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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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A COMPARATIVE ANALYSIS OF TRENDS IN CERVICAL CANCER MORTALITY AMONG MESTIZO AND INDIGENOUS WOMEN IN ECUADOR, 2010–2024.

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Abstract.

Cervical cancer is one of the leading causes of death from malignant neoplasms among women in Ecuador, a problem influenced by social and health determinants. The objective of this study is to analyze the trends and magnitude of inequalities in cervical cancer mortality among mestizo and indigenous women in Ecuador during the period 2010–2024. The study design is observational, retrospective, and ecological, using a time-series approach. A total of 6,090 deaths of women aged 20 years and older recorded by the National Institute of Statistics and Census (ICD-10 code: C53) were included. Age-standardized mortality rates were calculated. Joinpoint regression models were used to assess trends. Risk gaps were quantified using the mortality rate ratio (MRR) by comparing the three-year periods 2010–2012 and 2022–2024. Mestizo women accounted for 87.8% of deaths, and indigenous women for 6%. The trend among the mestizo population remained stable (APC: 0.8%), while the indigenous population increased (APC: 3.3%). A statistically significant increase was observed in the indigenous cohort aged 20 to 44 (APC 11.2%). In the 2010–2012 period, indigenous women aged ≥65 had lower mortality than mestizo women (MRR 0.64); however, in 2022–2024, a numerical trend toward risk reversal was observed (MRR 1.13; 95% CI: 0.82–1.55), without reaching statistical significance. Cervical cancer mortality in Ecuador follows divergent trajectories depending on ethnicity. The increase among young indigenous women and the shift in risk among older women highlight profound structural inequities in access to prevention.

Key words. Uterine cervical neoplasms, mortality, indigenous peoples, health status disparities, time series analysis.

Introduction.

Cervical cancer remains a global public health problem, ranking as the fourth leading cause of cancer-related deaths among women and posing a particularly serious threat in low-income countries, where mortality rates are 5 to 6 times higher than in countries with a high human development index [1]. In 2020, 342,000 deaths from cervical cancer were reported worldwide, with a rate of approximately 7 deaths per 100,000 woman-years [2]. In Latin America, an estimated 23,471 deaths from cervical cancer occurred in 2022, with a standardized rate of 7.8 per 100,000 women; the impact is significant among women over the age of 40, who accounted for 20,440 of the total deaths that year [1].

In Ecuador, cervical cancer is the second leading cause of cancer in women and one of the leading causes of cancer-related deaths among women [3]. In 2022, 1,792 cases of cervical cancer were reported, resulting in 939 deaths [4]. This issue is closely linked to risk factors such as HPV infection (70%), early onset of sexual activity (55%), promiscuity (35%), and prolonged use of hormonal contraceptives (28.1%) [4].

Mortality from cervical cancer is not evenly distributed across the entire population of Ecuadorian women; rather, it is influenced by social and structural determinants of health. Several studies indicate that indigenous women living in rural areas with low levels of education have never been screened [5,6]. This lack of secondary prevention in a high-risk biological environment highlights a higher prevalence of HPV infection among indigenous women compared to mestizo women [7]. The combination of high viral exposure and systematic exclusion from preventive screening creates a situation of chronic structural vulnerability for these populations [8].

Although cervical cancer is a preventable cause of death through vaccination and screening, it remains one of the leading causes of premature death among women in low- and middle-income countries [9]. This epidemiological persistence may be due to structural shortcomings in the accessibility and continuity of health care systems. In Ecuador, the disease burden remains at critical levels, suggesting a shortfall in the primary and secondary prevention programs implemented by the national health care system.

However, an overall analysis of mortality from this cause tends to mask a deeper reality. The Ecuadorian healthcare system is characterized by significant fragmentation and by geographical, economic, and cultural barriers to access that disproportionately affect ethnic minorities [10]. Historically, the indigenous population has had suboptimal access to reproductive health services compared to the predominant mestizo population [11]. To date, there remains a critical gap in the scientific literature, and the true extent of the mortality gap between indigenous and mestizo women—as well as the rate at which this disparity has evolved over the past decade and a half—remains unknown.

