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RESEARCH ARTICLE

Old but gold: The use of multiregional life tables and the place-of-birth-dependent approach for studying recent internal migration in Italy

Alessio Buonomo[1†*], Federico Benassi[1†], Oliviero Casacchia[2†], and Salvatore Strozza[1†]

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Abstract

There has been a significant shift in migratory behavior within Italy over time. The origins and destinations of the migration flows, which were previously characterized by a clear prevalence of moving from the south to the center-north, are now much more heterogeneous and complex. Despite the important progress achieved in the past 20 years, the measurement of internal migration remains a contentious topic in international research. Using data provided by the Italian National Institute of Statistics, we applied Rogers' multiregional model place-of-birth-dependent approach to assess the internal migration flows that occurred in Italy in the period 2002 – 2013. This approach provides accurate measurements of internal migration, noting in particular the years of life expectancy for each birth cohort living in each geographical Italian macroregion (northeast, northwest, center, and south). The results indicate that the northwest is the main area of destination for internal migration. The birth cohort in the south is the one that has the greatest number of years of life expectancy in other macroregions. Interestingly, this cohort is the only one characterized by a predominantly male migratory model.

Keywords: Macroregion; Multiregional model; Multiregional life table; Gender; Life expectancy; Italy; Migration

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1. Introduction

Internal migration is recognized as a complex phenomenon involving demographic, spatial, and economic aspects (Bell *et al.*, 2015; Courgeau, 2021). Although demographic indicators used for comparison and measurement have been unanimously recognized for the study of mortality and fertility, a set of measures utilized for gauging migration remains to be determined (Raymer & Willekens, 2008; United Nations, 2014). Over the past 15 years, important progress has been made in the statistical estimation of indicators for measuring international migration (Rees *et al.*, 2017). However, the measurement of internal migration, despite the significant strides made, remains a contentious topic in international research. This paper aims to make a scientific contribution to the challenge of studying internal migration through less explored methods. This challenge

is particularly important for Italy, a country significantly affected by internal migration. Before the unification of Italy (1861), the peninsula was divided into many small states that differed in language, culture, customs, and economy (Gramsci, 2012). Even today, these differences persist and have led to internal migrations with specific characteristics that have changed over time (Pipitone *et al.*, 2022). Since the mid-1990s, migratory behavior on the Italian peninsula has changed significantly (Golini & Reynaud, 2010). The origins and destinations of the flows, which were previously characterized by a clear prevalence of moving from the south to the center-north (Marini & Busetta, 2005), are now much more heterogeneous and complex (Bonifazi & Heins, 2017). The new attractiveness of the northeast and the growth of shifts between the northeast and northwest have led to an increase in non-traditional migratory trajectories (Bubbico *et al.*, 2011).

In addition to the shifting migratory flows, the characteristics of the individuals that drive such mobilization have also altered. In the past, internal migration was more concentrated among relatively young adults, but in recent years, the age profile has changed (Bonifazi *et al.*, 2012). On the one hand, the migrating population has been experiencing aging, but on the other, an increasingly important role has been played by young graduates, fueling a very lively discussion about the escape of the top talents from the south of Italy (Piras, 2007; Basile *et al.*, 2019). During the same period, the number of women engaging in internal migration increased, filling the gender gap in internal migration between Italians' geographical macroregions (northwest, northeast, center, and south), which, in the past, was dominated by men (Di Bartolomeo & Golini, 2010). In the light of these increasingly atypical, temporary (based on the growth of commuting), and widespread (due to the increasing ease of moving) shifts, the study of migration based on the duration of residence in a territorial area has become particularly important. The international literature has already shed light on a positive association between the length of residence and well-being, education, and employment of the immigrant population (Malmusi *et al.*, 2010; De Valk *et al.*, 2011). However, estimating the duration of residence is not always possible. It is generally calculated based on retrospective questions that refer to a limited number of years. Moreover, the data are not always provided (in the Italian context, it would not have been possible to reconstruct the duration of residence with retrospective questions for the period studied in this work). To overcome these limitations, we propose to study internal migration by measuring the duration of residence where each birth (hypothetical) cohort lives throughout their lives. This approach is in line with the previous studies (DeWaard & Raymer, 2012; DeWaard *et al.*, 2017) that have already shown the validity of using this type of measure based on multiregional approach (Rogers, 1995).

Although many factors (*i.e.*, economic characteristics of the area of origin and destination, quality of life, efficiency of institutions, and infrastructure) have been considered in the study of recent internal migration flows and dynamics (Greenwood, 1997; Crown *et al.*, 2020; Pipitone *et al.*, 2022), to the best of our knowledge, only a few studies have focused on the role played by the migrant's place of birth. This is quite surprising since, according to past and even more recent research, the international literature has shown that place of birth plays a relevant role in shaping migration choices both internally and abroad (Long & Hansen, 1975; Rogers & Belanger, 1990; Abel, 2013). There is no doubt that one's place of birth still constitutes a powerful background variable on the basis of which individuals shape their existence, values, and aspirations. Migration behavior is also strongly linked to this variable, especially in a country like Italy, which is characterized by deep spatial disparities and even inequalities that generate different propensities to move (Biagi *et al.*, 2011; Basile *et al.*, 2012).

Considering place of birth is of central importance in the study of internal migration. First, Italian regions are characterized by distinct cultures, economies, and even languages (Basile *et al.*, 2012; Gramsci, 2012). These characteristics are signs that the Italian context could be treated as studying international migration among countries (where the place of birth of migrants is a crucial variable). This holds significant relevance working in terms of macroareas, as proposed by Bernard & Vidal (2023). Second, place of birth is linked to the concept of identity (Tajfel, 1981; Akerlof & Kranton, 2000); in other words, it allows for identifying the sociocultural roots of those who migrate, which constitute key information about those who change residence. Third, considering the place of birth allows for distinguishing the shift of those who return to it, those who leave it and those who move between two territories that do not involve their place of birth. Therefore, knowing the place of birth enables determining the type of migration flow (Bonifazi *et al.*, 2021). Fourth, individuals' place of birth changes their propensity to migrate. Prior research shows that the risk of migration is much higher among persons returning to their place of birth, and the duration of residence is affected by this variable (Rogers, 1995; Long & Hansen, 1975; Ledent, 1980). For all these reasons, we applied Rogers' (1995) multiregional model place-of-birth-dependent approach (Ledent, 1980) to assess the internal migration flows within Italy.

Unlike studies where the multiregional life table is applied to international migrations, we used place of

birth not to identify migrants born abroad, but those born outside the macroregion considered (Ledent, 1980). Moreover, considering life expectancy offers measures for effectively characterizing internal migration behaviors, allowing for effective and robust comparisons. These behaviors have a bearing on the migratory choices in future between macroregions, which were shaped since young age (Casacchia & Strozza, 2002). This approach helps deepen our understanding of migration dynamics, facilitating formulation of informed migration policies, and addressing the challenges and opportunities associated with the migration of the population. In the case of Italy, however, contemporary research tends to preclude this variable in relevant analysis, with very few exceptions (Impicciatore & Strozza, 2016).

The fundamental idea behind our analysis is that place of birth (like in the case of the study and modeling of international migration) acts as a pivotal variable in understanding internal migration dynamics and trends and, therefore, it cannot be ignored. In other words, knowing the area of birth helps the researcher predict and interpret internal migration within a specific country under investigation. On the basis of these premises and the main international literature on the topic, we propose an approach that outlines the role played by the place of birth in internal migration within Italy from 2002 to 2013, while also considering gender and age. The model used is the multiregional model place-of-birth-dependent approach, that is, the multiregional model of Rogers (1973) taking into consideration the place of birth of whoever migrates (Ledent, 1980). Our goal is to provide accurate measurements of internal migration, noting the years of life expectancy for each birth cohort living in each geographical macroregion of Italy. Our research questions are as follows:

(i) How does internal migration differ if it is distinguished by place of birth?
(ii) Are there different migration patterns for each birth cohort?
(iii) How has the ability to absorb years of life expectancy from other birth cohorts changed in each macroregion in the past 15 years?
(iv) Are there gender differences among birth cohorts?

This paper is structured as follows: in the next section, a brief description of Italian migration between geographical macroregions is provided, and the subsequent section briefly reviews the literature on the multiregional model of the place-of-birth-dependent approach. The sources of data and research methodology are described, and the results obtained through the application of the multiregional model are presented. Finally, this work offers some discussions and conclusive remarks.

1.1. Internal migrations between geographical macroregions in Italy: A brief overview

Migration from the south to the rest of Italy became more noticeable between 1955 and 1975 (Golini, 1974; Bonifazi & Heins, 2000; Bonifazi *et al.*, 2021). Explanations for this intensity of migration included, on the one hand, the abandonment of the rural areas in favor of urban centers and, on the other, the industrial success attained in northwestern Italy, the most attractive migration destination for the south (Bubbico *et al.*, 2011). During that period, the Lazio region (particularly Rome, the capital city of Italy) became the most alluring destination of migration, attracting flows mainly from specific regions of the south such as Abruzzo, Campania, Puglia, and Sardinia. In this case, the shifts were primarily noticeable in the field of public administration and construction (Primavera, 2002).

In the 1970s and 1980s, the downsizing of economic growth and financial difficulties in Italy led to a reduction in the magnitude of migration flows between macroregions and a growing lack of interest by scholars in this field of study (Bonifazi, 1999; Bonifazi *et al.*, 2014). In the early 1990s, an economic recovery led to a non-negligible growth in industrial equipment in Italy. During this period, industrial growth was no longer focused solely on the northwest, but also on the northeast. For this reason, internal migration continued to grow again, mainly through the flows from the south (Bonifazi & Heins, 2000; 2017) and the migration of immigrants who arrived in Italy from abroad (Bonifazi *et al.*, 2012).

At the beginning of 2000, the migration flows maintained a similar increasing trend was still, reminiscent of those in the previous decade. The flows were no longer concentrated solely in the northwest. At the same time, the central macroregion continued to be an important destination, while the northeast was becoming more appealing for migrants. The growth of temporary work contracts, the enlargement of the services sector, and the rise in small businesses also led to northeast areas becoming important destinations of migration flows (Crisci & Di Tanna, 2016). In recent years, in fact, short-range shifts have increased, leading to a renewal of the migration momentum between the northwest and northeast of the country, due to the so-called housing carriers boosted by the Italian middle class (Bottai & Benassi, 2016).

In 2008 – 2009, due to the economic crisis, internal migration suffered another setback, before returning to pre-crisis levels in subsequent years (Bonifazi, 2015). In those years, the internal migration of residents in Italy was also characterized by a change in the patterns relating to age of migration. The emigration rate among young people, compared with previous years, grew intensely

(Staniscia & Benassi, 2018). In total, the number of those who abandoned the south from 1995 to 2008 was approximately 1 million people aged between 20 and 40 (Cantalini & Valentini, 2012). Yet, while in the 1990s, it was individuals between 20 and 25 years of age who had the highest propensity to migrate, in the following decade, it was those between 25 and 30 years old who were most likely to do so (Svimez, 2009).

More recent studies on the internal migration flows in Italy confirmed the persistence of a south to north migration axis (Benassi *et al.*, 2019a) and even the resurgence of the importance of metropolitan areas in attracting internal migration, especially foreign citizens residing in Italy (Strozza *et al.*, 2016; Benassi *et al.*, 2019b). Persistent and even increasing socioeconomic disparities between the different areas of the country seem to continue to play a fundamental role in defining the migration mechanism and intensities across Italy (Buonomo *et al.*, 2023). In this general framework, foreign citizens are in some way overlapping their internal migration trajectories to the ones of Italians, but with higher intensities (Casacchia *et al.*, 2022). Distinctions such as age at migration, types of trajectories, and returns to the macroregion of origin represent the core variables of the present study of internal migration in Italy.

It is important to bear in mind that the studies presented so far used the traditional approach, where migratory trajectories are generally measured through the calculation of rates or propensities distinguishing, at most, gender, age, and direction of displacement. In contrast, migration measures based on the multiregional approach enable us to obtain a much more effective vision of the process of mobility (Rogers, 2008). In particular, the place-of-birth-dependent approach presented here, which has never previously been utilized in the measurement of migration trajectories in Italy, allows for obtaining a much more effective perspective, perhaps the most useful in light of the existing methods in demography and the data available. This measurement is not affected by bias caused by the different size of the groups observed and/or their different structural characteristics (Rogers, 2015). Therefore, highly accurate measurement of migration propensity can be made. In other words, this method allows access to the field of "pure" measures in the field of demography, devoid of compositional effects that could exert a strong perturbing effect on the measurement of the true extent of internal migration (Willekens, 2016).

The information regarding the flows distinguished by age, gender, place of birth, and direction of movement is best summarized with this approach, which leads to a comparison of four typical individuals (eight if we consider that the construction of table was based on gender), for each of which we measure the intensity that the four macroregions demonstrate in attracting portions of the life expectancy at birth (e0) for each of the types. In the next section, we present how the internal migration was analyzed based on the macroregion of birth of those who change residence using Rogers' multiregional life table model (1973).

2. Data and methods

2.1. Traditional life table and multiregional life table

The traditional life table is a central concept in demography. Its use allows us to follow the survivorship of a closed group of people born at the same time. Such a cohort decreases over time until its extinction with the death of the last individual (Preston *et al.*, 2001). The key element of this instrument is the certainty of the irreversibility of the transition from surviving to deceased status (Preston *et al.*, 2001). There are extensions of the life table, in particular the multiple decrement life table, which allow for distinguishing between different causes of death (Land & Rogers, 1982). However, the traditional life table does not allow us to follow the transitions of repeatable events. In other words, it does not permit us to follow people who have moved from one state to another and to analyze their subsequent experiences (Ledent, 1980). A single-region life table shows only the life expectancy of people who remain in one specific region, and migration is completely disregarded (Rogers & Willekens, 1986). More complex tables can overcome this limitation by considering not only irreversible events but also renewable and subsequent ones, through the construction of a table characterized by a plurality of inputs and outputs (Rogers, 1973). These tables, also called increment-decrement life tables, enable us to study marriage and divorce, employment, birth, and internal migration. In the latter case, we refer to multiregional tables (Rogers, 1973), which are the subject of this study. Many different varieties of migration data have been employed as inputs for the multiregional life table, and several methods of converting these migration data and associated mortality data into the probabilities needed in the life table have been suggested (Rees & Wilson, 1975; Rogers & Ledent, 1976; Ledent, 1978). There are many applications of the multiregional model (Ledent & Rees, 1980), and the robustness of these results has been extensively demonstrated in comparison to those derived from the computation of traditional measures, including total and age-specific migration rates (Philipov & Rogers, 1981; Jozwiak, 1992; Halli & Rao, 2013).

In general, multiregional tables are based on two rigorous assumptions. On the one hand, the homogeneity

of the population and, on the other, the population follows the rules of the Markov chain model (Ledent, 1980). In other words, the transition from one state to the next, by the observed population, depends only on the immediately preceding state (in our case survivorship and migration) and no account is taken of the history that determined it. Another important element to consider is that multiregional life tables are built for contemporaries (Rogers, 1995). Indeed, a longitudinal approach would require a great deal of information with a huge number of details that are, at present, rarely (if ever) provided by the national statistical offices. Therefore, the kind of information used to construct such tables plays a crucial role. Ordinary multiregional tables, however, are characterized by a strong element of approximation; they are developed based on the place of residence of the population (and not the place of birth). In addition, the starting cohort of the traditional table is considered a birth cohort although it is created without using information on the place of birth of individuals (Willekens & Rogers, 1978; Rogers, 1995). Yet, as has been widely demonstrated, the propensity to migrate depends on the place of birth of the individuals (Long & Hansen, 1975) and, therefore, it is very important to take this variable into account.

2.2. Building multiregional life table for Italy

The multiregional table built in this study is defined as the "place-of-birth-dependent approach" (Ledent, 1980; Rogers, 2015), which creates tables distinguishable from those built through the traditional approach based only on the place of residence (the place-of-birth-independent approach). In Italy, life tables are built precisely through the traditional method based on the location of residence while neglecting the place of birth (Bertino *et al.*, 2015). This instrument is largely used to make demographic forecasts in national official statistics (Italian National Institute of Statistics [Istat], 2017). However, official Italian statistics do not provide data about the resident population classified by place of birth. It should be noted that such data are available only in the years of the census. The aim of this research is to investigate internal migration using the multiregional model of the place-of-birth-dependent approach. The multiregional life table requires the availability of stock data on the resident population and flow data, particularly births, deaths, immigration, and emigration both inside and outside the country.

