Preventive Medicine Reports 36 (2023) 102363

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Short communication

Combined influence of immigration status and income on cervical cancer screening uptake

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ARTICLE INFO

Keywords:
Cervical cancer screening
Migration status
Social inequalities
France

ABSTRACT

The regular performance of Pap tests for cervical cancer screening reduces this disease's incidence and mortality. Income inequalities have been reported for this screening, partly because in some countries women must advance or even pay out-of-pocket costs. Because immigrant status is also associated with low Pap test uptake, we aimed to analyze the combined impact of immigrant status and low income on cervical cancer underscreening. This study, based on the French CONSTANCES cohort, uses data from the cohort questionnaires and linked health insurance fund data about Pap test reimbursement. To measure income inequalities in screening, we calculated a Slope Index of Inequality (SII) by linear regression, taking into account the migration status of participants. The majority of the 70,614 women included in the analysis were not immigrants (80.2%), while 12.9% were second-generation immigrants, and 6.9% first-generation immigrants. The proportion of underscreening increased with immigrant status, from 19.5% among nonimmigrants to 23.6% among the second generation, and 26.5% among the first ($P < 0.01$). The proportion of underscreening also increased as income level decreased. The income gradient rose significantly from 14% among nonimmigrants to 21% in second-generation immigrants and 19% in the first generation ($P < 0.01$). Among first-generation migrants, the shorter the duration of residence, the higher the SII. Women who are first- or second-generation immigrants are simultaneously underscreened and subject to a more unfavorable economic gradient than native French women born to native French parents. The accumulation of several negative factors could be particularly unfavorable to screening uptake.

1. Introduction

Regular Pap tests for cervical cancer screening (CCS) reduce the incidence and mortality rates of cervical cancer (Hakama et al., 2008). Before 2019, public health authorities in France, as in most Western countries, recommended Pap tests every 3 years for all women aged 25–65 years after two normal Pap tests at age 25 and 26 (Haute Autorité de Santé, 2013).

This test is performed during a gynecological examination — an invasive and intimate procedure with potential cultural barriers. Studies of CCS by migration status consistently report a lower proportion of CCS uptake among women of foreign origin, nationality, country of birth, or whose parents come from abroad (Echeverria and Carrasquillo, 2006; Tsui et al., 2007).

France is one of the European countries with the highest proportion of immigrants and descendants of immigrants, that is, first-generation immigrants who came to France from another country, and second-generation immigrants (i.e., women born in France with at least one parent born abroad) (Agafitei Mihaela, 2017). Immigrants to France may be entitled to reimbursement of medical care three months after their arrival, although this depends on their legal situation and their income. But even in irregular situations (i.e., without the required visas), immigrants may be entitled to receive health insurance coverage that gives them access to preventive care, such as CCS, with a total exemption from advance payment.

Underscreening of immigrant women but also of women with an immigrant parent has previously been reported in France (Rondet et al., 2014). The length of stay among immigrant women may serve as a proxy

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https://doi.org/10.1016/j.pmedr.2023.102363
Received 19 September 2022; Received in revised form 10 July 2023; Accepted 4 August 2023
Available online 9 September 2023
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Table 1
Proportion of underscreened women by migrant status, age, and monthly income.

	Sample size N (%)	Underscreened women (%) Total N = 70614	Non– immigrant women N = 56604	Second-generation immigrant N = 9119	First-generation immigrant N = 4891
Age (years)					
[27–30[	5905 (8.36)	21.3	19.6	27.4	28.5
[30–35[	8801 (12.5)	18.6	17.5	21.5	25.2
[35–40[	10 046 (14.2)	17.0	15.6	20.1	25.1
[40–45[	11 187 (15.8)	18.2	17.0	21.0	25.7
[45–50[	9149 (13.0)	18.0	16.9	20.7	25.3
[50–55[	8286 (11.7)	19.5	18.6	23.2	22.7
[55–60[	8404 (11.9)	24.9	24.1	27.8	30.9
[60–65]	8836 (12.5)	28.0	27.3	31.2	32.1
Monthly income (€)					
>4200	19,336 (27.4)	16.1	15.4	17.2	20.4
]4200–2800]	22,171 (31.4)	18.3	17.5	20.3	22.4
]2800–2100]	10606(15.0)	22.8	21.7	24.7	26.6
]2100–1500]	7789 (11.0)	26.8	25.5	27.8	29.3
< 1500	6473 (9.2)	32.5	29.5	36.5	36.1
Missings data	4239 (6.0)	22.6	20.3	26.5	26.3

Rates of underscreening differ significantly between the three groups < 1% level in Chi-2 test.