In this context, it is essential to analyze ethnic disparities in cervical cancer mortality in order to move from general health policies to interventions tailored to the Ecuadorian ethnic context. While most studies focus on short-term crude rates, this study presents a 15-year analysis using age-standardized rates and Joinpoint regression models. This methodological approach allows, for the first time, for the separation of mortality trends between the dominant population group and historically marginalized minorities.

The findings of this study will provide the scientific evidence needed for Ecuador's healthcare system and international organizations to reassess the allocation of cancer resources,

prioritizing culturally adapted screening strategies, the reopening of rural health centers, and the removal of logistical barriers that currently turn a preventable disease into a death sentence for the country's indigenous women.

The objective of this study is to analyze the trends and magnitude of inequalities in cervical cancer mortality among mestizo and indigenous women in Ecuador during the period 2010–2024, using the Joinpoint regression model and the calculation of age-specific rate ratios, with the aim of highlighting the differential impact of structural barriers on premature mortality among ethnic minorities.

Materials and Methods.

This study is an observational, retrospective, and ecological study based on time series data, designed to assess trends in cervical cancer mortality in Ecuador from January 1, 2010, to December 31, 2024.

The mortality data are drawn from the General Death Statistics of the National Institute of Statistics and Censuses (INEC) [12]. The population denominators were derived from intercensal projections based on the 2010 and 2022 national censuses and were classified by year, age, and self-identified ethnicity.

The study included all women aged 20 years or older whose cause of death was coded as C53 (malignant neoplasm of the cervix) according to the International Classification of Diseases, 10th Revision (ICD-10). To avoid demographic bias, mortality among those under 20 years of age was excluded, given the low mortality rate in the child and adolescent population.

The General Deaths databases for the study period were standardized through a computerized data cleaning process. The cause-of-death variable was standardized by using an algorithmic search for the ICD-10 code (C53) and its literal description for the years in which INEC used open-text records. Subsequently, records with missing data, miscoded data, or data recorded as "Ignored" (codes 9, 99, or 999) in the age, sex, and ethnicity variables were excluded. The self-identified ethnicity variable was dichotomized for the comparative analysis, isolating the "Mestizo" and "Indigenous" populations. After the cleaning process, the final analytical sample consisted of 6,090 deaths.

Age-standardized mortality rates were calculated using the direct method, with weights from the World Health Organization's (WHO) World Standard Population, truncated at age 20 and older [13]. In addition, specific rates by age group: ages 20 to 44, ages 45 to 64, and those 65 and older.

JoinPoint regression models were used to analyze trends. This methodology employs the Monte Carlo permutation test to identify the year in which significant changes in the trend occur [14]. Furthermore, this methodology enables calculation of the Annual Percentage Change (APC) and its corresponding 95% confidence interval. Statistical significance was set at $p < 0.05$.

To quantify the magnitude and temporal evolution of survival inequality among mestizo and indigenous women, the mortality rate ratio (MRR) was calculated. To stabilize the rates and reduce the statistical volatility inherent in the low annual counts of the minority population, the data were grouped into three-year periods. A direct comparative analysis was conducted between the initial three-year period of the study (2010–2012) and the final three-year period (2022–2024).

This MRR calculation was stratified independently across the three predefined age groups. In all calculations, the standardized rate for the mestizo population was used as the reference group. Therefore, an MRR > 1.0 indicates an excess mortality risk among indigenous women, while an MRR < 1.0 indicates a lower risk than that of mestizo women. For each estimated MRR, the corresponding 95% confidence intervals were calculated to assess the statistical significance of the gaps observed in each period and age cohort.

Statistical analysis of the data, including standardization of rates and calculation of mortality rate ratios, was performed using Stata, version 18, while analysis of trends and inflection points was performed using the Joinpoint program, version 5.4.0.

Since the study was based exclusively on the secondary analysis of anonymized, publicly available INEC databases, neither approval from a Human Research Ethics Committee (CEISH) nor informed consent was required, in strict compliance with Ecuadorian law and the Declaration of Helsinki.