In our application, the multiregional life table takes the place of birth of both the resident population and the migratory flows into account. However, as mentioned above, Istat only provides data of the population by region of birth in the census years (in our reference period, 2001 and 2011). Therefore, a preliminary allocation of the region of birth to the Italian population during the period 2002 – 2013 was necessary (for a detailed overview of the applied procedure, see: Buonomo & Strozza, 2020). The period chosen for reference ranges from January 01, 2002, to January 01, 2013. We divided this period into four triennials (2002 – 2004, 2005 – 2007, 2008 – 2010, and 2011 – 2013) and focused on macroregions (northwest, northeast, center, and south, Figure 1) with respect to both residence and place of birth. This aggregation assured us that while dividing our population and internal migration flows, apart from gender and age, even by macroregion of birth, the frequencies obtained were strong enough to ensure statistically valid results. It also confirmed that flows between macroregions were never equal to zero. We chose single years of age and decided to create an open-ended class (70 years old and more) to obtain the highest possible adherence to the data released by official Istat statistics. After obtaining the distinct population by macroregion of birth, it was possible to move to the multiregional table using Rogers' suggested formulas. In our annotations, we use "i" to indicate the macroregion of origin and "j" the macroregion of destination of the internal migration flows (we place the age in brackets on the right side of the capital letter, like in Rogers' [1995] annotations). We always refer to "origin" to indicate the macroregion where the migration flow starts; conversely, we use the locution "place of birth" to indicate where individuals are born. In other words, we never use the term "origin" to indicate the birthplace.

It is important to recall that in Rogers' (1973; 2015) multiregional model, international migrations simultaneously act as both disturbing and competing events. Therefore, in the denominators of multiregional probability formula, there are no international migrations. In other words, this approach only indirectly considers international migrants because they are included in the population considered and they can engage in internal migrations as well. According to Rogers (1973), these limits do not have a significant effect on the construction of the number of years of life expectancies in other macroregions or on in the interpretation of results.

The first operation required to calculate the multiregional table was the determination of mortality and emigration rates by age. We calculated the specific mortality rates (${}^{b}m_{i}$) for the origin of each migration flow (i), sex (s), age (x) and macroregion of birth (b), and for each of the four triennials (t). The annotation "i" represents both the macroregion of origin of the emigration and the place of residence of the population considered. In other words, we considered the macroregion of residence (r) equal to the macroregion of origin of internal emigration (i); therefore, r = i. We also measured the specific emigration rate by age (x), origin (i),

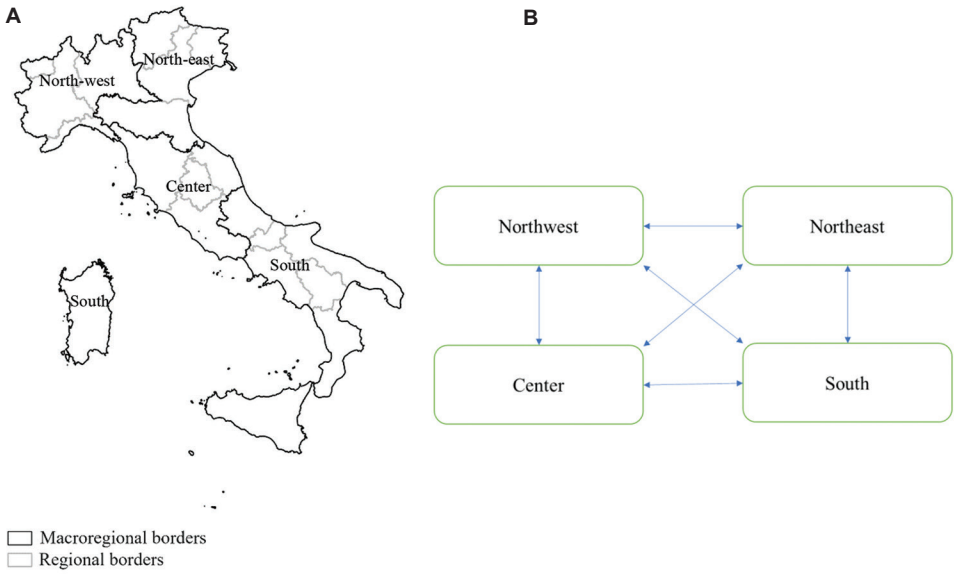

Figure 1. Regional and macroregional borders of Italy (A) and diagram of origin and destination of internal migration trajectories (B)

and destination of migration flows (j) with j ≠ i. This is the 1st time that an Italian multiregional table has been built while taking into account the macroregion of birth.

Once the rates were obtained, it was possible to apply the passage formulas to measure the probability series (death, emigration, and permanence). In our approach, consideration was also given to the probability of emigrants dying if they remained in a mentioned territory ($^{b}P_{i,i}$).

Clearly, since death is unavoidable, the matrix of probabilities has been closed by making the probability of death equal to 1 for the final open age class (70 and older years) and, of course, the remaining probabilities equal to 0 (emigration and permanence).

After these preliminary calculations, we calculated the survivors' series (l), the deaths of the table (d), the total number of years (L) lived in the macroregion j (or k) among the ages y and y+1 by individuals observed in the macroregion j (or k) at age y who lived in the macroregion i at age x applying Rogers' (1973; 2015) formulas. Therefore, "j" and "k" indicate two different macroregions of destination. The point (.) is used to signify that all the macroregions are jointly considered. This procedure, consistent with the traditional Rogers' model (2015), has assured us greater confidence of the results.

Finally, after the calculation of the total number of years lived (T) using Rogers' (1973) approach, the life expectancy (e) from the age y in the macroregion j of the cohort formed in i at x age was obtained as follows:

$$ {}^{b}_{ix}e_{j}(y) = \frac{{}^{b}_{ix}T_{j}(y)}{{}^{b}_{ix}l_{.}(y)} \quad \text{(I)} $$

$$ {}^{b}_{ix}e_{.}(y) = \frac{\sum_{j=1}^{3} {}^{b}_{ix}T_{j}(y)}{{}^{b}_{ix}l_{.}(y)} \quad \text{(II)} $$

To grasp the role played by age (x) in relation to migration between macroregions, a measurement of "temporary life expectancy" (Arriaga, 1984) has been constructed. This indicator represents the life expectancy between two age groups and can be represented with the following formula:

$$ {}^{b}_{i}e(x) = \frac{{}^{b}T(x) - {}^{b}T(x+n)}{{}^{b}l(x)} \quad \text{(III)} $$

In this case, "*n*" is a generic number of years.

The last three variables indicated represent the main measures on which the analyses proposed in this contribution will focus.

3. Results

3.1. The survivorship history of the birth cohort

The construction of the multiregional table has allowed us to follow the survivorship and the migration history of four birth cohorts in relation to the four Italian macroregions (northwest, northeast, center, and south) from 2002 to 2013 (survivors and life expectancy by age, gender, and macroregion of residence). As already stated, according to international literature, the place-of-birth-dependent approach is of higher accuracy. This approach enables

not only following the survivorship history of the various cohorts but also keeping track of their migration history from one macroregion to another. We can study their internal migration with higher accuracy to the analysis conducted using the traditional rates of emigration. Before moving on to examine life expectancy, it is interesting to explore the survivorship profiles distinctly by macroregion of birth. In a dynamic sense, all cohorts have had such a trend. In fact, survivors outside the macroregion of birth first dropped in 2005 – 2007 and in 2008 – 2010 and then reached values higher than the first 3 years (2002 – 2004) in the 2011 – 2013 periods. This evolution can be observed in all birth cohorts, for both males and females. Figure 2 depicts the survivorship of men from 2011 to 2013. On the vertical axis, the figure indicates the survivorship by macroregion (values per thousands) and on the other axis the age. As described above, the root of the table is 100,000 individuals. This figure offers a glimpse into the hypothetical history (both migratory and death-related) of the birth cohort formed by 100,000 individuals from the age of 0 to 70. In this way, for each age and for each birth cohort, the sum of survivors by macroregion of residence plus the cumulative deaths always returns to a total of 100,000. At this point, it will be clear that at age 0 there are no deaths and the whole cohort of 100,000 individuals is alive in the macroregion of birth; vice versa, after age 70 all 100,000 individuals have died.

Figure 2 shows that the males born in the northeast comprise the main cohort with the fewest individuals outside the birth area. In addition, when they leave the macroregion of birth, most of their migration flows are concentrated toward the northwest. On the other hand, the cohort of males born in the central regions and those born in the northwest show similar patterns of migration. They have a certain equal distribution in the macroregions (outside the macroregion of birth). As expected, the cohort of males born in the south is the one that has the greatest amount of survivorship outside the macroregion of birth. Compared to the other macroregions of birth, in percentage, in fact, the values are almost triple. Female survivors show similar profiles. However, there are important gender differences that should be highlighted. Figure 3 is obtained by subtracting survivorship by age of females from the corresponding males (males minus females), distinctly by birthplace in 2011 – 2013. In this way, when the values in Figure 3 are placed on the negative side of the y-axis, the values for females exceed those of the males. The opposite happens on the positive side.

In essence, the graph obtained is strongly influenced by the greater mortality of males compared to females. For this reason, for all cohorts of birth, there is a prevalence of the cumulative deaths on the positive side of the y-axis. However, based on what has been said, the cases in which survivors in other sections are predominantly male are

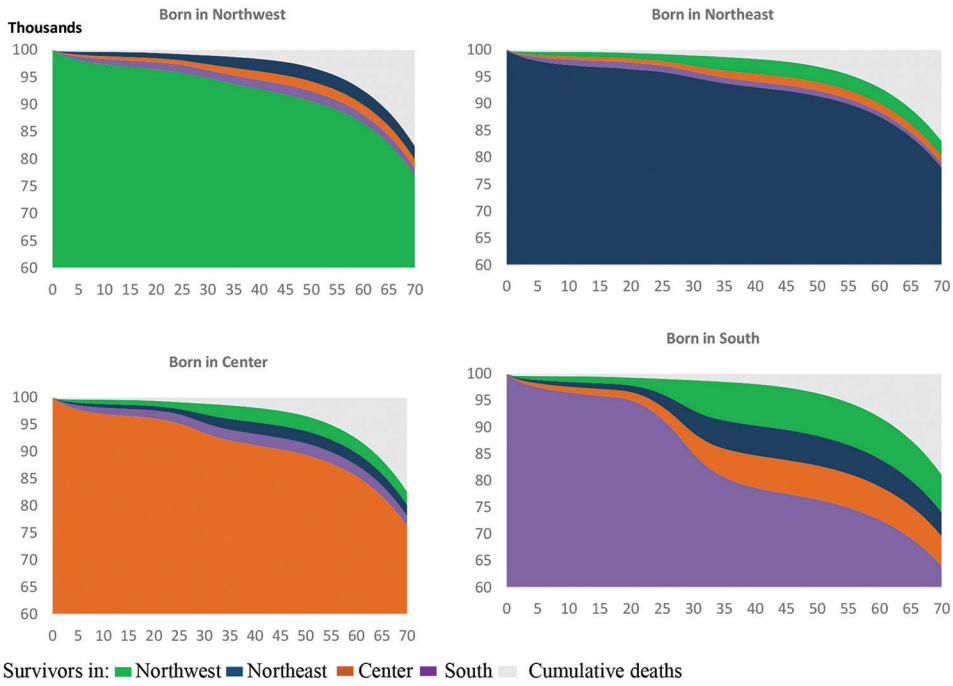

Figure 2. Survivorship of males represented by age, macroregion of residence, and macroregion of birth from 2011 to 2013. Data are expressed in values per thousands.
Source: authors' elaborations based on Istat data (estimates).

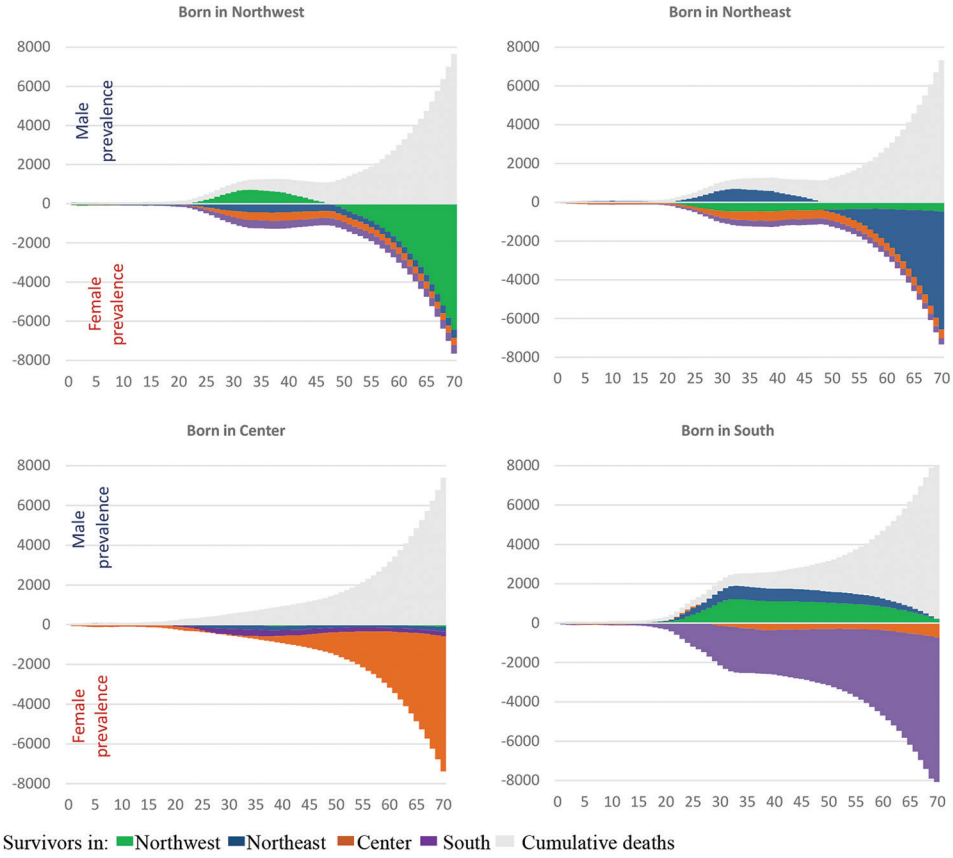

Figure 3. Gender difference (males minus females) in survivorship and cumulative deaths represented by age, macroregion of residence, and birth from 2011 to 2013.
Source: authors' elaborations based on Istat data (estimates).

particularly notable. Having highlighted these important premises, we can see that in the central regions, except for a small prevalence of male survivors in the northwest up to 26 years old, the prevalence of the cumulative deaths is still predominant. In both macroregions of the north (northwest and northeast), more males than females, up to approximately 50 years of age, survive in the macroregion of birth. The birth cohort in the south stands out as following a completely different pattern. Despite the male predominance in deaths, males born in the south that survive in the northwest and northeast are prevalent in all ages considered (including the older ones). Although this is interesting, the deaths make it difficult to interpret the migration flows. The study of life expectancy allows us to go beyond what we have just outlined and to draw sounder conclusions on the migration between the macroregions of each birth cohort.

3.2. The life expectancy of each geographical macroregion by birth cohort

The construction of the multiregional table has enabled an analysis of life expectancy for each birth cohort. In Table 1, the e0 for each birth cohort is studied without distinction in which macroregions the years of life expectancy are lived (for example, the life expectancy of those born in the total northwest, without distinguishing in which macroregion such a cohort spends its years of e0). The differences between the values obtained with the multiregional model and the life expectancy data derived from the Istat tables (traditional uniregional model) are relatively small. The major differences occur in the first and last 3 years. Between 2002 and 2004, there are major differences concerning the northwest for both genders (−0.97 for males and −1.17 for females). In 2011 – 2013, however, the highest difference relates to the south, especially for females (0.50 for males and 0.84 for females). Overall, the observed variances can be considered small. In the first place, this is due to the different time intervals analyzed. In fact, the multiregional model is built on four triennials, while the Istat data relate to the past year of the corresponding 3-year period. A second element of difference is that the multiregional table is built on the basis of the macroregion of birth, whereas Istat data refer to the resident population in their respective allocations. Finally, international research has already highlighted that the variations between e0 in uniregional and multiregional

Table 1. Comparison of life expectancy at birth estimated by multiregional approach and estimated by Istat. Italian macroregions, 2002-2013

Birth cohort	Males			Females		
	Multiregional	Istat	Differences*	Multiregional	Istat	Differences*
	2002–2004	2004		2002–2004	2004	
Northwest	76.83	77.80	−0.97	82.63	83.80	−1.17
Northeast	77.48	78.26	−0.77	83.42	84.16	−0.74
Center	77.95	78.27	−0.32	83.42	83.70	−0.28
South	77.56	77.62	−0.06	82,99	82.97	0.03
	2005–2007	2007		2005–2007	2007	
Northwest	78.40	78.70	−0.30	83.59	84.17	−0.59
Northeast	78.83	79.11	−0.28	84.21	84.52	−0.30
Center	79.05	78.96	0.08	84.52	84.19	0.32
South	78.55	78.02	0.53	83.32	83.09	0.24
	2008–2010	2010		2008–2010	2010	
Northwest	79.07	79.35	−0.27	84.15	84.48	−0.32
Northeast	79.40	79.78	−0.38	84.64	84.97	−0.33
Center	79.56	79.46	0.10	84.53	84.44	0.09
South	78.88	78.70	0.17	84.10	83.62	0.48
	2011–2013	2013		2011–2013	2013	
Northwest	79.70	80.04	−0.34	84.59	84.89	−0.30
Northeast	80.12	80.36	−0.24	84.83	85.19	−0.35
Center	80.03	80.04	−0.01	84.76	84.77	−0.01
South	79.66	79.16	0.50	84.75	83.91	0.84

Notes: *Istat data minus multiregional life table birth-dependent approach data.
Source: Authors' elaborations based on Istat data (estimates).

life tables are equal to the values included between −1.5 and +1.5 (Rogers, 1995). Table 1 confirms what is already known: e0 is increasing over time for both males and females and the gender differential is decreasing in all birth cohorts. What is more interesting is to investigate where each birth cohort resides over their years of life expectancy, an operation that of course can only be achieved using the multiregional life table.