Table 2
Income inequalities in underscreening according to migrant status, adjusted for age, with imputed data. N = 70,614.

	Non-immigrant women N = 56604	Second-generation immigrant N = 9119	First-generation immigrant N = 4891	$P_{interaction}$
CCS not up to date (%)	19.5	23.6	26.5	
$SII_{monthly\ income\ (\%)}$ [95% CI]	14 [13–15]	21 [18–24]	19 [15–24]	<0.001

CCS: Cervical cancer screening CI: Confidence interval SII: Slope of inequality index.
The interaction test compares the interaction between the migration status variable in three categories and the monthly income variable in 5 categories.

Table 1
Income inequalities in underscreening according to migrant status, adjusted for age, with complete case analysis. N = **66,375.**

	Nonimmigrant women N = 56604	Second-generation immigrant N = 9119	First-generation immigrant N = 4891	$P_{interaction}$
CCS not up to date (%)	19.5	23.6	26.5	
$SII_{monthly\ income\ (\%)}$ [95% CI]	14 [13–15]	21 [19–22]	19 [17–21]	<0.001

CCS: Cervical cancer screening CI: Confidence interval SII: Slope of inequality index.

Table 2
Calculation of group based ranking in the cumulative distribution of monthly income with complete case analysis, N = 66,375.

Monthly income	Population (%)	Cumulative (%)	Range	Midpoints (ranks)
>4200	0.29	0.29	0.00–0.29	0.145
]4200–2800]	0.33	0.62	0.29–0.62	0.455
0.3698] 2800–2100]	0.16	0.78	0.62–0.78	0.70
]2100–1500]	0.12	0.90	0.78–0.90	0.84
< 1500	0.10	1.0	0.90–1.00	0.95

for the integration process and may be a potential modifier of immigrant health behavior (WHO Migration Health Programme, Office of the Regional Director, WHO Regional Office for Europe et al., 2019).

A low socioeconomic status is associated with a higher risk of cervical cancer, a finding partly explained by the underuse of Pap tests among low-income women (Palencia et al., 2010). Several studies have demonstrated social inequalities in CCS performance in the form of a social gradient disfavoring low-income women (Kelly et al., 2017).

In France, CCS is not exclusive to any type of professional or site. Women can be screened at their convenience by any of the following health professionals: gynecologists, general practitioners, hospital-based gynecologists, midwives, and medical biologists (doctors working in clinical laboratories for outpatients). Gynecologists perform most of these tests, and the proportion of general practitioners (GPs) doing them appears to have diminished in recent years (Poncet et al., 2016). Patients are left with out-of-pocket expenditures because most gynecologists charge more than the National Health Insurance (NHI) reimburses. Other European countries also fail to provide complete financial support for Pap tests (Garnier, 2013). It should be noted that nationwide organized cervical cancer screening began in France in 2020. There is no out-of-pocket expenditure: 100% of the cost of the CCS analysis is covered. New guidelines has increased the interval between CCS to every 5 years in women over 30 years, and the screening includes a human papillomavirus (HPV) test. In the coming years, this test will be done by self-sampling (Haute Autorité de Santé, 2020).

In this study, we focus on two points fundamental for improving the quality of CCS: the proportion of underscreening, that is, the lack of CCS uptake, and the existence of a gradient of inequality according to income. Our objective is to study how migrant status affects these two markers of CCS.