Results.

In Ecuador, between January 1, 2010, and December 31, 2024, there were 6,090 deaths from cervical cancer among women aged 20 and older. Table 1 details the demographic characteristics of the analyzed population; the highest mortality rate was observed in the 45–64 age group (41.2%), followed by

Table 1. *Demographic characteristics and cervical cancer mortality burden among women aged 20 years and older by ethnicity.*

Characteristics	Deaths	Percent
Total	6090	100.0
20-44 years	1175	19.3
45-64 years	2508	41.2
≥ 65 years	2407	39.5
Mestizo	5344	100.0
20-44 years	1020	19.1
45-64 years	2215	41.4
≥ 65 years	2109	39.5
Indigenous	365	100.0
20-44 years	73	20.0
45-64 years	138	37.8
≥ 65 years	154	42.2

Note: *The total sample includes 6,090 deaths. The remaining 381 individuals (6.3%) belonged to other ethnic groups (White, Afro-Ecuadorian, Montubio, and other/unspecified ethnicities) and were excluded from the comparative analysis between Mestizo and Indigenous populations.*

Table 2. *Age-adjusted mortality rates and Annual Percent Change (APC) of cervical cancer by age group and ethnicity.*

TOTAL					
			Trend		
Age groups (years)	**2010 Rates**	**2024 Rates**	**Period**	**APC (95% CI)**	**P-Value**
20-44	0.91	1.69	2010-2024	4.6* (2.2; 7.0)	<0.001
45-64	3.08	3.62	2010-2024	1.1 (-0.5; 2.7)	0.163
≥ 65	3.40	2.94	2010-2024	-2.6 (-7.1; 2.1)	0.565
MESTIZOS WOMEN					
Age groups (years)	**2010 Rates**	**2024 Rates**	**Period**	**APC (95% CI)**	**P-Value**
20-44	1.21	2.02	2010-2024	4.6*(1.8; 7.5)	<0.001
45-64	3.84	3.80	2010-2024	0.8 (-0.4; 2.1)	0.154
≥ 65	4.09	2.84	2010-2024	-0.9 (-2.5; 0.7)	0.307
INDIGENOUS WOMEN					
			Trend		
Age groups (years)	**2010 Rates**	**2024 Rates**	**Period**	**APC (95% CI)**	**P-Value**
20-44	0.33	1.17	2010-2024	11.2* (3.1; 19.9)	<0.001
45-64	2.70	4.76	2010-2024	1.6 (-2.4; 6.0)	0.424
≥ 65	4.13	4.35	2010-2024	3.6 (-3.2; 10.2)	0.312

Table 3. *Mortality Rate Ratios (MRR) comparing Indigenous to Mestizo women, highlighting the widening gap in health disparities (2010–2012 vs. 2022–2024).*

Period (Triennium)	**Age group (years)**	**Mestiza Rate**	**Indigenous Rate**	**MMR**	**CI 95%**
2010-2012	20-44	1.99	1.12	0.56	0.25-1.28
	45-64	11.69	10.15	0.87	0.56-1.35
	≥ 65	28.52	18.31	0.64	0.40-1.02
2022-2024	20-44	3.25	2.09	0.64	0.38-1.08
	45-64	13.44	11.19	0.83	0.59-1.18
	≥ 65	23.95	27.06	1.13	0.82-1.55