Figure 4 shows, for males, the percentage of years of e0 lived outside the birth macroregion distinctly for each birth cohort. The birth cohorts are on the x-axis, while the macroregions where the years of e0 are lived are differentiated by color. As predicted, the trend of time is the one described above with respect to survivorship: for both males and for females, the trend is decreasing from the first 3 years (2002 – 2004) to the second (2005 – 2007) and then reversed in the last 3 years (2011 – 2013). Males born in the south in 2011 – 2013 live outside the birth macroregion for 14.4% of their e0 (5.8% in the northwest, 4.6% in the center and 4% in the northeast). Considering the other birth cohorts, the percentages are much lower. Central Italy is the second macroregion of birth for a life expectancy lived in another macro-area with a total of 5.7%, 8.2 percentage points less than in the south. In addition, 2.1% of e0 live in the northwest, the macroregion that is marked by the highest percentage. Second place in the ranking is the south (1.9%), which shows an important role played by distance and returns (Bonifazi & Heins, 2017). Those born in the northwest and in the northeast make up 4.7% and 4.4% of e0, respectively. If those born in the northwest comprise the main share of e0 in the northeast (2%), in the same way, the cohort born in the northeast mainly lives its e0 in the northwest (2.2%). Moreover, in all 4 time periods considered, the northeast has the lowest e0 spent in the south (1% in 2011 – 2013).

Figure 5 compares the percentage of male and female e0 in those living outside the macroregion of birth. Using percentages, it was possible to control the highest mortality of males and to make more effective gender comparisons. When the rectangle is above the x-axis, e0 in areas lived outside the macroregion of birth is higher for males. The opposite is true when the rectangle is below the x-axis. For cohorts born in the northwest and northeast, females have higher percentages of years lived outside the macroregion

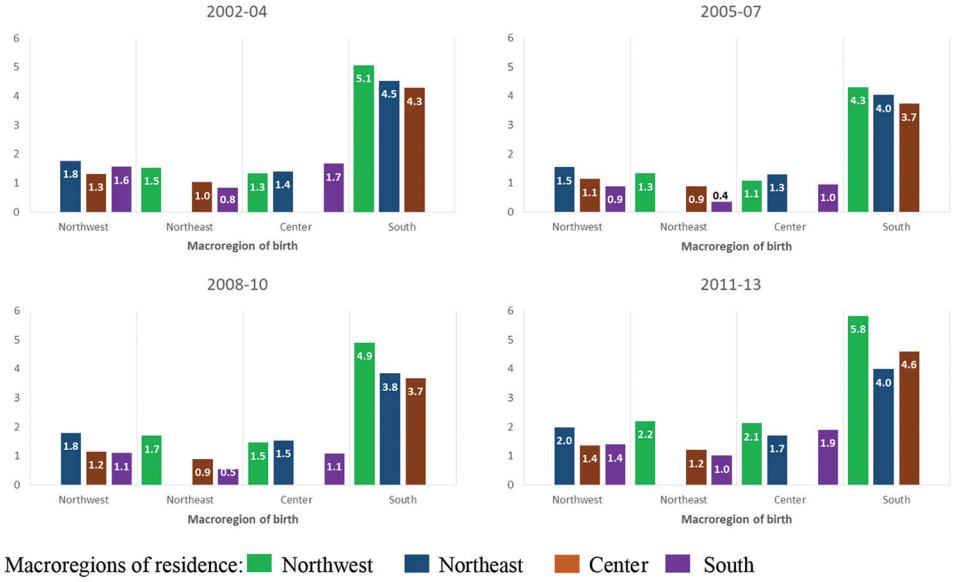

Figure 4. Percentage of life expectancy at birth of males living in a macroregion other than the macroregion of birth from 2002 to 2013. Source: authors' elaborations based on Istat data (estimates).

of birth. The gender differential for these cohorts also increases over time (from −0.5% in 2002 – 2004 to −0.7% for northwest and −0.8% for northeast in 2011 – 2013). The south is traditionally characterized by migration related to searching for a job (Bonifazi & Heins, 2017), and there is a clear male prevalence. It should be stressed, however, that in 2011 – 2013, the prevalence is higher in females than males if we consider central regions as the only destination. In addition, as shown in the graph, the gender differential in the birth cohort in the south falls from 0.7% in 2002 – 2004 to 0.5% in 2011 – 2013 (although with a fluctuating trend over time). Finally, the birth cohort in the central regions has a greater gender balance throughout the time interval.

Figure 6 shows the "temporary life expectancy" of the 3-year period 2011 – 2013 of those who live their years of life expectancy outside the macroregion of birth divided by gender. The age classes distinguish young people (0 – 19 years), adults (20 – 39 years and 40 – 59 years), and finally, those who are about to leave the labor market or have already left (60 years and older). Note that life expectancy is not expressed as a percentage in this figure. Therefore, the comparison of males and females can only be made considering the lower mortality rates of females, especially concerning the elderly (see survivorship in previous section). Individuals born in the south, in all age groups, have a temporary life expectancy that is higher than the other cohorts of birth for both males and females. The temporary life expectancy of the births in this macroregion rises as the age increases and then decreases in the final age

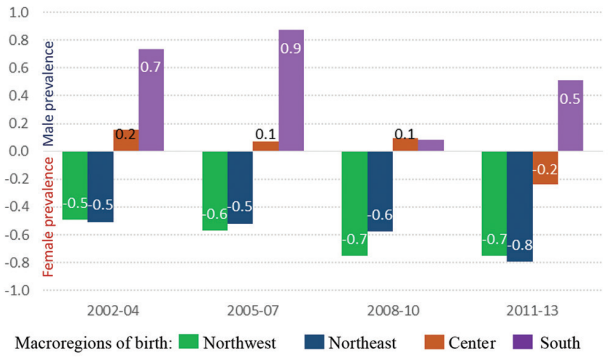

Figure 5. Gender difference (males minus females) in percentages of life expectancy at birth lived outside the macroregion of birth from 2002 to 2013. Gender difference in favor of males is evident when each chart is above the X-axis, denoting higher life expectancy at birth lived outside the macroregion of birth for males, and vice versa. Source: authors' elaborations based on Istat data (estimates).

class. Individuals born in the central regions of Italy are ranked second in all age classes with a profile that resembles (by age) that of those born in the south. The profiles of the birth cohorts in the north are more varied. Individuals born in the northeast take higher values than northwestern births in the first class (0 – 19 years). However, the northwest has a higher temporary life expectancy (compared to the northeast) after 50 years. In terms of gender differences, we immediately notice a clear split between those born in the south and center-north macroregions. In the latter macroregion, female temporary life expectancy (out of the macroregion of births) is higher than that of males.

The model of the south is different. In this birth cohort, temporary life expectancies lived outside of macroregion of birth by males are higher than those of females in all age classes, except for individuals 0 – 19 years old.

What percentage of e0 does each macroregion absorb from each birth cohort? Figure 7 answers this question with reference to the period 2011 – 2013. Unlike the previous representations of e0, in Figure 7, each of the macroregions of residence (rather than birth) are included on the x-axis. The percentages of e0 absorbed from each macroregion of birth are differentiated with different colors. As expected, it is the northwest that most attracts those born in other macroregions. However, similar to other macroregions of residence, life expectancy quotas are absorbed above all from those born in the south. The percentages of e0 absorbed from the central macro-area and from the northeast in northwest are notable (approximately 2% for both males and females). The south, on the other hand, is the least attractive macroregion in this regard. When analyzing the gender differences, we found that the second most attractive macroregion for the males is the northeast (7.4% for males and 7.6% for females), while it is the center for females (7.0% for males and 7.9% for females).

The most recent 3-year period considered (2011 – 2013) has both greatest highest number of out-of-region survivors outside the macroregion of birth and the highest e0 lived outside the birth macroregion values of all the 3-year periods considered. This result is probably a consequential effect of the Great Recession (Bonifazi & Heins, 2017).

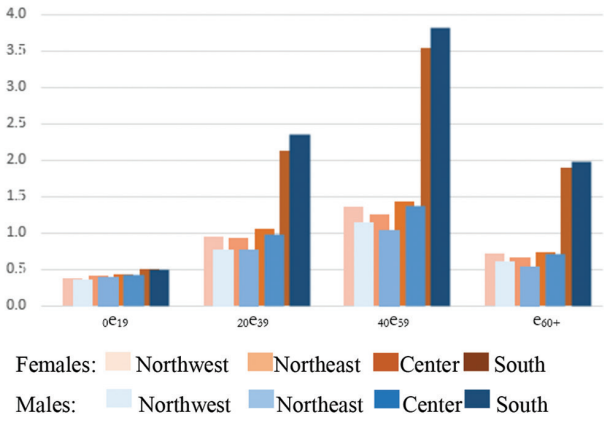

Figure 6. Temporary life expectancy (0 – 19, 20 – 39, 40 – 59, 60+) in a macroregion of residence other than macroregion of birth from 2011 to 2013.
Source: authors' elaborations based on Istat data (estimates).

4. Discussion

In the study of mobility (both internal and international migration), place of birth is widely used in analyses conducted by international scholars (Molloy *et al.*, 2011; Abel, 2013). This approach enables distinguishing whether the migrant's place of birth serves as the origin or destination of migration, thereby allowing consideration of the amount of time spent by the individual in their birth territory. The construction of the multiregional life table using the place-of-birth-dependent approach has allowed us to follow, for the 1st time in Italy, the migratory history and the survivorship of individuals born in the four Italian macroregions. The obtained results provide a perspective that enriches the one traditionally obtained using the area of residence and indicate that the use of place of birth is important for understanding internal migration.

Implementing Rogers' multiregional model place-of-birth-dependent approach allows for more precise analyses and accurate results based on standardized comparison between cohorts. These are considered more reliable in contrast to using only the place of residence. This work represents, in our view, a starting point for further research that, on the basis of the achieved results, appears necessary. Knowing how many years have been spent in each macroregion by the different populations can help policy makers in planning more specific policies and interventions in terms of taxation and inclusion, as well

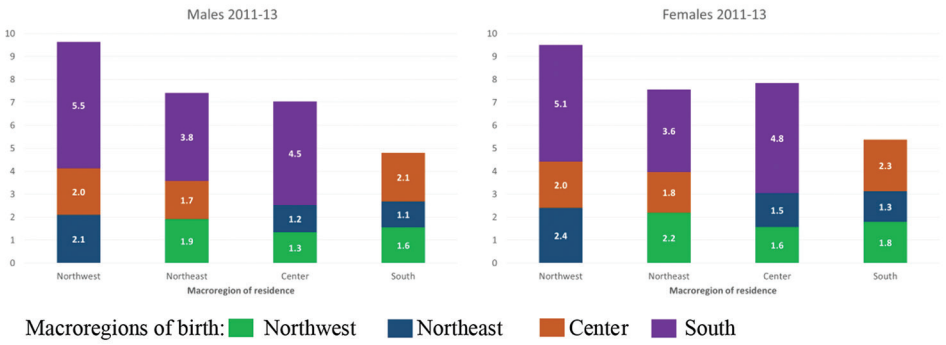

Figure 7. Life expectancy at birth from each macroregion, other than that of residence, from 2011 to 2013

as preventing brain drain migration (especially from the south to the other Italian's macroregions). Furthermore, the results highlight the importance of collecting information on the birthplace of those migrating, as well as considering the origin and destination (residence) of migration trajectories. Since the migrant's place of birth opens up new frontiers in the analysis of internal migration, this variable should also be included in other types of analysis such as gravity models or statistical inference to explore the weight, direction, and role played by this important variable in the internal migrations of different European countries.

The results of this contribution encourage the use of an approach that is replicable by scholars and, most importantly, by statistical institutes and offices (at both the national and regional/local level) for the study of internal migration in a more accurate way, using a new perspective for analysis. This is particularly important in Italy because, to the best of our knowledge, this approach is not currently provided by Istat. This contribution does, however, have some limitations that are worth mentioning. The period considered is 2002 – 2013, due to availability of data. Istat usually does not provide information on the place of birth of the internal migration; therefore, we used *ad hoc* elaborations that are available only for this period. However, since the purpose of this paper is to test the association between internal migration and place of birth, the period considered is not a relevant limitation for our investigation. We believe that our results will encourage and motivate national (and international) statistical institutes to collect and disseminate official data about the place of birth of the population broken down by age, gender, and place of residence. Furthermore, since no previous work has adopted the same approach in Italy, we have no established reference analyses for us to compare our results with. A future development could be to incorporate age- and sex-specific rates of international out- and in-migration by making some specific assumptions to the model that we applied. This would overcome the current limitation of our approach, which is the indirect consideration of international migrants in the analysis (Rogers, 1995).

Essentially, our investigation has an explorative nature. We assumed that the multiregional life table and the place-of-birth-dependent approach were sufficiently well-established and the rigorous methods for empirically testing whether place of birth plays an important role in determining internal migration. This allowed us to distinguish specific migration patterns by highlighting that place of birth is indeed relevant to understanding migration mechanisms. It would be interesting to apply our proposed method to the study of internal migration during COVID-19 pandemic. Migrations between macroregions decreased due to the COVID-19 pandemic (Istat, 2023). The most important internal migration trajectory has remained the one originating in the south of Italy. However, compared to pre-COVID-19 years, migration from the south to the center-north decreased by approximately 17 percentage points. In other words, in Italy, as in other European countries, the pandemic had the effect of decreasing internal migration (González-Leonardo *et al.*, 2022). In the pandemic years, there was also a slight increase in internal migration from the north to the south of Italy. With our proposed approach, it would be possible to study whether the migrations to the south are returns to the migrants' place of birth. Furthermore, we expect that despite this migration dynamic, life expectancy years in the center-north are increasing during the COVID-19 pandemic and decreasing in the southern macroregion. Once the data are available, it will be interesting to answer these questions using the approach proposed in this paper.

5. Conclusion

In this study, we applied the multiregional model place-of-birth-dependent approach (Rogers 1995) to study internal migration in Italy in the period 2002 – 2013. This approach allowed us to: (i) estimate the duration of residence of migrants (which could not be estimated in any other way in Italy in the period here considered) and (ii) to focus on the migrants' place of birth, which has proved to be one of the most important determinants of internal migration (Rogers & Belanger, 1990; Abel, 2013). This approach reveals the significantly different migratory patterns for each (hypothetical) cohort of birth. International literature has pointed out that gender and distance between territories are some of the main determinants affecting the magnitude of migration flows worldwide (Abel & Muttarak, 2017). Our results indicate that in the case of Italy, those born in the northeast show the lowest levels of internal emigration compared to the other birth cohorts, with a large proportion of young people (0 – 19 years) moving to different macroregions. They are the least likely to live their years of e0 in the south. Indeed, those born in the northeast move mainly to the northwest, of which the migrants are predominantly women, against a backdrop with a rising gender differential over time. Moreover, the important role played by distance is evident, as there is a significant predilection for the neighboring macroregions. Distance is less important for those born in the south. In this case, it is probably the push factors (fewer job opportunities and a more fragile economic system) that play a crucial role. The internal migration of the northwest cohort is higher than that of the northeast cohort. Those born in the northwest concentrate their years of life expectancy in the northeast

especially, but the number of years lived in the south and in the central regions is also important. The northwest is particularly characterized as an area of attraction, showing, in 2011 – 2013, the ability to attract almost 10% of e0 of those born in other macroregions. The central macroregion stands out from the previous cohorts of birth examined, given the greater gender balance in migration to other macroregions.

This cohort is also characterized by an important presence in the south and a homogeneous distribution in all other macroregions. The birth cohort in the south, of course, is the one that has the greatest number of years of life expectancy in other macroregions. Interestingly, this cohort is the only one characterized by a male-predominant migratory model. An increasing number of migrating females, however, have reduced the gender gap over time. Compared to 2011 – 2013, most of the female migrants were of younger ages (and therefore less tied to searching for a job) and engaged with migration flows toward central Italy. However, it appears that job-seeking migration continues to be a male prerogative, although it seems that females are bridging the gap over time. The results obtained indicate that in the study of internal migration, birth cohorts play a central role and cannot be neglected. In light of these results, place of birth emerges as a crucial variable in the study of internal migration, underscoring the need to further investigate its role in future research.

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Conflict of interest

The authors report that there are no competing interests to declare.

