tests are negative, subsequent tests should be repeated every third year [10]. In spite of these recommendations, Pap test coverage in Colombia is lower than in other Latin American countries [11]. Furthermore, the CC screening programme is decentralised in Colombia; health insurance companies and their network of health care providers are responsible for Pap testing [12].

Studies conducted in Colombia have identified differences in access to Pap testing between rural and urban areas and among geographic region of residence [13,14], educational level [15], wealth quintile [15], age group [15,16], and type of health insurance [16]. Colombia has an insurance-based health care system, the *Sistema General de Seguridad Social en Salud* (SGSSS – the General Social Security System in Health), with two schemes: contributory and subsidised [17]. Workers and retired individuals with the ability to pay belong to the contributory system, and those unable to pay are part of the subsidised system [17,18]. Public teachers and universities workers, members of the military forces, police, and employees of the Colombian Oil Company have special health insurance plans [18]. Differences in access to health care benefits between the contributory and subsidised systems have been reported [19–21] which mainly affect disadvantaged populations [19,22,23]. The SGSSS has been criticised for not considering geographical, social, and cultural contexts, increasing barriers to access health care [24].

While residential context influences participation in Pap testing [25], previous studies exploring factors affecting Pap test uptake in Colombia [13,15] have not considered the influence of contextual factors on the probability of having a Pap test. The aim of this study was to identify socio-demographic factors related to ever having had a Pap test among sexually active women aged 18–49 years in Colombia, considering the influence of neighbourhood and municipality where women live. The specific objectives of this study were to: identify factors associated with whether women in Colombia have had a Pap test, evaluate differences in risk factors between rural and urban residence, and evaluate the contextual effect of the lack of education on having had a Pap test.

2. Material and methods

2.1. Study population and data

Data for this study were part of the 2010 National Demographic and Health Survey (NDHS), a Colombian nationwide survey assessing different aspects of women's health. The NDHS included information from 53,521 women, aged 13–49 years representing 51,447 households [13]. The data were collected using random, cluster, and multistage sampling. Households were grouped with others of similar characteristics and proximity, creating groups of houses (hereinafter called neighbourhoods) with an average of ten households. The NDHS subdivided Colombia into five geographic regions (Amazon-Orinoquía, Pacific, Central, Atlantic, and Eastern).

In the NDHS, only women 18 years or older, who had not had a hysterectomy, and who had experienced intercourse, were eligible to answer questions about CC prevention. Consequently, this work is based on the responses of the 40,410 (out of the original 53,521) women who met this eligibility criterion for answering questions related to CC screening (Pap test). Women, who self-declared they had heard about Pap smears and have ever had a Pap test, were classified as "1 = have had a Pap test"; otherwise, they were classified as "0 = have not had a Pap test". This was the outcome variable of interest for this study.

The Ethical Committee of the *Asociación Probienestar de la Familia Colombiana (Profamilia)* provided ethical approval prior to data collection. Also, *Profamilia* obtained consent from participants before the administration of the NDHS. To conduct the present analysis using the 2010 NDHS database, the University of Saskatchewan Research Ethics exempted the project.

2.2. Statistical analysis

The frequencies of women who had a Pap test were calculated according to socio-demographic factors of interest, including: age, whether women had children, whether they had the final say on their own health (who makes decisions related to the woman's health), educational level, wealth quintile, working status, rural/urban area of residence, region of residence, and type of health insurance (Table 1). Considering the sampling procedure and the resulting hierarchical structure of the data (Fig. 1), a three-level mixed model (first level: women, second level: neighbourhoods, and third level: municipalities) for a binomial outcome with a logit link function and Laplacian approximation was used. The errors for the second and third levels were considered as random effects to account for variation in the probability that women would have a Pap test among municipalities and neighbourhoods. Multilevel modelling has the advantage of examining how both group and individual factors impact the outcome variable [26], considering the potential clustering of outcomes within groups [27]. This technique also allows an exploration of the potential contextual effects of group membership [28]. The average number of observations and proportion of replications per level were examined for each of these random intercepts. The geographic region (group of departments) was considered as a predictor in the fixed portion of the model.

Unconditional analyses between each predictor and the outcome in the multilevel model were conducted and unadjusted odds ratios (UOR) were computed. Risk factors with unconditional p-values ≤ 0.2 [27] were retained for consideration in the multivariable analysis. A manual backward selection strategy was used to build the multivariable model, removing the predictor with the highest *p-value*, one at a time until only variables with $p < 0.05$ remained. Categorical variables with more than two categories were assessed using a type-3 likelihood ratio test. The linearity assumption of age was tested using a quadratic term. Age was used as a four-category variable given that the linearity assumption was not met ($p < 0.001$). Observations with missing values were removed from the analysis. Potential confounders were retained in the final model if including the variable changed the coefficients of other variables of interest by >10%. Interactions were assessed between the retained main effects in the multivariable model and rural/urban residence; interactions were considered significant if $p < 0.05$. Post hoc comparisons were used to explore differences across multiple categories. A contextual effect measuring the prevalence of no education in the neighbourhoods was examined for an association with having had a Pap test. Finally, an interaction was examined between the prevalence of no education within each neighbourhood and an individual woman's educational level.

Population-averaged odds ratios (OR) and their corresponding 95% confidence intervals (95% CI) were computed using population-averaged coefficients (β^{PA}) calculated from the final multivariable model. Using subject-specific coefficients (β^{SS}) from the final multivariable model, the following formula was employed: $\beta^{PA} \approx \beta^{SS} / \sqrt{\left(1 + 0.346\left[\sigma_v^2 + \sigma_\mu^2\right]\right)}$ [27], where σ_v^2 was the municipality level variance and σ_μ^2 represented the neighbourhood level variance.

In the null model, the variance partition coefficient (VPC) was computed for the neighbourhood and municipality levels to measure clustering in the probability of having had a Pap test. The VPCs were computed using the latent response