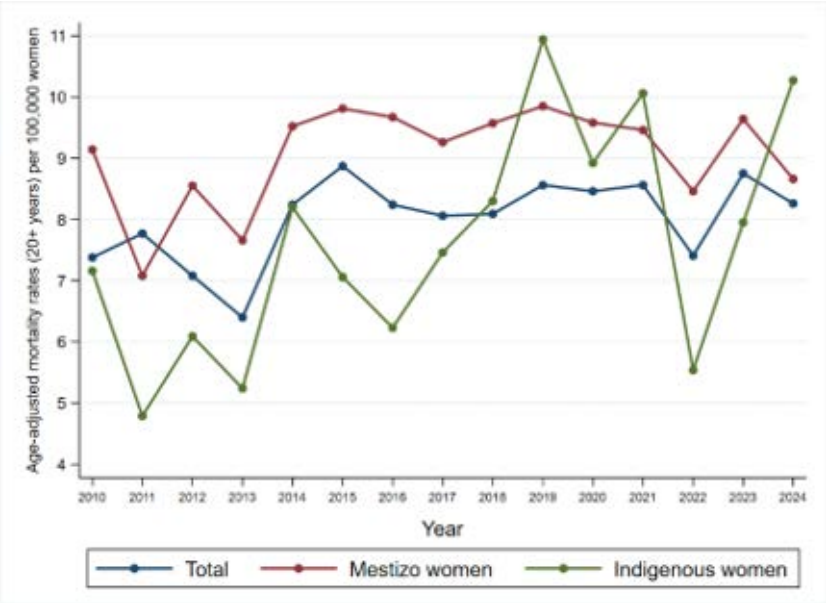

Figure 1. *Trends in age-adjusted cervical cancer mortality rates per 100,000 women (20+ years) by ethnicity.*

the ≥65 age group (39.5%). In contrast, women aged 20–44 had the lowest rate, at 19.3%.

When mortality rates were broken down by self-identified ethnicity, mestizo women accounted for 87.8% of all deaths from this cause, while indigenous women accounted for 6%. The age group with the highest proportion of deaths in the mestizo population was 45 to 64 years old, at 41.4%, followed by the group aged 65 and older, at 39.5%. The 20- to 44-year-old group had the lowest percentage, at 19.1%.

Among the indigenous population, the age distribution of mortality shows a higher concentration in the ≥65 age group (42.2%), followed by the 45–64 age group (37.8%). The 20–44 age group has a similar percentage to that of the mestizo population and the overall population, with 20% of deaths occurring in this group.

The trend in cervical cancer mortality among women aged 20 and older during the study period showed a slight, non-statistically significant increase, with an APC of 1.03% (95%

CI: -0.2, 2.1), rising from an age-adjusted rate of 7.38 in 2010 to 8.26 in 2024. When stratified by self-identified ethnicity, the group of mestizo women showed a stable trend in mortality over the 15-year study period, with an APC of 0.8% (95% CI: -0.3 to 2.0), rising from 9.14 in 2010 to 8.66 in 2024. In the indigenous population, a statistically nonsignificant upward trend was observed, with an APC of 3.3% (95% CI: -0.3 to 7.0), rising from 7.16 in 2010 to 10.20 in 2024 (Figure 1).

Table 2 presents the analysis of trends in age-adjusted mortality rates. Overall, the group of women aged 20–44 showed a statistically significant upward trend, with an APC of 4.6 (95% CI: 2.2, 7.0). In the group of women aged 45–64, a slight but non-significant upward trend was observed, with an APC of 1.1 (95% CI: −0.5, 2.7). In contrast, the group aged ≥ 65 years showed a non-significant downward trend, with an APC of -2.6 (95% CI: -7.1 to 2.1).

When breaking down the data by self-identified ethnicity, mestizo women aged 20 to 44 showed a statistically significant upward trend, with an APC of 4.6 (95% CI: 1.8; 7.5), rising from 1.2 in 2010 to 2.0 in 2024. In the age groups 45–64 years and ≥65 years, no significant changes in trend were observed, with stability, and APCs of 0.8 (95% CI: −0.4, 2.1) and −0.9 (95% CI: −2.5, 0.7), respectively.

Among indigenous women aged 20 to 44, a statistically significant upward trend was observed, with an APC of 11.2 (95% CI: 3.1, 19.9), rising from 0.33 in 2010 to 1.1 in 2024. The age groups 45 to 64 years and 65 years and older showed a non-significant increase in the trend, with an APC of 1.6 (95% CI: -2.4, 6.0) and 3.6 (95% CI: -3.2, 10.2), respectively.