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Writing – review & editing: All authors

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Data are available from the Italian National Institute of Statistics (Istat) on official request to the Istat.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Assessment of prenatal care adequacy using different normative criteria in a municipality in Santa Catarina, Brazil

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Abstract

The current study aimed to evaluate the quality of prenatal care and identify associated factors among women admitted for delivery at a public maternity hospital in greater Florianópolis, Santa Catarina. This cross-sectional study included women who had received prenatal care through the Government Unified Health System in the city of São José and had been subsequently admitted to the hospital for delivery from November 2021 to April 2022. Data were obtained from the pregnant women's booklet, their health records, and a specific questionnaire. The evaluation criteria included the Takeda-modified Kessner index, adapted adequacy of prenatal care utilization index, and Anversa classification. Adequacy was assessed based on pregnancy parameters and the patients' characteristics. Among the 237 pregnant women in the sample, prenatal care adequacy ranged from 48.5 to 83.1% and was associated with older age, education, referral to high-risk prenatal care (HRPN) (20 – 30% higher prevalence of adequacy), and pregnancy planning. Notably, there was a tendency toward a reduction in the number of examinations (laboratory and physical) during pregnancy. The adequacy rate decreased with the application of stricter normative criteria and in advanced pregnancy stages. In conclusion, prenatal care quality was predominantly adequate, although it varied across indices and was associated with age, education, HRPN, and pregnancy planning.

Keywords: Prenatal care; Quality of health care; Primary health care

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1. Introduction

Prenatal care is the assistance offered to pregnant women with the aim of ensuring maternal and fetal well-being, ultimately reducing the associated morbidity and mortality (Camargo *et al*., 2021; OPAS, 2018). Maternal mortality serves as an indicator of women's health and overall quality of life within a population. According to the World Health Organization (WHO), reducing maternal mortality rates requires ensuring quality health care for pregnant women and enhancing the collection of prenatal data (OPAS, 2018).

The first step in improving prenatal care in Brazil was the development of the Programa de Assistência Integral à Saúde da Mulher (PAISM, Program for Integral Assistance to Women's Health) in the 1980s, which expanded over subsequent years into the Política Nacional de Atenção Integral à Saúde da Mulher (PNAISM, National Policy for Integral Attention to Women's Health). The Programa de Humanização no Pré-Natal (PHPN, Prenatal Humanization Program), established in 2000 by the Ministry of Health (MoH), has been guiding health-care actions for pregnant women to this day. In 2011, the Cegonha network emerged to ensure the fulfillment of PHPN initiatives while defining new goals and conducts, which, from 2012 onwards, were updated in the Basic Care Book for Low-Risk Prenatal Care and in the Technical Manual for High-Risk Pregnancy. Recently, GM/MS Ordinance No. 2228, dated July 1, 2022, updated the Cegonha Network and provided qualification and funding for the *Rede de Atenção Materna e Infantil* (RAMI, Maternal and Child Care Network). Such initiatives have fostered an important expansion of prenatal care, reaching a coverage of over 90% of all regions in Brazil (Brasil, 2012a; Brasil, 2012b; Brasil, 2011; Brasil, 2022; Cruz *et al.*, 2019).

These national recommendations include early prenatal care (starting with up to 12 weeks of gestation), its periodic and continuous provision, the performance of specific examinations, gestational risk classification, and documentation in both the pregnant woman's health record and pregnancy booklet (Rodrigues *et al.*, 2020). However, the quality of care did not proportionally improve with the increase in coverage (Leal *et al.*, 2020; Esposti *et al.*, 2020), still falling short of the established recommendations (Pilau *et al.*, 2014; Martin *et al.*, 2022; Moron-Duarte *et al.*, 2021).

Several parameters underlie this evaluation, including information recorded in the pregnant woman's booklet, specific indices, and compliance with MoH guidelines. The Kessner index, developed in 1973, was one of the pioneering and widely utilized indices in literature (Kessner *et al.*, 1973). In 1994, Milton Kotelchuck adapted the Kessner index to facilitate cross-population comparisons (Kotelchuck, 1994). In Brazil, the Kessner index was modified by Takeda in 1993 to align with national guidelines (Takeda, 1993). However, the Kessner index did not align with the Brazilian guidelines due to the incorporation of additional tests beyond those recommended by the original index. All three evaluations were carried out quantitatively, utilizing variables such as the "beginning of prenatal care" and the "number of physician office visits" (Cruz *et al.*, 2019).

Although essential for evaluation, these indices do not precisely define the quality of care since the recommended number of visits or the beginning of prenatal care at the correct time does not ensure that patients receive all the recommended physical and laboratory examinations. In 2012, Anversa *et al.* grouped the quality of prenatal care into levels based on the fulfillment of other variables, providing a more comprehensive classification (Anversa *et al.*, 2012).

The lack of uniformity in evaluation criteria results in large variations in measurements and complicates comparisons of the studied populations. Thus, the objective of this study is to evaluate the quality and factors associated with prenatal care for women admitted for childbirth at a public reference maternity hospital in greater Florianópolis. The study considers the various indices available and compliance with the current guidelines of the MoH (Brasil, 2012b) and the municipality of São José, Santa Catarina (São José, 2015).

2. Methods

2.1. Study design and area

This cross-sectional study was carried out on women who received prenatal care in the municipality of São José through the Sistema Único de Saúde (SUS-Government National Health System) and were admitted for delivery at the maternity hospital of the Hospital Regional de São José (HRSJ) from November 2021 to April 2022. This reference maternity hospital is located in the municipality of São José in greater Florianópolis, in the State of Santa Catarina, Southern Brazil.

2.2. Sample design and selection procedures

From an average of 300 monthly deliveries at this maternity hospital, including deliveries of women with high-risk and usual-risk pregnancies, an estimated 97 deliveries originated from the municipality of São José. With a total of 582 pregnant women observed over a 6-month collection period and considering a prevalence of 50% (unknown), relative error of 5%, and confidence level of 95%, the minimum calculated sample size was composed of 232 women.

The study included women admitted for childbirth at the HRSJ maternity hospital; they were on SUS prenatal care in the municipality of São José and possessed a prenatal booklet. Women who did not attend prenatal visits and those with a gestational age of <37 weeks at the time of delivery were excluded from the study.

Sample selection was conducted consecutively over the 6-month data collection period, as there were no parameters indicative of heterogeneity in the population of interest. Considering an average 48-h hospitalization period, in

the 1st week, puerperal women admitted to the maternity ward on Monday, Wednesday, Friday, and Sunday were contacted, while in the 2nd week, those admitted on Tuesday, Thursday, and Saturday were approached. This alternation was maintained throughout the duration of the study.

Women were approached at their puerperium beds in the HRSJ ward at least 6 h post-delivery, at an appropriate time determined by them and according to the evaluation of the medical and investigation team. After receiving information about the survey, patients signed the free and informed consent form and/or the free and clarified assent form for minors.

2.3. Measuring instruments

We employed two instruments for data collection. The first instrument was for the collection of secondary data, either from the prenatal booklet or from the medical records, while the second one consisted of a questionnaire administered to the patients.

Initially, the records in the prenatal booklet were verified, followed by the review of data entered in the medical records of puerperal women. The secondary data were transcribed into the data collection instrument. Subsequently, the patients responded to a questionnaire comprising 16 multiple-choice questions about prenatal care and their socioeconomic conditions. If a participant was unable to respond at the time of approach, the questionnaire was left with them and collected later, before hospital discharge.

The date and time of delivery, along with gestational age, were extracted from the medical records of each puerperal woman based on the list of deliveries during the data collection period. Socioeconomic information was drawn from the prenatal booklet, including age group, self-reported skin color, education level, marital status, and lifestyle habits such as smoking history, as well as alcohol and drug use. Obstetric clinical history and records of the current pregnancy, including whether the pregnancy was planned, laboratory and ultrasound examinations performed each trimester, identification of any pathologies during pregnancy, and referral to high-risk prenatal care (HRPN), were also documented. Any variables not recorded in the prenatal booklet were considered procedures not performed. According to the municipal protocol, patients are referred to the HRPN in the municipality of São José if they have comorbidities that require specialized monitoring by an obstetrician, in addition to the assistance provided by the nursing and medical staff at the Primary Health Unit (UBS) (São José, 2015).

Data concerning women's socioeconomic conditions and verbal guidance/recommendations received during prenatal care, especially regarding breastfeeding, physiological and pathological signs and symptoms of pregnancy and childbirth, newborn care, healthy habits, iron and folic acid supplementation, and participation in pregnancy support groups with health-care professionals to gain information about pregnancy and newborn care, were collected through questionnaire responses from the patients.

2.3.1. The normative criteria of prenatal care

The quality of prenatal care was assessed based on the Kessner index modified by Takeda (1993), the adapted adequacy of prenatal care utilization (APNCU) index (Kotelchuck, 1994), the Anversa *et al.* (2012) classification, as well as the review of compliance with essential recommendations from both the MoH and the municipality of São José. The adequacy categories (adequate and very adequate) and non-adequacy (intermediate and inadequate) were grouped to assess the relationship with the sociodemographic, behavioral, and gestational data.

For the Kessner index modified by Takeda (1993), prenatal care was considered inadequate if it began after 28 weeks of gestational age or <3 physician office visits. Adequacy was defined as the beginning of prenatal care before 20 weeks and six or more physician office visits. Intermediate status encompassed all other situations.

As for the adapted APNCU index (Kotelchuck, 1994), prenatal care was considered inadequate if there were no visits at the beginning of prenatal care, visits after 15 weeks of gestational age, and fewer than 50% of expected visits to the physician's office. It is intermediate if the expectant mother visited the physician's office for 50 – 79% of expected visits, adequate if she performed 80 – 109% of expected visits, and very adequate if she performed 110% or more expected visits.

The Anversa classification is divided into four levels (Anversa *et al.*, 2012). Level 1 is the same as the Kessner index modified by Takeda. In Level 2, prenatal care was considered adequate if it began before 20 weeks and included six or more physician office visits, along with five or more recordings of blood pressure (BP), weight, gestational age, uterine fundal height, and four or more recordings of fetal heart rate and fetal movement. Inadequacy was determined by the beginning of prenatal care after 28 weeks and <3 physician office visits, two or fewer records of BP, weight, gestational age, uterine fundal height, fetal heart rate, and fetal movement. Intermediate status was applied to the remaining situations. Level 3's adequacy was the beginning of prenatal care before 20 weeks and six or more physician office visits. It included records of the examinations of blood type and Rh factor, hemoglobin and hematocrit,

syphilis test, qualitative urine test, blood glucose, human immunodeficiency virus (HIV) test, and toxoplasmosis test. Inadequacy was determined by the beginning of prenatal care after 28 weeks and <3 physician office visits with no record of examinations. Intermediate status was applied to other situations. Level 4 encompassed adequacy and inadequacy across all three levels. Intermediate status was applied to all other situations. Since Anversa's level 4 is the most comprehensive one, it will be the level used to describe the quality of prenatal care in this criterion.

Additionally, recommendations of the MoH (Brasil, 2012a, 2012b) that were considered essential for prenatal care include:

(i) Initiating prenatal care before 12 weeks of gestation and attending six or more physician office visits
(ii) Administering vaccination (Tdap vaccine and Hepatitis B vaccine)
(iii) Conducting laboratory examinations (first trimester: blood type and Rh factor, hemoglobin and hematocrit, indirect Coombs test, qualitative urine test, blood glucose, syphilis test, screening for Hepatitis B and C, HIV test, and toxoplasmosis test; second trimester: indirect Coombs test, oral glucose tolerance test; third trimester: hemoglobin and hematocrit, indirect Coombs test, qualitative urine test, blood glucose, syphilis test, screening for Hepatitis B, and toxoplasmosis test)
(iv) Conducting physical examination (gestational age, BP, body mass index, edema, uterine fundal height, fetal heart rate, fetal movement, fetal presentation)
(v) Providing iron and folic acid supplementation
(vi) Offering guidance on prenatal care, childbirth, postpartum period, breastfeeding, newborn care, healthy habits, and emotional and bodily changes.

In this study, we evaluated whether prenatal care followed all the recommendations (complete) or not (incomplete).

The recommendations of the municipality of São José (2015) that was considered essential for prenatal care include the laboratory examinations (first trimester: blood type and Rh factor, hemoglobin and hematocrit, indirect Coombs test, thyroid-stimulating hormone-TSH test, qualitative urine test, blood glucose, syphilis test, screening for Hepatitis B and C, HIV test, and toxoplasmosis test; second trimester: indirect Coombs test, oral glucose tolerance test, toxoplasmosis test; third trimester: hemoglobin and hematocrit, indirect Coombs test, qualitative urine test, blood glucose, syphilis test, screening for Hepatitis B, HIV test, and toxoplasmosis test). We evaluated if the prenatal care fulfilled these requirements (complete) or not (incomplete).

2.4. Statistical analysis

The data were tabulated in a Microsoft Excel spreadsheet and analyzed using the Jamovi 2.2.5 and Stata 16.0 Software packages. Quantitative variables were described using measures of central tendency and data dispersion, while qualitative variables were presented as absolute (n) and relative (%) frequencies. To verify associations between variables of interest, Pearson's Chi-square test was applied for qualitative variables, Student's t-test for quantitative variables, or non-parametric correspondents, based on data normality. Binary comparisons were performed based on the dichotomization of variables and/or the definition of a reference category (dummy). When the normative criteria had more than two categories for the classification of the outcome (adequacy of prenatal care), the intermediate category was aggregated as inadequate. According to the recommendations of the MoH and the municipality of São José, criteria were classified as complete, incomplete, or absent. The results were expressed as prevalence ratios (PR), with 95% confidence intervals (CI) and a 5% significance level. The prevalence was adjusted for confounding variables detected through a multivariate Poisson regression model with robust variance, considering statistical ($p < 0.20$) and variables of epidemiological relevance. Poisson regression is a generalized linear model with a log link and a Poisson distribution. When the outcome is binary, the exponentiated coefficients are risk/PR instead of incidence-rate ratios (Cummings, 2009). The Poisson regression model has been used in epidemiologic studies to estimate the PR, as the prevalence of the condition studied is countable in the sample, and the use of logistic models can overestimate the relationship between exposure and outcome measures. The best-fit model, determined by the coefficient of determination (R^2) and AIC value, incorporated variables such as age, education, and referral to HRPN.

Data collection commenced only after obtaining informed consent from the involved institutions and approval from the Comitê de Ética em Pesquisa (CEP, Research Ethics Committee) of the University of Southern Santa Catarina, under registration CAAE: 51583121.0.0000.5369 and Opinion number 5,022,991, dated October 6, 2021.

3. Results

During the data collection period, 1647 deliveries (vaginal or cesarean) occurred in the maternity hospital. Out of these, 372 women met the inclusion criteria; 100 were excluded due to prematurity; eight did not accept to participate in the survey; three were in isolation due to COVID-19; 16 were not located in their beds; and eight

were lost. Thus, 237 women participated in the study between the months of November 2021 and April 2022. The mean age of the study population was 27.4 ± 6.7, ranging from 14 to 43 years.

In relation to sociodemographic data (Table 1), during interviews, 52.3% of participants identified their skin complexion as white and 28.7% as brown. However, these data were recorded in only 49.4% of the patients' booklets. Information on education level was absent in 29.5% of the prenatal booklets. A total of 54.4% of the respondents reported having begun high school, corresponding to 9 – 11 years of education. Regarding marital status, 53.2% reported being in a common-law marriage, while 24.5% were married.

According to booklet records, 8% of the pregnant women were smokers; however, there was no record of this information for 24.9% of patients. When questioned, 16.5% admitted to smoking during pregnancy, with 11% continuing to smoke after diagnosis (Table 1). In terms of alcohol consumption, 45.1% of patients reported consuming alcoholic beverages before pregnancy, with 8.4% continuing alcohol consumption after diagnosis (Table 1).

The average gestational age at the beginning of prenatal care was 10.1 (±5.8) weeks, and the average number of health visits was 9.22 (±3.3). According to booklet records, 20.7% of women planned the pregnancy, while 37.6% did not have this data filled in. Regarding clinical-obstetric procedures, weight and BP were documented in over 90% of booklets (Table 2).

When considering compliance with the MoH, 77.2% of women began prenatal care before 12 weeks, and 87.3% had more than six prenatal visits (Table 2). It was found that when advancing in the prenatal care period, there was a tendency toward a reduction in supplementary examinations. In the first trimester, the MoH routine recommendations were completed in 70% of prenatal care, reaching 38% in the third trimester (Table 2). When evaluating São José municipal guidelines (São José, 2015), 39.7% of women completed the routine indicated in the first trimester of pregnancy and 18.6% in the third trimester (Table 2).

According to data from the pregnant women's booklet (Table 2), double adult immunization (dT) was completed in 43.5% of patients, while 37.6% had no record of this datum. Regarding the hepatitis B vaccine, 57.4% of patients completed the vaccination schedule. Information on iron and folic acid supplementation was completed for 77.6% of patients (Table 2).

According to the questions posed to women (Table 2), the guidelines recommended by the MoH, namely on physiological and pathological pregnancies, healthy habits, delivery, and breastfeeding, were fully covered in 17.7% of

Table 1. Socioeconomic, demographic, and behavioral profile of women assisted at the São José Regional Maternity Hospital, Santa Catarina (*n*=237)

Criteria	*n*	%
Age (in years)		
11 – 19	23	9.70
20 – 34	169	71.30
35 – 43	45	19.00
Education (in years)		
0 – 8	31	13.10
9 – 11	129	54.40
≥12	77	32.5
Skin color		
White	124	52.30
Black	33	13.90
Brown	68	28.70
Yellow	9	3.80
Indigenous	3	1.30
Income (in minimum wage)*		
<1	70	29.50
1 – 2	73	30.80
>2	94	39.70
Own a house		
Yes	120	50.60
No	117	49.40
Marital status		
Common law marriage	126	53.20
Married	58	24.50
Single	50	21.10
Divorced	3	1.30
Widow	-	-
Smoking before pregnancy		
Yes	39	16.45
No	198	83.55
Smoking during pregnancy		
Yes	26	11.00
No	211	89.00
Alcohol use before pregnancy		
Yes	107	45.10
No	130	54.90
Alcohol use during pregnancy		
Yes	20	8.40
No	217	91.60

Note: *Current minimum wage=brl 1,212.00.