2. Methods

This study analyzes data from the CONSTANCES cohort, a general-purpose epidemiologic cohort designed to study a wide range of health problems in the general population. CONSTANCES collects data on personal, behavioral, occupational, and social factors from self-administered questionnaires at inclusion and health examinations. Other information, such as reimbursement data (visits to doctors and other health professionals, reimbursement of the cost of care), is collected from databases of the French NHI. Inclusion in this cohort began in 2012 with the ultimate objective of including 200,000 cohort members (men and women) from the French population, aged 18 to 69 years. The random selection of the cohort is stratified for age, sex, region, and socioeconomic position (Goldberg et al., 2017). The data

considered here were collected at inclusion and come from women's self-completed questionnaires about their socioeconomic, national, ethnic, and medical characteristics and linked NHI data about Pap test reimbursement. The National Data Protection Authority (authorization n°910486) approved the CONSTANCES studies. Volunteers' agreement to participate in this cohort includes consent to take part in all the CONSTANCES scientific studies.

This analysis covers the 90,023 women recruited from January 2012 through December 2019. Finally, 17,940 were not eligible for Pap tests (13,755 women younger than 27 years or older than 65, 3,196 with a history of uterine cancer or hysterectomy, 985 with no sexual relations ever, and 4 seropositive for HIV). To ensure that the first-generation immigrants in this sample had been residing in France for at least 3 years, we excluded the 93 women who had not been reimbursed for any medical services during the 3 years before inclusion as well as 1,376 participants whose migrant status was unknown. These exclusions left 70,614 women in this analysis.

2.1. Measures

In accordance with French guidelines, women with an interval exceeding three years between the date of their last Pap test (identified from NHI reimbursement data) and inclusion were classified as underscreened (2).

Age was used as a categorical variable in 5-year age groups. Immigrant status was constructed from three variables: the woman's country of birth, her parents' country of birth, and her administrative status (foreigner, French nationality born in France, naturalized). The variable was divided into three main categories: nonimmigrant women (women born in France with both parents born in France), second-generation immigrant (women born in France to at least one parent not born in France), and first-generation immigrant women (women born abroad and living in France).

Length of stay was a binary variable used only for first-generation women, classifying them according to whether they had lived in France for at least 10 years, or for less time. It was calculated by the difference between the women's age at inclusion and their age at arrival in France. Monthly household income in euros was reported in five categories: <€1500, [€1500-2100[, [€2100-2800[, [€2800-4200[, and ≥ € 4200.

2.2. Statistical analyses

To measure income inequalities in screening, a Slope Index of Inequality (SII) was calculated by binary linear regression (Moreno-Betancur et al., 2015; Wachtler et al., 2019). The SII is a single, synthetic measurement index that is independent of the distribution of the population according to social categories. To calculate SII, we classified the CONSTANCES population included here by income level and compared it with the same population classified by the proportion of underscreening. This index can be interpreted as the absolute difference of prevalence in CCS uptake at the two opposite ends of the income scale. A high score on the SII implies substantial differences in screening uptake between the highest and lowest positions on the income scale. These scores were calculated as a function of income, adjusted for age, and stratified by migrant status and duration of residence. Stratified SII scores were compared by interaction tests (see appendix for model details).

The missing data for income (6.0%) were taken into account by fully conditional specification methods, with the MICE package in R (Buuren and Groothuis-Oudshoorn, 2011). The imputation model includes all variables associated with the variables to be imputed, including age, reported coverage by specific government-funded medical insurance for very low-income individuals from 2009 to 2016, overall perceived health condition (rated from 1 to 8), living with a partner, living with a child, and perceiving one's daily living financial situation as difficult. Five complete datasets were created. R software version 4.0.4 was used to conduct all analyses in 2023.

3. Results

Among the 70,614 women analyzed, nearly four in five were not immigrants (N = 5,604, 80.2%), 12.9% were second-generation immigrants (N = 9,119), and 6.9% first-generation (N = 4,891) (Table 1). We note a continuous increase in underscreening women both according to their monthly income, disfavoring those with the lowest revenues, and according to the migration status, disfavoring the first-generation migrants who arrived most recently (<10 years before inclusion). The proportion of underscreening increased with immigrant status, from 19.5% among nonimmigrants to 23.6% among second-generation immigrants, and 26.5% among the first generation ($P < 0.01$) (Table 2).