Table 3 presents a comparative analysis of the mortality rate ratio (MRR) between indigenous and mestizo women for the three-year periods 2010–2012 and 2022–2024, stratified by age group.

Among women aged 65 and older, during the initial three-year period (2010–2012), the mortality rate among indigenous women was lower than that of mestizo women, with an MRR of 0.64 (95% CI: 0.40–1.02), indicating a 36% lower mortality burden in the indigenous population during that period. However, in the final three-year period (2022–2024), a numerical trend toward risk reversal was observed. The rate for indigenous women increased from 18.31 to 27.06, while that for mestizo women decreased from 28.52 to 23.95. As a result, the MRR shifted to 1.13; however, given that the 95% confidence interval (0.82–1.55) spans the null value of 1.0, this reversal should be interpreted as a trend in the point estimate without statistical significance, rather than a definitive difference.

Meanwhile, among young women (aged 20–44), the indigenous rate was lower during the initial three-year period, with an MRR of 0.56 (95% CI: 0.25–1.28)—that is, a burden 44% lower than that of mestizo women. In the final three-year period (2022–2024), a convergence is observed. The rate for indigenous women increased from 1.12 to 2.09, and for mestizo women from 1.99 to 3.25. As a result, the MRR shifted to 0.64; this means that mortality among indigenous women in this group was 36% lower than among mestizo women during the final period, narrowing the gap that existed in the previous decade.

Finally, among women aged 45 to 64, the trend remained relatively stable. In 2010–2012, the age-standardized mortality rate was 0.87 (95% CI: 0.56–1.35), indicating a 13% lower mortality rate in the indigenous population. For the 2022–2024 period, rates for both populations increased (from 10.15 to 11.19 among indigenous women and from 11.69 to 13.44 among mestizo women). As a result, the MRR shifted slightly to 0.83; this means that mortality among indigenous women in this age group remained 17% lower than that of mestizo women during the 2022–2024 period.

Discussion.

This study documents, through a 15-year time-series analysis, the magnitude and evolution of ethnic inequalities in cervical cancer mortality in Ecuador. The trend among the indigenous population showed a slight increase, in sharp contrast to the stabilization observed among the mestizo population. This pattern of worsening cancer burden differs substantially from findings reported in neighboring countries with similar demographic dynamics. For example, recent studies in Colombia have documented a diametrically opposite scenario, noting that, for cervical cancer, both crude and age-standardized rates remain lower in indigenous communities than in the mestizo population [15].

This regional divergence is of utmost importance, as it may be due to two key factors: on the one hand, persistent underreporting and misclassification of cancer deaths among indigenous populations in neighboring countries [16]; and, on the other hand, to the fact that indigenous women in Ecuador are undergoing a much more rapid and lethal epidemiological transition regarding HPV infection and screening barriers. Segarra et al. [17] reported that in three indigenous communities in southern Ecuador, 23.48% of women had high-risk oncogenic HPV. Similarly, Bayas-Rea et al. [7] documented an even more critical situation in rural communities in the northwest, noting an overall HPV prevalence of 56% with a predominance of high-risk genotypes. Taken together, this sustained exposure to the virus, coupled with the lack of secondary prevention, explains the upward trend in mortality documented in our analysis.

Another important point to consider is that cervical cancer mortality in Ecuador follows divergent epidemiological trends depending on age group and ethnicity, indicating that structural health inequalities not only persist but are actually worsening among the most vulnerable segments of the population. When analyzing trends by age group, it is critical to note that women aged 20 to 44 show a significant increase in mortality, in contrast to the stability observed in older age groups, whose historically longer exposure to conventional cytology screening programs could explain, at least partially, the absence of significant trends in those cohorts [18,19].

This age-specific pattern is consistent with the findings reported by Lemp et al. [20], who documented that younger generations of women in low- and middle-income countries have lower cumulative coverage of early detection, leading to diagnosis at more advanced stages and, consequently, higher mortality rates. In this context, the WHO has warned that, without sustained vaccination and screening interventions, the burden of cervical cancer mortality will continue to shift toward younger cohorts in the coming decades—a projection that the data from this study anticipate with alarming accuracy [21].