Table 2. Procedures performed in the prenatal care of women admitted for childbirth at the Maternity at the São José Regional Hospital, Santa Catarina (*n*=237)

Procedures	Complete (%)	Incomplete (%)	Absent (%)	No information (%)
Vaccine				
Tetanus	43.50	15.20	3.80	37.60
Hepatitis B	57.40	27.40	-	15.20
Supplementation*	77.60	19.80	2.50	-
MoH guidelines**	17.70	81.40	0.80	-
Start of PN				
<12 weeks	77.20	-	22.80	-
Number of PN visits				
≥6	87.30	-	12.70	-
MoH laboratory***				
1st Quarter	70.00	17.70	12.20	-
2nd Quarter	59.50	3.80	36.70	-
3rd Quarter	38.00	51.50	10.50	-
SJ laboratory****				
1st Quarter	39.70	48.10	12.20	-
2nd Quarter	29.50	48.90	21.50	-
3rd Quarter	18.60	70.90	10.50	-
Procedures				
Weight	92.80	7.20	-	
BP	93.20	6.30	0.40	-
UH	74.70	23.50	1.70	-
FHR	81.90	16.00	2.10	-
FM	64.10	30.80	5.10	-
Presentation	40.90	48.10	11.00	-

Notes: *Iron and folic acid. **Breastfeeding, physiological and pathological signs and symptoms of pregnancy and childbirth, newborn care, healthy habits. ***Brasil, 2012a. ****São José, 2015.
Abbreviations: BP: Blood pressure; FHR: Fetal heart rate; FM: Fetal movements; MoH: Ministry of Health; PN: Prenatal care; SJ: São José; UH: Uterine height.

Table 3. Quality of prenatal care for women admitted for delivery at the maternity at the São José Regional Hospital, Santa Catarina, according to different normative criteria (*n*=237)

Quality level	Kessner index modified by Takeda (%)	APNCU index adapted (%)	Anversa level 4 (%)	Anversa level 3 (%)	Anversa level 2 (%)	Anversa level 1 (%)
Very adequate	-	74.40	-	-	-	-
Adequate	83.10	5.50	48.50	50.60	74.30	83.10
Intermediate	12.20	1.70	46.00	45.10	20.30	12.20
Inadequate	4.60	18.10	5.50	4.20	5.50	4.60

Abbreviation: APNCU: Adequacy of prenatal care utilization.

prenatal care sessions. Moreover, only 15.6% of women were invited to participate in pregnant women's groups at primary health units. Only two patients complied with all MoH recommendations, with 21.1% undergoing all the laboratory examinations recommended by the MoH and 3.8% undergoing all the laboratory examinations recommended by the São José municipality.

When assessing the quality of prenatal care using specific indices (Table 3), different values were observed, indicating a reduction in adequacy rates as the evaluation

criteria became stricter. Adequacy of prenatal care ranged from 83.1% according to the Kessner index modified by Takeda (1993) and classification by Anversa *et al.* (2012) at level 1, to 79.9% according to the adapted APNCU index (Kotelchuck, 1994). However, this percentage decreased to 48.5% at level 4 of the Anversa *et al.* classification (2012).

The relationship between the adequacy of prenatal care according to various indices used and sociodemographic variables, habits, and clinical data is illustrated in Tables 4 and 5. Age was a determinant in the outcome of adequate prenatal care according to the APNCU index and classification by Anversa *et al.* (2012) at level 4 (Table 4). For the Kessner index adapted by Takeda (1993), after adjusting for education and HRPN (Table 5), women aged over 35 years exhibited a higher prevalence of adequacy (adjusted PR = 1.17, 95% CI 1.05; 1.30), as well as for the adapted APNCU index (Kotelchuck, 1994) (adjusted PR = 1.2, 95%, CI 1.08; 1.36). For the classification by Anversa *et al.* (2012) at level 4, younger women (age <20 years) had a 53% higher prevalence of adequacy compared to those aged 20 – 34 years (adjusted PR = 1.53, 95% CI 1.18; 1.97).

Regarding education, after fit analysis, having 12 years or more of schooling increased the prevalence of adequacy by 33% for the Kessner index adapted by Takeda (1993). Referral to HRPN revealed an influence on the quality of prenatal care across all indices, with a 20 – 30% higher prevalence of adequacy (Table 5).

Pregnancy planning was associated with an increased proportion of adequacy in both the Kessner index modified by Takeda (PR = 1.22, 95% CI 1.10; 1.36) and the adapted APNCU index (PR = 1.28, 95% CI 1.13; 1.45) (Table 5).

In the binary analysis, previous smoking worsened the outcome of adequate prenatal care according to the Anversa classification at level 4 (Table 4); however, after adjusting the variables, this interference did not persist (Table 5), even with the use of other adjustment variables in additional models tested (Table A1).

4. Discussion

In this study, we evaluated the quality of prenatal care for women in the city of São José, Santa Catarina, who delivered at the local maternity hospital (HRSJ) under the SUS. The adequacy of prenatal care ranged from 48.5 to 83.1%, according to the various normative criteria used, and was associated with older maternal age and education, referral to HRPN, and pregnancy planning. Using more variables and stricter criteria, as in the classification by Anversa *et al.* (2012) at level 4, naturally resulted in lower adequacy rates. It was found that more than 75% of the women met the basic recommendations of the MoH regarding the number of prenatal visits and the beginning of follow-up. However, only two of the 237 prenatal records reviewed fulfilled all requirements. The municipality of São José employs a guideline for complementary examinations (São José, 2015) that are more comprehensive than that of the MoH, and only nine women performed all of them, while 50 of them (21.1%) completed all laboratory examinations indicated by the MoH.

An integrative review carried out from 2012 to 2018 highlighted the lack of uniformity in the method used to assess the quality of prenatal care in Brazil (Cruz *et al.*, 2019). According to validated criteria, the best evaluation category for each index yielded different results, contributing to discrepancies in populations from nearby regions or those following the same guidelines. In the state of Rio de Janeiro, a study that used the Sistema de Informação de Nascidos Vivos (SINASC, Live Birth Information System) data for the years 2015 and 2016 discovered that 80.88% of prenatal care was adequate according to the Kessner index modified by Takeda (1993), while a lower rate was obtained when using the APNCU index (Kotelchuck, 1994), with only 31.55% of prenatal care procedures deemed adequate and very adequate (Vale *et al.*, 2021).

A study carried out from October to December 2020 during the COVID-19 pandemic in Florianópolis, a city located in the same micro-region and with a protocol similar to the municipality of São José, found that 35.8% of prenatal care was adequate, with 46.8% considered intermediate, and 17.4% inadequate according to the Kessner index (Martin *et al.*, 2022; Kessner *et al.*, 1973). In a previous study carried out in São José (Pilau *et al.*, 2014) in 2013, prenatal care was inadequate in 77.1% of pregnant women and partially adequate in the others; in other words, none was considered adequate. This difference, despite an 8-year span, was probably due to the different analysis methods, as the previous study only considered prenatal care meeting all recommendations as adequate.

In our study, 83.1% of prenatal care cases were considered adequate according to the modified Kessner index by Takeda (1993). This finding is in line with findings from the 2013 National Health Survey, a household survey carried out by the IBGE in conjunction with the MoH and Fiocruz, which reported that the adequacy of prenatal care was 80.6% in Brazil, 86.3% in the Southeast region, 82.7% in the Southern region, 80% in the Midwest, 76.1% in the Northeast, and 69.5% in the Northern region (Mario *et al.*, 2019). A study conducted in the state of Minas Gerais in 2011 with 200 pregnant women found 67.7% adequacy and 32.4% intermediate adequacy in prenatal care cases.

Table 4. Relationship between sociodemographic, behavioral, and gestational factors and the quality of prenatal care for women admitted for delivery at the Maternity at the São José Regional Hospital, Santa Catarina, according to different normative criteria (*n*=237)

Factors	Kessner index Modified by Takeda		APNCU index adapted		Anversa level 4	
	Adequate		Adequate		Adequate	
	%	*p*-value	%	*p*-value	%	*p*-value
Total	83.10		79.90		48.50	
Age						
11 – 19	82.60	0.123	78.30	0.048#	26.10	0.002#
20 – 34	80.50		76.90		46.20	
35 – 43	93.30		93.30		68.90	
Income						
<2 MW*	82.50	0.759	79.90	0.831	47.60	0.712
≥2 MW*	84.00		80.90		50.00	
Education						
0 – 8 years	67.70	0.034#	67.70	0.177	29.00	0.061
9 – 11 years	83.70		82.20		50.40	
≥12 years	88.30		81.80		53.20	
Skin color						
White	83.10	0.980	83.10	0.242	46.00	0.410
Not white	83.20		77.00		51.30	
Marital status						
With partner	82.60	0.694	80.40	0.848	50.50	0.246
Without partner	84.90		79.20		41.50	
HRPN**						
Yes	94.70	0.001#	90.80	0.005#	61.80	0.005#
No	77.60		75.20		42.20	
Planned pregnancy						
Yes	98.00	0.006#	98.00	0.001#	59.20	0.267
No	81.80		77.80		49.50	
Primiparous						
Yes	86.00	0.346	84.90	0.169	48.80	0.942
No	81.50		77.50		48.30	
Smoking before pregnancy						
Yes	76.90	0.258	76.90	0.578	30.80	0.015#
No	84.30		80.80		52.00	
Smoking during pregnancy						
Yes	73.10	0.147	69.20	0.138	30.80	0.055#
No	84.40		81.50		50.70	
Alcohol use before pregnancy						
Yes	83.20	0.984	79.40	0.798	49.50	0.778
No	83.10		80.80		47.70	
Alcohol use during pregnancy						
Yes	75.00	0.311	70.00	0.233	50.00	0.890
No	83.90		81.10		48.40	

Notes: *Current minimum wage (MW) = BRL 1212. **Referral to high-risk prenatal care (HRPN). #Indicates significant differences at the 5% level.
Abbreviation: APNCU: Adequacy of prenatal care utilization.

Table 5. Relationship between sociodemographic, behavioral, and gestational factors and the adequacy of prenatal care after fitting estimates

Factors	Kessner index modified by Takeda		Adapted APNCU index		Anversa *et al.* level 4	
	PR (95% CI)	PR adjusted (95% CI)	PR (95% CI)	PR adjusted (95% CI)	PR (95% CI)	PR adjusted (95% CI)
Age (years)						
11 – 19	1.03 (0.84; 1.26)	1.06 (0.88; 1.29)	1.02 (0.81; 1.28)	1.05 (0.85; 1.31)	0.57 (0.28; 1.15)	1.53 (1.18; 1.97)
20 – 34	1.00	1.00	1.00	1.00	1.00	1.00
35 – 43	1.16 (1.04; 1.29)	1.17 (1.05; 1.30)	1.21 (1.08; 1.36)	1.21 (1.08; 1.36)	1.49 (1.16; 1.93)	1.52 (0.31; 1.26)
Income*						
<2 MW	0.98 (0.87; 1.10)	1.01 (0.90; 1.14)	0.98 (0.86; 1.12)	1.02 (0.90; 1.16)	0.95 (0.72; 1.24)	1.05 (0.80; 1.37)
≥2 MW	1.00		1.00		1.00	
Education						
0 – 8 years	1.00	1.00	1.00	1.00	1.00	1.00
9 – 11 years	1.23 (0.96; 1.60)	1.25 (0.97; 1.61)	1.21 (0.94; 1.57)	1.23 (0.96; 1.59)	1.74 (0.97; 3.09)	1.67 (0.95; 2.96)
≥12 years	1.30 (1.00; 1.69)	1.33 (1.02; 1.72)	1.21 (0.93; 1.57)	1.23 (0.94; 1.60)	1.83 (1.02; 3.31)	1.70 (0.94; 3.06)
Skin Color						
White	0.99 (0.89; 1.12)	0.99 (0.89; 1.12)	1.08 (0.94; 1.23)	1.07 (0.94; 1.21)	0.89 (0.68; 1.16)	0.86 (0.66; 1.11)
Non-white	1.00		1.00		1.00	
Marital status						
With partner	0.97 (0.85; 1.11)	0.96 (0.84; 1.10)	1.02 (0.86; 1.19)	0.99 (0.85; 1.15)	1.22 (0.85; 1.73)	1.14 (0.81; 1.60)
No partner	1.00		1.00		1.00	
HRPN**						
Yes	1.22 (1.11; 1.35)	1.20 (1.08; 1.32)	1.21 (1.08; 1.35)	1.18 (1.05; 1.33)	1.46 (1.14; 1.89)	1.30 (1.00; 1.67)
No	1.00		1.00		1.00	
Planned pregnancy						
Yes	1.20 (1.08; 1.32)	1.22 (1.10; 1.36)	1.26 (1.13; 1.41)	1.28 (1.13; 1.45)	1.2 (0.88; 1.62)	1.20 (0.87; 1.64)
No	1.00		1.00		1.00	
Primiparous						
Yes	1.06 (0.94; 1.18)	1.06 (0.94; 1.20)	1.10 (0.96; 1.24)	1.13 (0.98; 1.28)	1.01 (0.77; 1.33)	1.16 (0.88; 1.53)
No	1.00		1.00		1.00	
Smoking before pregnancy						
Yes	0.91 (0.76; 1.09)	0.93 (0.78; 1.13)	0.95 (0.79; 1.15)	0.96 (0.79; 1.16)	0.59 (0.36; 0.96)	0.63 (0.39; 1.01)
No	1.00		1.00		1.00	
Smoking during pregnancy						
Yes	0.86 (0.68; 1.10)	0.88 (0.70; 1.12)	0.84 (0.65; 1.11)	0.85 (0.65; 1.09)	0.6 (0.36; 1.10)	0.63 (0.35; 1.13)
No	1.00		1.00		1.00	
Alcohol use before pregnancy						
Yes	1.00 (0.89; 1.12)	1.92 (0.91; 1.15)	0.98 (0.86; 1.12)	1.00 (0.88; 1.13)	1.04 (0.79; 1.35)	1.16 (0.86; 1.45)
No	1.00		1.00		1.00	
Alcohol use during pregnancy						
Yes	0.89 (0.69; 1.16)	0.88 (0.69; 1.12)	0.86 (0.64; 1.16)	0.84 (0.64; 1.11)	1.03 (0.65; 1.64)	1.06 (0.82; 1.57)
No	1.00		1.00		1.00	

Notes: *Minimum wage (MW) BRL 1,212.00. ** Referral to high-risk prenatal care (HRPN). Each relation between the outcome and the predictor was adjusted for age, education, and referral to HRPN (or two of them, when one of the adjustment variables was used) by the Poisson regression model with robust variance.

Abbreviations: CI: Confidence interval; PR: Prevalence ratio; APNCU: Adequacy of prenatal care utilization.

A 2010 study in the state of Rio Grande do Sul, with 1,228 women, observed adequacy in 64.6% (Zanchi *et al*., 2013). Such studies were carried out at the beginning of the last decade and, especially before the implementation of the PHPN (Mario *et al*., 2019), which represented a great development of prenatal care in Brazil and can be associated with the best results achieved in this study.

The APNCU index (Kotelchuck, 1994) was developed to compare populations with varying recommendations regarding the frequency and timing of the beginning of prenatal care. This index is not widely used in national research; however, it is important to compare it with international studies (Kotelchuck, 1994). With the adapted APNCU index (Kotelchuck, 1994), 74.4% of the prenatal care cases were classified as very adequate, along with 5.5% as adequate, totaling 79.9% adequacy.

Using this same index, a study carried out in Aracaju, Northeast Brazil, found adequate/very adequate prenatal care in 66.1% of the cases, with a 26.8% level of inadequacy in prenatal care cases (Ribeiro *et al*., 2009). The recent studies conducted in America, where the index was developed, demonstrate similar results to our study findings (Osterman & Martin, 2018; Manjavidze *et al*., 2020). This suggests that the southern region of Brazil, despite being a region within a developing country with high maternal morbidity and mortality rates, exhibits a prenatal quality level comparable to developed countries. However, there is no homogeneity across different regions of this country, with the North region reporting the lowest adequacy rates (Mario *et al*., 2019). A study in Amapá state in the North of Brazil confirmed this discrepancy, where only 43.3% of prenatal care was adequate (Nemer *et al*., 2021). Furthermore, the analysis carried out with the SINASC data in Rio de Janeiro, in the Southeast region, from 2015 and 2016, revealed even lower adequacy values (31.55%) (Vale *et al*., 2021).