The income gradient increased from 14% among nonimmigrants to 21% in the second and 19% in the first generation (interaction test significant, $P < 0.01$). Among the first generation, the income gradient increased from 18% among women with a duration of residence of at least 10 years to 22% among women in France for<10 years (nonsignificant increase).

4. Discussion

The proportion of underscreening and CCS-related income inequalities increased with migration status and were worst for first-generation immigrants and intermediate for those in the second generation. The absolute difference in screening between each end of the income scale was greater among both second- and first-generation immigrants than among native women with no first-generation immigrant first-degree relatives.

Measuring a synthetic social gradient makes it possible to compare social inequalities over time (Choi et al., 2018) as well as according to the screening organization (Palencia et al., 2010). Our results thus show that two barriers to screening (here, immigrant status and low income) have synergistic effects, that is, the combination of disadvantages produces effects that are greater than their sum. The interaction test and a synthetic social inequality index make it possible to combine these two factors and demonstrate this synergistic action. The increase in inequalities by the accumulation of disadvantages has already been demonstrated in an earlier work where high Body Mass Index combined with CCS underscreening to exceed the sum of the two inequalities (Sassenou et al., 2021), but this is the first time that this effect has been shown according to immigrant status.

Other studies have already demonstrated greater underscreening of second-generation immigrants (Crampe-Casnabet et al., 2019; Rondet et al., 2014). The persistence of more difficult living conditions probably explains why second-generation immigrant women remain in an intermediate position between first-generation immigrants and nonimmigrants, with lower incomes, lower educational attainment, and more difficulty finding employment in the labor market than nonimmigrants (Beauchemin et al., 2015).

The increase observed in CCS-related income inequalities suggests that first- and second-generation immigrant women at the top of the social hierarchy compensate for their migration-related disadvantage in CCS, unlike those at the bottom of the social scale. That is, the latter undergo CCS less often — have fewer Pap tests — than women at the same income level who are not immigrants. Several mechanisms may explain this higher proportion of underscreening: greater discrimination by doctors performing Pap smears against the poorest women immigrants, of either the first or second generation, or a lower density of physicians performing this test in their residential area (Vallée et al., 2010), sometimes ghettoized (Pan Ké Shon, 2010), or their lack of knowledge of the health care system and recommendations for preventive health care (Marques et al., 2020). Unfortunately, we do not have any data on cultural issues, such as ethnic origin or religion,

potentially related to taboos in the field of prevention of sexually transmitted diseases and the performance of Pap tests.

The wider social inequalities in screening observed even among second-generation women compared with the nonimmigrants are quite surprising. That is, we anticipated a higher rate of social inequalities in CCS for first-generation immigrants, but considered that the health behaviors of the women born in France would be similar to those of nonimmigrants. Our results suggest that among those at the bottom of the income scale there are synergistic difficulties both in integration and in understanding the health care system.

A duration of residence longer than 10 years among first-generation immigrants seems to decrease income inequalities in CCS. These results, although not statistically significant, suggest that the duration of residence has a positive effect on the CCS-related inequalities among first-generation immigrants.

One of the weaknesses of this study is due to the differences between the population of immigrants and their children in our sample from the population of immigrants observed in another national cohort (Beauchemin et al., 2015) or with data from the national institute of statistics and economics (Institut national et des études statistiques (Insee), 2020). We observe similar proportions of nonimmigrants and of first- and second-generation immigrants, but the distribution by geographic origin of first-generation immigrants differs: the CONSTANCES cohort has a higher proportion of Europeans and a lower proportion of participants from North Africa; the distributions of participants from Asia and sub-Saharan Africa are similar. Most European countries have organized national CCS programs (Garnier, 2013), and immigrants of European origin may thus be more up to date with their screening than those from non-European countries (Di Felice et al., 2015). Moreover, all women in the CONSTANCES cohort are covered by French NHI and volunteered to participate. This cohort therefore does not include the women living in the most extreme precarity (insecurity, due to lack of regular or secure income, housing, legal status, even health) in France. We can thus suppose that the immigrant women of both the first and second generations in our sample are substantially less underscreened than the immigrant women in the French general population.