The ethnic dimension of this issue adds an additional layer of analytical complexity. The disparity in the annual growth rate of mortality between indigenous and mestizo women aged 20 to 44 cannot be interpreted in isolation, but rather as a manifestation of structural inequities that have historically been perpetuated within the region's health systems. Sethi et al. [22], in their global study on the health of indigenous peoples, they demonstrated that indigenous women bear a disproportionate cancer burden, determined by the intersection of social exclusion, geographical and cultural limitations in access to health services, and systematic underrepresentation in epidemiological surveillance systems. Díaz et al. [23] complemented this perspective by showing that cervical cytology coverage among indigenous women in Latin America is consistently lower than that of their non-indigenous peers, which constitutes a structural pattern of late diagnosis that directly translates into higher preventable mortality.

This is further supported by the findings of Ning et al. [24] and Deng et al. [25], who noted that the prevalence of high-risk HPV infection is disproportionately higher in populations with low levels of education and limited access to reproductive health services—conditions that characterize a significant proportion of the region's indigenous communities and act as biological accelerators of progression to malignancy.

A comparative analysis using mortality ratios provides deeper insight into the temporal dynamics of these disparities and reveals findings of particular significance. During the 2010–2012 period, mortality rates among indigenous women were lower than those among mestizo women in all age groups, although no statistically significant differences were observed. Far from being interpreted as a favorable indicator, this result could reflect the coexistence of cultural protective factors, such as community cohesion and social support networks that influence access to preventive interventions, whose protective effect tends to erode amid cumulative processes of acculturation, migration, and structural marginalization [26,27].

The trend leading up to the 2022–2024 period is consistent with this hypothesis: for the first time, a numerical trend toward higher mortality was observed among indigenous women aged 65 and older compared to mestizo women (MRR: 1.13; 95% CI: 0.82–1.55), although the confidence interval spanning the null value of 1.0 indicates that statistical uncertainty remains. This pattern suggests a progressive deterioration in access to timely diagnosis and treatment in this subgroup. Armenta-Paulino et al. document a similar pattern in Mexico, where indigenous women face "triple discrimination" for being women, indigenous, and poor; these factors severely restrict their access to culturally appropriate cancer care, a finding that these data empirically corroborate [28].

Finally, the gradual narrowing of the mortality gap between young indigenous and mestizo women constitutes what Nogueira et al. [29] termed an adverse epidemiological transition, in which insufficient HPV vaccination coverage and the loss of cultural protective factors lead to a convergence toward mortality rates that are equivalent to—and potentially higher than—those of the majority populations. Taken together, these findings demonstrate that ethnic disparities in cervical cancer mortality are not a static phenomenon, but rather a dynamic process of progressive worsening that conventional epidemiological surveillance systems—which are not disaggregated by ethnicity—are unable to detect in a timely manner [30].

Among the study's main strengths is the length of the analysis period, which enabled the identification of long-term trends that have been poorly documented in the regional literature on ethnic inequalities in cancer mortality. However, the ecological design prevents drawing causal inferences at the individual level and does not allow control of relevant confounding variables, such as clinical stage at diagnosis or effective HPV vaccination coverage. Furthermore, the systematic underreporting of deaths in rural indigenous communities could constitute a source of structural bias that underestimates the true magnitude of the documented disparities.

Conclusion.

During the period 2010–2024, cervical cancer mortality in Ecuador followed divergent trends depending on ethnicity and age group. Indigenous women aged 20 to 44 had the fastest annual growth rate, while among women over 65, a numerical trend toward risk reversal was observed, with indigenous mortality rates exceeding those of mestizo women for the first time, although this difference did not reach statistical significance (MRR: 1.13; 95% CI: 0.82–1.55). These findings are a quantifiable expression of accumulated structural inequities: low screening coverage, high prevalence of high-risk HPV, and geographic, linguistic, and cultural barriers to accessing cancer services.

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