Anversa *et al.* (2012) stratified the quality of prenatal care by adding more variables to the assessment and, with the advancement of the levels (from 1 to 4), the assessment of prenatal care becomes stricter. As shown in our study, as the requirements increase, the quality of prenatal care decreases: 83.1% of adequacy was found in the first level – a value similar to the Kessner index modified by Takeda (1993), but 48.5% in level 4, which includes clinical and laboratory examinations. In the State of Espírito Santo (Southeast region), a study conducted between the years 2013 and 2014 with 5030 women, corresponding to about half of the pregnant women for the period in the State, revealed a higher prevalence of inadequate prenatal care: for level 4, prenatal care was considered adequate in 0.16%, intermediate in 33.06%, and inadequate in 66.78% of the cases (Maia *et al*., 2017).

Regarding the PHPN guidelines, 77.2% of women complied with the recommendation to start prenatal care before 12 weeks of pregnancy, and 87.3% carried out more than six prenatal physician office visits, above the average of other studies (Camargo *et al*., 2021; Martin *et al*., 2022; Oliveira *et al*., 2021), exceeding the MoH recommendations. Tomasi *et al.* (2022) verified these findings in a national study spanning 2012, 2014, and 2018, reporting a decline in the proportion of women attending six or more visits over time, with 89.1%, 84.3%, and 77.8%, respectively, and that the highest rates were observed in the Southern region of the country (Tomasi *et al.*, 2022), consistent with our study.

There was a trend in the reduction of supplementary examinations during the prenatal period, falling from 70% completed examinations in the first trimester to 38% in the third trimester. In São José, Santa Catarina, the municipality's recommendation of a greater number of laboratory examinations compared to MoH indications resulted in even lower completion values. A study carried out in the state of Minas Gerais, in the Southeast region of Brazil, also observed this decline, with 31.2% of the routine examinations completed in the first trimester and a mere 4.3% in the third trimester (Camargo *et al.*, 2021).

It is pertinent to investigate whether these examinations were indeed not performed or if the data reflect an underreporting throughout pregnancy. Regardless of the cause, the consequence is poorly conducted prenatal care, with examinations either not being released by the health system or patients' lack of commitment during pregnancy. In Sergipe (Northeast region), 65% of pregnant women performed all the required examinations; however, the study was carried out by population interview outside the puerperium period, potentially introducing memory bias (Oliveira & Cavalcanti Filho, 2021).

According to data collected from the pregnant women's booklet, 15 – 37.6% of them lacked records of double tetanus immunization for adults (dT) and hepatitis B vaccination, reflecting a degree of incompleteness similar to findings in another study, where 32.8% of the subjects did not have tetanus vaccination records (Vaichulonis *et al*., 2021). In a national study from 2018, 90.4% of the subjects reported complete tetanus vaccine data; however, this relied on participants' self-reports, without direct verification (Tomasi *et al*., 2022). This fragility regarding immunization among pregnant women is due to different factors such as maternal socioeconomic conditions, insufficient information during prenatal visits, and resources and infrastructure deficits (Pedraza & Gomes, 2021).

Regarding prescriptions, iron and folic acid supplementation was recommended in 77.6% of patients,

below the national average seen in studies reporting values above 95% (Oliveira & Cavalcanti Filho, 2021; Tomasi *et al*., 2022; Pedraza & Gomes, 2021). Guidance on pregnancy and the puerperium was fully reported in 17.7% of prenatal care cases, a frequency found in a study conducted in Santa Catarina, which is lower than in other studies reporting ranges from 55.7 to 59.3% (Oliveira & Cavalcanti Filho, 2021; Tomasi *et al*., 2022). The guidelines recommended by the MoH aim to minimize the risk factors that compromise maternal and fetal health (Pedraza & Gomes, 2021). The recommendations constitute relatively accessible actions, which do not require additional resources and depend only on the health professional; thus, it is an important point to be improved (Pedraza & Gomes, 2021). The deficit in this regard may be associated with inadequate training of health-care professionals, high service demand limiting patient education, or disruptions in health care during the COVID-19 pandemic (Pilau *et al*., 2014; Oliveira & Cavalcanti Filho, 2021).

This investigation revealed that only 15.6% of women were invited to participate in prenatal groups at primary health units. It is important to point out that data collection was carried out during the same period of the COVID-19 pandemic, and the health system was globally affected and was still suffering from its residual effects. It is believed that this low percentage is a reflection of physical isolation and the decrease in social activities, especially those at higher risk for COVID-19 (Martin *et al.*, 2022; Pinkhasov *et al.*, 2022).

In the clinical-obstetric evaluation, certain procedures such as uterine height, fetal movement, and fetal presentation that should be performed during the physician's office visits actually occurred at a level below expectations. As verified in other national studies (Camargo *et al*., 2021), examinations relying on devices (scales, sphygmomanometer, and Doppler sonar) were more frequently performed than clinical examinations, possibly due to the practicality or the confidence that these technological instruments provide. BP and weight were the most frequently measured and/or recorded, both crucial for patients' care because obesity, excessive weight gain, and BP changes can cause direct complications during pregnancy, worsening the maternal and perinatal outcome (Camargo *et al.*, 2021).

The population profile is an important factor since it may influence prenatal outcomes (Mario *et al*., 2019). The mean age was similar to other studies of the same nature (Camargo *et al.*, 2021; Vaichulonis *et al.*, 2021). It was observed that age was related to prenatal quality, as described in existing literature (Oliveira & Cavalcanti Filho, 2021; Domingues *et al*., 2015; Tomasi *et al.*, 2017), but in different ways. According to the classification by Anversa *et al.* (2012) at level 4, women under 20 years of age exhibited a 50% higher adequacy frequency, while using the Kessner index modified by Takeda (1993) and the APNCU index (Kotelchuck, 1994), approximately 20% greater fit was seen for women as of 35 years of age. It is assumed that older women may be more attentive and concerned about their pregnancy (Oliveira & Cavalcanti Filho, 2021; Tomasi *et al*., 2022), due to greater gestational risk. In other studies (Oliveira & Cavalcanti Filho, 2021; Tomasi *et al*., 2022), worse quality of prenatal care for adolescents was noted, which may be related to inexperience or a certain immaturity to perceive the gestational risks, which are even greater for this population. On the other hand, this group, requiring more attention, may have had better access to health services and received more guidance from health-care professionals, leading to an improvement in the quality of prenatal care.

Based on the results of our study, awareness regarding the gestational risk appears to significantly influence the adequacy of prenatal care. Patients referred to the HRPR showed a higher prevalence of adequate prenatal care for all indexes and, after adjusting the variables, this relationship was maintained for the modified Kessner index by Takeda (1993) (20% higher prevalence of adequacy) and for the adapted APNCU index (Kotelchuck, 1994) (18% higher prevalence of adequacy). This relationship has been noted in the literature (Martin *et al*., 2022); however, it is not widely discussed since many studies exclude HRPR from the analysis (Vaichulonis *et al*., 2021), due to different guidelines based on pathology (Brasil, 2012b). This variable was included in this study because evaluating the quality of prenatal care according to the minimum criteria is even more important for this population, which requires greater investment in health. HRPN, performed by specialized teams with a higher frequency of medical visits, may explain the greater observed adequacy. In the study by Martin *et al.* (2022), with each increase in the number of prenatal physician office visits, the chance of adequacy increased by 34%.

Our findings revealed that planned pregnancies increased the frequency of adequacy by more than 20% for both the Kessner index modified by Takeda (1993) and the adapted APNCU index (Kotelchuck, 1994). When planning pregnancy, it is expected that the woman starts prenatal care in a timely manner, an important variable for these two indices. It is unfortunate that this information was not recorded in 37.6% of the booklets assessed. Screening of this information by the health professional is relevant to encourage patients to pursue prenatal care, visit the physician's office, and perform the examinations requested, to reduce gestational morbidities (Camargo *et al.*, 2021).

We observed that women with higher education had better prenatal care, according to the Kessner index modified by Takeda (1993). Women with more than 12 years of study had a 33% higher prevalence of adequacy, corroborating with other studies (Moron-Duarte *et al*., 2021; Oliveira & Cavalcanti Filho, 2021; Tadesse, 2020). Women with formal education have greater access to health-care services, have greater knowledge of health assistance, are able to identify gestational risks, and understand that worse outcomes result from poor adherence to prenatal care (Moron-Duarte *et al*., 2021; Oliveira & Cavalcanti Filho, 2021; Tadesse, 2020).

Contrary to expectations based on previous research, skin color was not associated with the quality of prenatal care. Non-white individuals are often associated with lower-quality prenatal care and higher maternal mortality rates (Martin *et al*., 2022; Mario *et al*., 2019). In our sample, over half of the women were white, a more common characteristic in the southern region of Brazil, which may partly explain the lack of differences in this regard, in addition to indicating that in this region, there are no discrepancies in health-care assistance for women enrolled with SUS, regardless of skin color.

There are concerns about the quality of prenatal care being compromised due to unsatisfactory use of the maternity booklet by health-care professionals and whether some actions are complied with but without proper registration. Incomplete entries may be related to the overload of pregnant women's care services, whether in primary health units or in high-risk units (Camargo *et al*., 2021). According to the WHO, incomplete records may also result from the lack of professional training or pregnant women failing to bring their booklets or abide by the information contained within (WHO, 2018). This fact hampers the communication of the health professionals in their follow-up of pregnant women and prevents a correct approach to the health care of those women. The importance of continuing health education is emphasized, duly considering the difficulties pointed out by health-care professionals and defining new strategies to improve their skills (Camargo *et al*., 2021; Rodrigues *et al*., 2020).

As for the limitations of our study, we emphasize that data collection occurred during the COVID-19 pandemic, and the results verified, especially for the third trimester of pregnancy, may have been affected by the restrictions imposed at that specific time. Women who delivered in a public maternity hospital and who came from just one municipality were assessed, thus not necessarily reflecting the reality of all puerperal women assisted at the service. In addition, the data were evaluated across time, largely using secondary data.

Our study was conducted at a public maternity hospital in the southern region of Brazil, an area known for its higher Human Development Index and better socioeconomic conditions. Therefore, characterizing the quality of prenatal care in a hospital in the metropolitan region of the state's capital may not necessarily depict the broader Brazilian reality. Instead, it can shed light on whether the reduction in maternal mortality observed in the southern region of Brazil was accompanied by improvements in local prenatal care, as seen in the state capital.

Based on the results presented, the following recommendations are proposed: (i) Continued education of health professionals who assist pregnant women, since requests differ from those recommended by the municipality; (ii) lack of compliance with certain procedures and failures in following the guidelines have been observed. Health-care teams should add a script to the pregnant woman's booklets to systematically verify compliance with the minimum recommendations; (iii) emphasize studies that scrutinize the difficulties encountered by the health system users to investigate the perception of the users themselves regarding the quality of the PN; and (iv) the adoption of normative criteria and single indexes would allow a broad, complete, and comparative analysis of the prenatal care offered in this country.

5. Conclusion

The adequacy of prenatal care ranged from 48.5% to 83.1%, according to the specific normative criteria applied, with factors such as older maternal age and education, referral to HRPN, and pregnancy planning associated with adequacy rates. A significant majority of women, over 75%, adhered to the MoH's basic recommendations regarding the number of prenatal visits and timely initiation of prenatal care. Notably, the adequacy rate decreased with the implementation of more rigorous assessment criteria and as the pregnancy advanced.

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Conflict of interest

The authors declare that they have no competing interest.

Author contributions

Conceptualization: Vanessa Martins Rosa, Betine Pinto Moehlecke Iser

Formal analysis: All authors
Investigation: Vanessa Martins Rosa, Betine Pinto Moehlecke Iser
Methodology: Vanessa Martins Rosa, Betine Pinto Moehlecke Iser
Writing – original draft: All authors
Writing – review & editing: All authors

Ethics approval and consent to participate

Data collection began only after the institutions involved were informed and approved by the Comitê de Ética em Pesquisa (CEP, Research Ethics Committee) of the University of Southern Santa Catarina, under registration CAAE: 51583121.0.0000.5369 and Opinion number 5,022,991, dated October 6, 2021. After providing information on the survey, patients signed the free and informed consent form and/or the free and clarified assent form for minors.

Consent for publication

Participants signed the free and informed consent form and/or the free and clarified assent form for minors (written) and declared that they agreed to the publication of their data, without any identifying information.

Availability of data

The database is not public but will be available upon request.

Further disclosure

This paper is derived from the graduate dissertation entitled "Quality of prenatal care for women admitted for delivery at the Maternity of the HRSJ/SC," submitted by Vanessa Martins da Rosa of the Universidade do Sul de Santa Catarina (Unisul) in 2022. The paper has not been published or deposited on a preprint server.

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Appendix

Table A1. Relationship between sociodemographic, behavioral, and gestational factors and the quality of prenatal care after different adjustment models

Factors	Kessner index modified by Takeda; PR (95% CI)			Modified APNCU index; PR (95% CI)			Anversa *et al.* (level 4); PR (95% CI)		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4	Model 2	Model 3	Model4
Age (years)									
11 – 19	1.06 (0.88; 1.29)	1.21 (1.08; 1.35)	1.18 (1.03; 1.35)	1.05 (0.85; 1.31)	1.26 (1.09; 1.44)	1.17 (1.02; 1.37)	1.53 (1.18; 1.97)	0.43 (0.13; 1.44)	0.44 (0.13; 1.50)
20 – 34	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35 – 43	1.17 (1.05; 1.30)	1.06 (0.92; 1.22)	1.10 (0.94; 1.30)	1.21 (1.08; 1.36)	1.17 (1.02; 1.34)	1.22 (1.04; 1.43)	1.52 (0.31; 1.26)	1.28 (0.93; 1.77)	1.23 (0.88; 1.72)
Income									
<2 MW*	1.01 (0.90; 1.14)	1.05 (0.93; 1.19)	1.06 (0.94; 1.20)	1.02 (0.90; 1.16)	1.07 (0.93; 1.24)	1.09 (0.95; 1.25)	1.05 (0.80; 1.37)	1.03 (0.75; 1.40)	1.03 (0.76; 1.41)
≥2 MW*		1.00							
Education									
0 – 8 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9 – 11 years	1.25 (0.97; 1.61)	1.01 (0.84; 1.22)	1.03 (0.85; 1.25)	1.23 (0.96; 1.59)	1.01 (0.84; 1.22)	1.04 (0.86; 1.26)	1.67 (0.95; 2.96)	1.43 (0.79; 2.59)	1.41 (0.79; 2.54)
≥12 years	1.33 (1.02; 1.72)	1.04 (0.87; 1.27)	1.07 (0.89; 1.30)	1.23 (0.94; 1.60)	0.96 (0.78; 1.19)	0.99 (0.81; 1.22)	1.70 (0.94; 3.06)	1.42 (0.76; 2.65)	1.36 (0.75; 2.56)
Color									
White	0.99 (0.89; 1.12)	0.99 (0.88; 1.12)	0.99 (0.88; 1.11)	1.07 (0.94; 1.21)	1.12 (0.98; 1.28)	1.11 (0.98; 1.27)	0.86 (0.66; 1.11)	1.00 (0.73; 1.36)	0.98 (0.72; 1.34)
Not white									
Marital status									
With partner	0.96 (0.84; 1.10)	0.94 (0.81; 1.08)	0.96 (0.82; 1.12)	0.99 (0.85; 1.15)	0.94 (0.80; 1.10)	0.96 (0.81; 1.13)	1.14 (0.81; 1.60)	1.08 (0.73; 1.59)	1.10 (0.74; 1.63)
No partner									
HRPN**									
Yes	1.20 (1.08; 1.32)	1.12 (1.01; 1.25)	1.12 (1.02; 1.24)	1.18 (1.05; 1.33)	1.04 (0.91; 1.18)	1.04 (0.92; 1.18)	1.30 (1.00; 1.67)	1.09 (0.79; 1.50)	1.11 (0.80; 1.54)
No									
Planned pregnancy									
Yes	1.22 (1.10; 1.36)	1.19 (1.07; 1.31)	1.20 (1.07; 1.34)	1.28 (1.13; 1.45)	1.28 (1.14; 1.44)	1.25 (1.10; 1.41) *	1.20 (0.87; 1.64)	1.18 (0.86; 1.60)	1.22 (0.87; 1.70)
No									
Primiparous									
Yes	1.06 (0.94; 1.20)	0.95 (0.84; 1.09)	1.06 (0.92; 1.21)	1.13 (0.98; 1.28)	1.11 (0.96; 1.28)	1.12 (0.97; 1.31)	1.16 (0.88; 1.53)	1.07 (0.76; 1.49)	1.04 (0.74; 1.05)
No									
Previous smoking									
Yes	0.93 (0.78; 1.13)	1.17 (1.05; 1.30)	1.21 (1.01; 1.44)	0.96 (0.79; 1.16)	1.19 (1.05; 1.34)	1.21 (0.97; 1.51)	0.63 (0.39; 1.01)	0.86 (0.35; 2.08)	0.65 (0.23; 1.84)
No									

(Cont'd...)