This work has two major strengths: the large national sample size, enabling interaction testing, and the reliability of the screening status data. Although some residual confounding may persist, these characteristics— migrant status and monthly income level — can be taken into account for they are easily available in primary care. These results highlight a group particularly vulnerable to underscreening. Their health care providers should discuss the importance of CCS with them during their consultations.

5. Conclusion

Immigrant women and women born in France to at least one immigrant parent are simultaneously underscreened for cervical cancer and subject to a more unfavorable economic gradient than native women born to native French parents. The new organized screening program, described above, may reduce social inequalities in screening. Similar effects by the combination of disadvantages have already been shown for women who are overweight or obese. Future studies should examine other social or medical characteristics associated with lower screening uptake that might lead to synergistic discrimination, such as disabilities or mental disorders. The accumulation of several negative factors could be particularly unfavorable to screening.

We have none conflict of interest. This study has received a financial support of Institute for Public Health Research (IRESP).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Acknowledgments

The article was supported by the 'Institut de recherche en Santé publique' (IReSP) located at 8 rue de la Croix Jarry 75013, Paris, France.

The authors thank the "Epidemiological Population-Based Cohorts Unit" (UMS 11) of Inserm-Versailles Saint Quentin en Yvelines University, whose researchers designed and are responsible for the Constances Cohort Study.

Ethics approval

The National Data Protection Authority (authorization n°910486) approved the CONSTANCES studies.

Appendix:

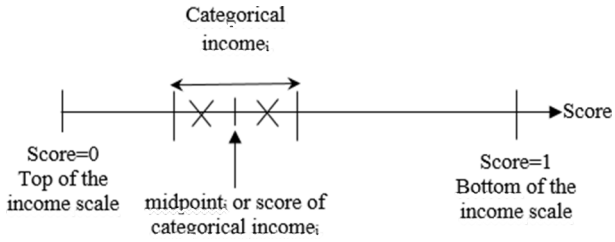
Model.

Let y_i our dependant variable for woman i, defined as

$$y_i = \begin{cases} 1, & \text{if woman } i \text{ is underscreened} \\ 0, & \text{otherwise} \end{cases} \quad i = 1, \ldots, 70,614$$

For each woman we measured 3 independents variables:

- Age of the woman: age_i in 8 categories:[25 −30[; [30 −35[; [35 −40[; [40 −45[; [45 −50[; [50 −55[; [55 −60[; [60 −65[
- Migration status: $status_i$ in 3 categories (Non-immigrant / Second-generation immigrant / First-generation immigrant)
- After ordering the five income categories from highest to lowest, we assigned each category a width proportional to its size in the population. In the end, we obtained a measure of income defined by a score ranging from 0 (highest income) to 1 (lowest income). This continuous score can therefore be interpreted as the percentage of the population with higher incomes. In subsequent analyses, we no longer used the income category but the score for each category, also known as the midpoint because it corresponds to the middle of the interval for each category. In the litterature, this variable is also called *ridit scores*. It is used to estimate the *SII* for each migration status.



We then adjusted a binary linear model with identity of *y* on age and the interaction of status and midpoint (we remove the *i* indice for clarity and we did not include the age adjustment variable):

$$y = \beta_1 \text{midpoint} + \beta_2 \text{status}_2 + \beta_3 \text{status}_3 + \beta_4 \text{status}_2 \times \text{midpoint} + \beta_5 \text{status}_3 \times \text{midpoint}$$

Where,

- β_1 is the estimated SII for women in status = 1 (Non-immigrant women)
- β_2 is the absolute proportion difference in underscreened between status = 2 and status = 1 (Second-generation immigrant VS Non-immigrant women) at midpoint = 0 ("highest" income)
- β_3 is the absolute proportion difference in underscreened between status = 3 and status = 1 (First-generation immigrant VS Non-immigrant women) at midpoint = 0 ("highest" income)
- β_4 is the SII for women in status = 2 (Second-generation immigrant)
- β_5 is the SII for women in status = 3 (First-generation immigrant)
- The interaction test corresponds to testing H0: $\beta_4 = \beta_5 = 0$

Table 1

The interaction test compares the interaction between the migration status variable in three categories and the monthly income variable in 5 categories.

Table 2

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