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Table A1. ***(Continued)***

Factors	Kessner index modified by Takeda; PR (95% CI)			Modified APNCU index; PR (95% CI)			Anversa *et al.* (level 4); PR (95% CI)		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4	Model 2	Model 3	Model4
Smoking during pregnancy									
Yes	0.88 (0.70; 1.12)	0.77 (0.60; 0.98)	0.78 (0.60; 1.02)	0.85 (0.65; 1.09)	0.72 (0.54; 0.95)	0.78 (0.58; 1.06)	0.63 (0.35; 1.13)	0.77 (0.27; 2.20)	0.82 (0.26; 2.58)
No									
Alcohol use before pregnancy									
Yes	1.92 (0.91; 1.15)	1.07 (0.95; 1.21)	1.08 (0.94; 1.24)	1.00 (0.88; 1.13)	1.04 (0.90; 1.21)	1.07 (0.91; 1.24)	1.16 (0.86; 1.45)	1.14 (0.84; 1.56)	1.08 (0.77; 1.52)
No									
Alcohol use during pregnancy									
Yes	0.88 (0.69; 1.12)	0.90 (0.69; 1.18)	0.86 (0.64; 1.15)	0.84 (0.64; 1.11)	0.81 (0.56; 1.17)	0.77 (0.53; 1.13)	1.06 (0.82; 1.57)	1.64 (1.08; 2.50)	1.56 (0.98; 2.50)
No									

Notes: *Minimum wage: BRL 1,212.00. **Referral to high-risk prenatal care (HPRN). Adjusted for age, education, and referral to high-risk PN by a Poisson regression model with robust variance. Model 2=all sociodemographic variables (age, education, income, marital status, race/color). Model 3=age, education, and referral to HPRN for planned pregnancy, previous smoking, and during pregnancy. Model 4=all variables shown in the table.

Abbreviations: CI: Confidence interval; PR: Prevalence ratio; APNCU: Adequacy of prenatal care utilization.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Information sources and factors influencing the use of herbal medicine among women during pregnancy and childbirth in rural Lilongwe, Malawi: A qualitative study

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#The use of the term "Taiwan Province of China" is consistent with the international practices, such as The United Nations Statistics Division and The International Organization for Standardization.

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Abstract

Existing literature shows increased use of herbal medicine during pregnancy, childbirth, and when tackling associated problems among Malawian women. Beyond Malawi, herbal medicine use is also common among women during pregnancy and childbirth in other parts of the world. However, little is known about the precise information sources and factors that affect women's use of herbal medicine in Malawi, especially in rural areas where it is commonly practiced. This study aimed at exploring information sources and understanding factors that influence herbal medicine use during pregnancy and childbirth among women living in the rural Lilongwe, Malawi. This is a qualitative descriptive study on 28 female participants purposively identified from four villages (Kagona, Champsinja, Mthupi, and Manja) of Traditional Authority Malili in rural Lilongwe, Malawi. Data were collected from four focus group discussions, with each group consisting of 6 – 8 women, and their discussions were transcribed and analyzed using content analysis method. The findings indicated that previous obstetric experiences (negative and positive), quick relief from labor pain, hastened delivery process, fear of abandonment by guardian during childbirth, and encouragement from peers (friends) are key factors influencing herbal medicine use in rural Lilongwe. We also found that peers (friends), parents, and traditional birth attendants are major sources of information regarding herbal medicine use in Malawi. This study concludes that herbal medicine use during pregnancy and childbirth in rural Malawi is largely influenced by previous labor experiences and fears of being abandoned during labor and childbirth, and that information on herbal medicine use is often sourced from peers, parents, and traditional birth attendants. Thus, this study sheds light on how the community-led pathways can be exploited to influence the decisions to use herbal medicine among women in the rural areas of Malawi.

Keywords: Pregnant women; Herbal medicine; Information source; Pregnancy and childbirth traditional birth attendants; Obstetrics

1. Introduction

The use of herbal medicine during pregnancy and childbirth among women is estimated to be at around 60% in developed countries (Quzmar *et al*., 2021; Frawley *et al*., 2013a) and between 34% and 80% in the Sub-Saharan Africa (El Hajj & Holst, 2020). Herbal medicine is provided in various forms, from plant parts with active ingredients to finished processed herbal products which women use during pregnancy and childbirth (World Health Organization, 2017). Evidence on the effects of herbal medicine has shown that it facilitates labor, treats common illnesses during pregnancy and childbirth, and prevents miscarriage (Peprah *et al*., 2019). However, the usage of herbal medicine, as reported in many places including Malawi, has been associated with bad obstetric outcomes, including uterine rupture, fetal distress, and meconium-stained liquor which leads to cesarean deliveries (Ngoma & Siachapa, 2017; Lampiao *et al*., 2018a; Balbontín *et al*., 2019).

Some theorists (Laor, 2022) have observed that individuals' abilities, knowledge, and motivation, as well as health literacy environments (policies, people, and processes), predominantly influence how they obtain, evaluate, understand, and apply information to make healthcare-seeking decisions. The authors suggest that the source of information for healthcare decision-making is important. Likewise, the sources of information about herbal medicine use among women are important for understanding the factors influencing women's decision-making process. For example, a cross-sectional study conducted in Iran found that the main sources of information for herbal medicine use are friends, colleagues and family members (33.5%), obstetricians and midwives (41.5%), books, journals and magazines (6.7%), traditional healers (3.6%), radio and television (5.1%), internet (3%), and other sources (9.3%) (Khadivzadeh & Ghabel, 2012). Similar results were also reported in an Australian study (Frawley *et al*., 2013b) where information about herbal medicine use among pregnant women originated from personal experiences (48%), family and friends (43%), general practitioners (27%), media (22%), obstetrician (21%) midwives (19%), internet (11%), and pharmacists (7%). Holst *et al.* (2009) also established that family and friends are the most frequent sources of information about herbal remedies to be used during pregnancy.

However, in Sub-Saharan Africa, the information sources are somewhat different from those reported in Western countries. Studies conducted in the Sub-Saharan Africa regions (Mugomeri *et al*., 2015; Mudonhi & Nunu, 2020) mainly cite grandmothers, traditional healers, mothers-in-law, and traditional birth attendants as primary sources, while friends and others come as secondary sources (Panganai & Shumba, 2016). In addition, there are many other reasons cited as the justifications of herbal medicine use among women globally. For instance, women choose to use herbal medicine because of the perceptions that biomedicine is not effective and herbal medicine can prevent miscarriage (Nyeko *et al*., 2016; Mothupi, 2014). Other studies demonstrate that women also use herbal medicine on the grounds of cost-effectiveness, perceived absence of side effects, cultural and personal beliefs, and philosophical views on life and health (Barnes, 2003; Gardiner *et al.,* 2007). In Malawi, women who have chosen to use herbal medicine were under the perception that it hastens labor, prevents pregnancy-related complications, and promotes infantile health (Makombe *et al*., 2023).

Thus, understanding information source pathways and the rationale behind the use of herbal medicine during pregnancy and childbirth among rural women in developing countries such as Malawi can help address the knowledge gap about the influencing factors and guide the development of health-related interventions. However, information source and factors that influence herbal medicine use among women during pregnancy and childbirth in Malawi are not well-documented. This study therefore sought to explore key information sources and influencing factors of herbal medicine use during pregnancy and labor in rural Lilongwe, Malawi.

1.1. Theoretical framing of the study: The health belief model (HBM)

There are various information source pathways and factors that influence herbal medicine use among women during pregnancy and labor. In this study, the HBM was applied to understand the factors that could influence the behavior of using herbal medicine during pregnancy and labor. Proposed by Rosenstock and his colleagues in the early 1950s (Sripad *et al*., 2019), the HBM focuses on predicting health behaviors and explaining why people would participate in certain programs to prevent disease (Butts & Rich, 2011). The HBM entails the influencing factors as well as the factors that discourage people from participating in disease prevention activities on the basis that people's beliefs about whether they are susceptible to disease or not, and their perceptions of the benefits of trying to avoid it, are influenced by their readiness to act (Glanz & Rimer, 2005). The HBM hence focuses on assessing health behaviors of individuals through examination of perceptions and attitudes that someone may have toward disease and negative outcomes of certain actions.

The HBM suggests six main constructs that influence people's decision-making regarding whether taking action could prevent or control diseases:

(i). *Perceived susceptibility*, which explains a belief that one will contract or not contract a disease. In the context of this study, women who have had a positive past experience of using herbal medicine may have a preconceived belief that it will not result in a complication in her.

(ii). *Perceived threat*, which explains how individuals perceive the threat or gravity of a particular health condition or problem. For instance, if a woman has knowledge of adverse outcomes of herbal medicine use during pregnancy and labor such as ruptured uterus or severe birth asphyxia, it is very unlikely that she will be influenced to use it.

(iii). *Perceived benefit*, which states that people believe that taking action to prevent harm/disease reduces susceptibility to the condition. In the current study, women would perceive the potential advantages associated with herbal medicine use, *that is*, quick relief of labor pains and hastened labor, which influence their decision to use.

(iv). *Perceived barrier*, which explains that people can take action if they believe that the cost of taking action are outweighed by the benefits. For instance, women may consider abstaining from herbal medicine use during pregnancy if they opt for normal, non-hastened delivery and believe that there are more benefits than the associated harm in not using herbal medicine.

(v). *Cues to action*, which explains that people can only act positively if they have ever been exposed to factors that prompt action. For instance, a bad or good obstetric outcome after using herbal medicine for any intention will inform the behavior in the other pregnancies. Health education from health workers, media, family and friends are other forms of cues to influence action.

(vi). *Self-efficacy*, which explains the instance whereby an individual feels confident that can act to achieve the desired outcome. For instance, a woman will choose to use herbal medicine if she is influenced by the belief that herbal medicine can accelerate labor.

This study was therefore guided by the theories and concepts of the HBM by highlighting insights on some of the factors influencing women's use of herbal medicine during pregnancy and labor (Figure 1). The theories from the HBM also provided us with opportunities to establish the sources of information leading to herbal medicine use during pregnancy and labor. Thus, adoption of the HBM gave more insights to understand why women still use herbal medicine during pregnancy despite the prevention messages in the media and different cues to action. Moreover, the discussion section of the present study coordinates the study findings and the building blocks of the theory to guide the researchers on the recommendations for addressing herbal medicine use during pregnancy and labor in rural communities in Malawi.

2. Data and methods

2.1. Study design and setting

We adopted the qualitative descriptive (QD) design while conducting this study. The QD design minimizes the chances of verbal misrepresentations, which often arise during field data transformation. This is achieved with the minimization of alterations to data, words, and events, which is more lenient in ethnographic or narrative study designs (Bradshaw *et al*., 2017). We purposively selected study participants from four villages under the Traditional Authority Malili in rural Lilongwe, Malawi. These villages — Kagona, Champsinja, Mthupi, and Manja — are located five kilometers from the mid-south part of Likuni community in Lilongwe city. Residents from these villages, including women, access health-care services in the two nearest hospitals located at Bwaila and Likuni. Anecdotal data show that out of 101 women admitted at the two medical centers, 25% had used herbal medicine during pregnancy and childbirth. Thus, this study was conducted within the settings required by the qualitative study design where the phenomenon being explored presents itself as if it were not under the study, so that we could reduce biased cases (Sandelowski, 2000).

2.2. Recruitment and sampling

The inclusion criteria of this study are described in the following. Only adult women aged 18 years and above at the time of the study, who had experienced at least two deliveries (parity 2), and who had given consent to participate in this study, were considered for recruitment. In addition, only women who agreed to share their lived experiences on the use of herbal medicine were recruited for interviews. We requested these women to provide demographic information, such as age, religion, and education levels, which were included in the analysis. In total, 28 women were enrolled in this study.

2.3. Method of data collection

Data collection was conducted through focus group discussions, where each participant was given a semi-structured interview guide from December 21–30, 2020. The guide was designed to collect normative views on their sources of information and factors that influence their decision to use herbal medicine during pregnancy and childbirth. Some of the included questions are: *How did you*

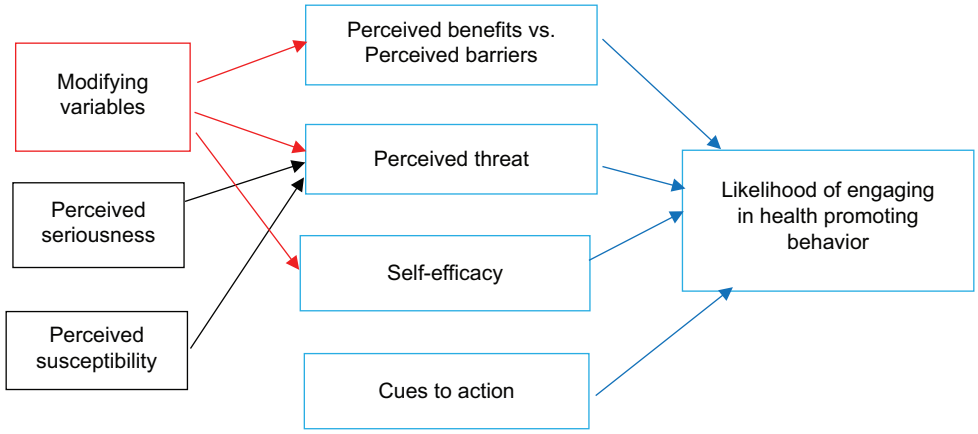

Figure 1. The health belief model as adapted for this study.

know about herbal medicine use? What influenced you or what do you think influences women to use herbal medicine during pregnancy? What do you think influenced you or other women to use herbal medicine during child birth? Do you have the right to decline using herbal medicine during pregnancy or childbirth? Participants were encouraged to share their personal experiences or general knowledge in this regard based on former cases they are aware of. Four FGDs were conducted, with seven participants in each group. The interview guides were translated into Chichewa, a local language in the study area. All interviews were audio recorded, transcribed verbatim, and translated into English. On average, each FGD took approximately 45 min. Although this study occurred during the COVID-19 pandemic, data collection activities were not severely disrupted due to the lockdown and other related restrictions. Data collection was conducted in the communities and was not affected by the travel restrictions at the time. Nevertheless, all precautionary measures were applied throughout the interview process. The researcher procured facemasks for participants and community health workers, and all participants were asked to put on face masks during the FGDs, in addition to keeping a social distance of 1 meter apart and using hand sanitizer, to avoid cross-infections.

2.4. Data management and analysis

Demographic data were descriptively analyzed in Microsoft Excel software, and verified by one of the authors (A.M.). Qualitative data analysis was conducted manually (by D.M.). The transcripts of participants' responses were read several times to ensure that the researchers could fully comprehend the responses. The transcripts were read several times to fully comprehend the responses which were provided by the participants. Data analysis was conducted in accordance with the suggested process of content analysis (Hsieh & Shannon, 2005), which include attending to the influencing factors, telling the influencing factors, transcribing the influencing factors, and reading. While analyzing the influencing factors, the transcribed data were read several times for familiarization, and the codes were then identified. The identified codes were subjected to further analysis, which generated results to enable categorization and theme classification. The themes were analyzed and named. Notes, including the tones and nonverbal expressions of the respondents, were recorded during the interviews, and they could potentially provide insights during data analysis. Direct spoken words (verbatim quotes) from the respondents were used to support the findings.

2.5. Ethical considerations

Ethical approval for this study was obtained from the College of Medicine Research and Ethics Committee (COMREC) of the University of Malawi (reference number: P.10/20/3169). In addition, verbal and written consent was obtained from the study participants before their participation in the FGDs. The study participants were also told that they could withdraw from the study at any time if they did not feel comfortable. To maintain privacy and promote anonymity, participant identifiers, instead of names, were used during data manipulation and analysis.

2.6. Trustworthiness of the study

It is very important to maintain trustworthiness of the study findings in a qualitative study; hence, measures were taken in this study through probing of the questions to elucidate more information and nuances in our interpretations of participants' responses. The interview guide was pre-tested and was the only tool used in all four FGDs. Note-taking was conducted during the interviews, and the notes taken were then used for verification purposes and to complement the narrative of the participants. Direct quotes from the women were employed to support the findings of the study.

Table 1. Sociodemographic characteristics of study participants (*N*=28)

Variable	Number of participants (%)
Age	
20 – 24	9 (32.14)
25 – 29	9 (32.14)
30 – 34	6 (21.43)
35 – 39	3 (10.71)
40 and above	1 (3.58)
Marital status	
Married	21 (75.0)
Divorced	3 (10.71)
Widowed	3 (10.71)
Single	1 (3.58)
Deliveries (parity)	
2 – 3	16 (57.14)
4 – 5	10 (35.71)
6 and above	2 (7.15)
Religious affiliation	
Christianity	26 (92.86)
Islam	2 (7.14)
Highest education level	
None	1 (3.57)
Primary education	21 (75.0)
Secondary education	6 (21.43)

Table 2. Themes and subthemes of the study

Themes	Subthemes
Influencing factors	Previous obstetric experiences (negative and positive)
	Quick relief from labor pain
	Hastened delivery process
	Fear of abandonment by guardian during child birth
	Encouragements from peers (friends)
Sources of information about HM use	Traditional birth attendant
	Peers (friends, women)
	Parents or guardians (including mother and grandmother)
	Radio
	Market advertisements

3. Findings

3.1. Characteristics of study participants

A total of 28 women were recruited and interviewed in this study. Most of the participants were in the age groups of 20 – 24 (32.14%) and 25 – 29 (32.14%). Out of the 28 women, 21 (75%) were married, and 57.14% of them had an average of three deliveries (parity 2 – 3) at the time of this study. Furthermore, 21 participants (75%) had completed primary school education at the time of the survey. In terms of religion, 92.86% of the participants were Christians, while the remaining (7.14%) were Muslims (Table 1).

Narratively, the findings were categorized into two major themes, namely, influencing factors of herbal medicine use during pregnancy and childbirth, and sources of information regarding herbal medicine use. Each of these themes was then further divided into subthemes. Themes and subthemes are presented in Table 2.

3.2. Influencing factors

Women in this study cited various reasons as to why they resorted to using herbal medicine. Some of the driving factors mentioned were previous obstetric experiences (both negative and positive), quick relief from labor pain, hastened delivery process, fear of abandonment by guardian during childbirth, and encouragement from peers (friends).

3.2.1. Previous obstetric experiences

Previous obstetric experience was reported as a propeller for women to use herbal medicine during pregnancy and childbirth. Based on a few participants' narratives, previous successful experiences following the use of herbal medicine would influence one to reuse herbal medicine during pregnancy and childbirth. Most of them claimed that they would use herbal medicine again since their children were delivered with non-cesarean methods. This perceived association has influenced the participants to use herbal medicine so that they can avoid delivering through the cesarean section. The following quotes illustrate this:

> *"And also, it happens that you had a cesarean section in your first pregnancy.and when you get the second pregnancy.you go to the traditional birth attendant to take herbal medicine...when your labor starts you find that you end up having a normal delivery.meaning that things have gone well".* (Participant #2 FGD4)

Past experiences were also expressed from a different perspective. Some women who had bad obstetric history, *for example*, miscarriages, resorted to taking herbal medicine to safeguard their pregnancies.

> *"When some women experience consecutive miscarriages, they rush to the traditional birth attendants for herbal medicine so that the pregnancy is never miscarried. So those are the issues that influence other women to seek care from traditional birth attendants…"* (Participant #3 FGD1)

"During pregnancy, what happens is that you decide that I wish to have a smooth or normal delivery so I need to do what? Avoid what happened in the past, aaah operation…so I should go to the traditional birth attendant [to] get herbal medicine so that I should end up with what… a normal delivery…" (Participant #1 FGD3)

"So [most of] the problems that one has experienced in life influence them to use herbal medicine in pregnancy…" (Participant #4 FGD3)

3.2.2. Quick relief from labor pain

Other participants indicated that pain experienced during the process of labor influences one to consider using herbal medicine to relieve the pain. The following participant said:

"At the time you are being given the herbal medicine, you are mostly in severe pain/agony…so for you to say aah don't give me the herbal medicine while what you just want that time is to get the possible relief from what is bothering you so that it leaves your body, it is not possible…" (Participant #1 FGD1).

Additionally, another participant said:

"And the severity of the labour pain makes you think of taking the herbal medicine..." (Participant #3 FGD3).

3.2.3. Hastened delivery process

Some of the women claimed that they were influenced to use herbal medicine because it was perceived as a catalyst of delivery process. Regarding this perceived function of herbal medicine, several participants said:

"When you take herbal medicine you deliver fast, it works faster for you so that you rest from labor…" (Participant #5 FGD1).

"The overall reason is that the woman aims [for] a quick delivery…" (Participant #2 FGD1)

"We as village people really depend on herbal medicine because we see that when we take herbal medicine we deliver fast and normally without problems…" (Participant #1 FGD2).

3.2.4. Fear of abandonment by guardians during child birth

Some participants indicated that herbal medicine is sometimes taken because of the fear of being neglected in the hospital by the guardians if they refuse to take the medicine. This mostly happens when the herbal medicine is given by the guardian who perceives that the hospitalization stay will extend if herbal medicine is not consumed. When left with no choice, some women choose to comply in order not to be abandoned by the guardian on grounds of non-cooperation. The following narrative reveals the case:

"Additionally, for fear of being abandoned by the guardian at the hospital, you just take the herbal medicine…" (Participant #2 FGD1).

3.2.5. Encouragement from peers (friends)

The study also found that some women used herbal medicine due to peer pressure and influence from their friends.

"I heard from friends that there is a traditional birth attendant somewhere who assist with herbal medicine when you are pregnant, so I went [to get] some…" (Participant #2 FGD2)

"I also heard from my friends whilst chatting and she convinced to use herbal medicine…" (Participant #6 FGD4).

3.2.6. Self-motivation

Two women from the FGDs alluded to the fact that they have not been influenced by others to use herbal medicine, but in fact, they would like to attempt due to their own personal motivation. When questioned further about what inspired them to use herbal medicine in the first place, they did not elaborate, but cited their intrinsic motivation to use as the reason. The following quotes illustrate these reasons:

"So those are the issues that influence other women to seek care from traditional birth attendants.but some really depend on the hospital care...so the use of herbal medicine depends on one's choice and not from what we hear from the radio..." (Participant #3 FGD3)

"As for me, it was my own influence…" (Participant #1 FGD3).

3.3. Sources of information about herbal medicine use

In this study, we found that information about herbal medicine use was readily available in the villages under study. For these women, information regarding herbal medicine use during pregnancy, labor, and delivery came from different sources (Table 3). The interviews revealed that most participants heard of herbal medicine from their friends, parents, and traditional birth attendants.

3.3.1. Peers (friends)

The majority of participants equated the peers, such as friends and other women, as the sources for obtaining information about herbal medicine use. The following quotes illustrate this:

"I have really ever used herbal medicine, but I did not see any benefit at all…I just got carried away…but I had no problem [taking] herbal medicine …but friends advised to go to traditional birth attendant as labor

Table 3. Examples of herbal medicines mentioned in the study and their uses

Chichewa name	English name	Scientific name	Part	Function
Peyala	Avocado	*Persea americana*	Leaves	To treat anemia in pregnancy
Chidede	Rose marrow	*Hibiscus*	Leaves	To treat anemia in pregnancy
Mwanamphepo	-	*Cissus/Vitaceae*	Roots	To hasten labor
Mwanamphepo	-	*Cissus/Vitaceae*	Roots	To prevent cesarean section

starts and then proceed to the hospital you will not take time to deliver…" (Participant #6 FGD3)
"As for me, I heard from other people, whom we were chatting with, and just heard them saying that herbal medicine helps in facilitating labor so that one should have a fast delivery…sure.so I heard from people who came to chat at my home and not from relatives…" (Participant # 1 FGD 1).

3.3.2. Parents or guardians

Some respondents indicated that they got the information about herbal medicine use from their parents or guardians, including their grandparents who raised them. For example, some participants said;

"Our parents just told us that when you are pregnant you should be taking herbal medicine from this tree…" (Participant #6 FGD 1)
"As for me I was with my parents, my grandmother is the one who informed me of herbal medicine use…" (Participant #5 FGD1)
"I heard from my mom…" (Participant #3 FGD1)

3.3.3. Traditional birth attendants

As anticipated, some women heard about herbal medicine use from traditional birth attendants in the villages.

"Aaah they [heard] from the traditional birth attendants…" (Participant #2 FGD3)
"I heard from my mother's friend, [who] is a traditional birth attendant…" (Participant #3 FGD2)

Unexpectedly, some women indicated that they got information about HM use from healthcare workers, such as nurses, who advised them to use herbal medicine during pregnancy. When probed further, these women said that, during the antenatal care visit, nurses would advise them to consume the concoction of boiled Avocado tree leaves or boiled Roselle *(Hibiscus sabdariffa)* juice to improve blood levels when they become low.

"When you go to the antenatal clinic and you are told that the blood is not enough in your body we are advised by the nurse to boil peyala (Avocado tree leaves) leaves and drink its concoctions…or you can boil Chikhada/ Chidede (Roselle) and then drink its concoctions…" (Participant #6 FGD3)

3.3.4. Market advertisement

The participants also mentioned that there are a lot of herbal medicines being sold in the local markets in their areas. As a result, a few of them indicated that they first heard about herbal medicine use from advertisements in these markets by the medicine sellers.

"As for me, I see herbal medicine in different places, i.e., in markets….so I just see people selling these herbal medicines and advertise them to us…" (Participant #7 FGD1).

3.3.5. Radio

Another woman cited radio as a source of information for herbal medicine use among women in the area.

"Aaah they also hear it from the radio…" (Participant #1 FGD3).

4. Discussion

This study explored sources of information and identified reasons of using herbal medicine during pregnancy and childbirth in rural Lilongwe, Malawi. Influencing factors and sources of information are the two themes surrounding the narratives. (1) Influencing factors: (i) Previous obstetric experiences (negative and positive), (ii) Quick relief from labor pains, (iii) Hastens delivery, (iv) Fear of abandonment by guardian during childbirth, and (v) Encouragements from friends (peers) and (2) Sources of Information for HM use: (i) Traditional Birth attendant (ii) Peers (friends, women) (iii) Parents/Guardians (Mother, grandmother), (iv) Radio, and (vi) Market advertisement.

Our findings revealed that some women use herbal medicine during pregnancy and child birth because of their previous obstetric experiences, either positive or negative. For example, when one has multiple consecutive miscarriages, or unintended abortions or any bad obstetric experience, they become more compelled to use herbal medicine to prevent similar occurrences in the next pregnancies. They will continue using herbal medicine during pregnancy or in labor if the past experiences in using herbal medicine prove to be favorable. Another scenario was that when they have experienced a cesarean section or a difficult labor, they will very likely choose to use herbal medicine in the next

pregnancy or childbirth, with the hope of abstaining from cesarean delivery or difficult labor. These findings agree with the studies conducted in Uganda and Nigeria, where women opted to use herbal medicine in pregnancy to avoid cesarean delivery (Adejoh *et al.,* 2020; Ibanda *et al*., 2021). Similar findings have also reported in a Zimbabwean study, which indicated that previous history of cesarean section influences women to resort to using HM so that they can go through a normal delivery next time (Panganai & Shumba, 2016). These findings also indicate that women perceive that herbal medicine use can obviate the need for performing cesarean section, while many of them do not realize that cesarean section is performed for other obstetric reasons. Nevertheless, these findings allude to the concept of "cues to action" of the HBM by informing health workforce that understanding women's past obstetric history would somewhat inform the likelihood of engaging in behaviors; such knowledge can help guide the formulation of clinical or community interventions targeting at the reduction of maternal and neonatal mortality in Malawi.

Another reason for herbal medicine use among the women is their desire to be relieved of labor pain. In other words, the women perceived that herbal medicine use could help quickly relieve one from the labor pain. This finding is consistent with those of a Nigerian study, which reported that women consume aqueous extracts of herbal plants during labor to alleviate labor pain (Attah *et al*., 2012). This report also further lauded the consistent use of herbal medicine during childbirth among women despite the scarcity of information supporting its benefits. Another justification for herbal medicine use among the women is that it hastens delivery process. The nuance between the two reasons is that the first one aims to offer relief from the pain, while the second one aims to shorten the labor process. The reasons explained are somehow relatable because most of the herbal medicines used during childbirth are associated with oxytocin effects (Lampiao *et al*., 2018b). In addition, previous studies indicate that herbal medicine facilitates and hastens labor process (El Hajj *et al*., 2020; Cheptum *et al*., 2017). Although the labor process is an excruciatingly painful experience for women, health-care professionals should lambast the use of herbal medicine, in adherence to the concept of "perceived threat" of the HBM, by promulgating the possible obstetric complications, such as ruptured uterus or fetal distress.

Another unusual finding of this study is projected at the role of a guardian during childbirth in this rural community. The surveyed women claimed that they consumed herbal medicine when provided by the guardian at the time of childbirth for the fear of being abandoned or left alone at the hospital. Guardians for these women, who are often their mothers or mothers-in-law prepare and provide herbal medicine to the women in labor. If the women refuse to consume, they are labeled as uncooperative and will be abandoned alone in the hospital or maternity room. Although this finding is rarely discussed in the literature, a study has alluded to this phenomenon that women are sometimes coerced or forced by a family member or a guardian to take herbal medicine (Mkize, 2015). This casts a spotlight on the issues surrounding herbal medicine use during pregnancy, which should be addressed at the community level with the involvement of family members. In line with the concept of "perceived barrier" of the HBM, we found that even some women acknowledge the unfavorable outcomes of using herbal medicine, they would still take it for the fear of being abandoned by the guardian due to prolonged hospital stay. Therefore, the acts or influence of a family member is perceived as a barrier to avoiding herbal medicine use during labor.

Our findings also showed that women, who often do not critically question their decisions, are under the constant influence of their friends and peers in herbal medicine use. This essentially reveals how peers and friends can influence health decision-making in community and village settings. Similarly, other studies alco cited peer pressure as the driver of herbal medicine use among women (Barnes *et al*., 2019). For women who expressed that they are intrinsically motivated to use herbal medicine, it is possible that they were raised in a culture where herbal medicine use is a commonplace or exposed to this practice since they were young. However, be it cultural or other reasons, the real motive behind the self-motivation in taking herbal medicine remains unclear. Ong *et al*. (2005) found that women are more likely to use herbal medicine if they are born in mainland China. In addition, a study found that participants from non-English-speaking regions are less likely to take herbal supplements than their counterparts from English-speaking regions (Forster *et al*., 2006). Evidence also suggests that personal beliefs toward holistic approach to health play a role in the practice of herbal medicine use since many women believe that herbal medicine provides safe alternatives to pharmaceuticals and are dissatisfied with conventional standard care (Hall *et al*., 2011). These mixed findings indicate a theory that regardless of one's origin or source of information, a woman's belief and confidence in the benefits of herbal medicine have an implication on its use, which is coherent with the "self-efficacy" concept of the HBM.

Consistent with other researchers (Tsui *et al*., 2001; Holst *et al*., 2009), this study found that family (parents, guardians), friends, and peers are the main sources of information on herbal medicine use among the rural women

in Malawi. This suggests that targeting peer social networks is crucial to strengthening health information dissemination system regarding the use of herbal medicine. Parents and/or guardians were also found to be the key sources of herbal medicine use. Similar findings have been presented in a systematic review, which reveals that pregnant women obtain the information from their family and friends (Dante *et al*., 2013). Although the participants in the previous studies were more highly educated than those in this study, both groups of participants were in a range of median to average age. This implies that age or education background does not affect whether someone is the source of information about herbal medicine use. Community interventions regarding herbal medicine use during pregnancy are significant as they serve to disseminate information on the implications of herbal medicine use during pregnancy.

Although herbal medicine is not incorporated as a treatment in Malawi, it is interesting to note that some nurses persuade women to use herbal medicine. Participants narrated that midwives at antenatal clinic sometimes tend to advise the women to use *Chidede* or avocado tree leaves to improve their blood levels in case of anemia. Other researchers have reported that part of the suggestions to use natural medicine may also come from clinicians (Dante *et al*., 2013; Kennedy *et al*., 2013). Nevertheless, medical personnel have never been formally educated about the efficacy and side effect of herbal medicine. The little information they provided may lead to unpleasant outcomes because these herbal medicines are not regulated in terms of safety and efficacy. The HBM indicates that care providers are among the "cues to action" that motivate women to use herbal medicine. To avoid disastrous consequences, care providers are advised to be well-informed about risks associated with herbal medicine use (Holroyd *et al*., 2008).

Most of the participants in the present study narrated that pregnant women visit traditional birth attendants weekly to obtain herbal medicine, which is thought to be able to sustain pregnancy and well prepare them for delivery. Some indicated that when a complication arises in the process of labor in the hospital, the guardians may contact the traditional birth attendant to bring herbs to the hospital. This phenomenon establishes traditional birth attendants as an important source of information on herbal medicine use during pregnancy and childbirth. This finding is similar to that of Adejoh *et al.* (2020b), who reported that women seek delivery care from traditional birth attendants that use herbal medicine to lessen pain and facilitate a smooth delivery. Although radio was the least mentioned source of information in this study, studies elsewhere indicate that radio and market advertisements are important sources of information on use of herbal medicine (Miles, 1998; Ekor, 2014). However, in the context of this study, less influence from the radio could be attributed to difficulty in receiving radio signals in rural areas. Besides, nowadays, people tend to access news and other information through social media platforms, which are installed on mobile phones, instead of from the radio (Laor, 2022). Health policymakers should consider involving traditional birth attendants, who, instead of preaching the benefits of herbal medicine, help to promulgate the adverse effects of the herbal medicines whose efficacy and safety have yet to be tested.

4.1. Strengths and limitations

The study's diverse and normative views from women of different age groups and parity are the main strength of this study. This study also contributes to the literature on information sources and factors influencing the use of herbal medicine during pregnancy and childbirth in Malawi. However, given the limited size of sample recruited from the same geographic location (rural Lilongwe), the results of this study can hardly be generalized to other populations. In addition, the research question "*why women would decide to use during pregnancy and childbirth?*" remains unanswered.

5. Conclusions and future directions

The study revealed that many factors influence herbal medicine use during pregnancy and child birth, ranging from previous labor experiences to external pressures. The reasons to use herbal medicine are also dependent on the types of information sources, such as friends, parents, and traditional birth attendants. To demystify some of the perceptions influencing herbal medicine use among rural women in Malawi, we can devise tailor-made interventions based on these factors. Furthermore, health professionals need to work hand in hand with community-based health structures to educate and provide accurate information regarding the use of herbal medicine. Such efforts may contribute to the reduction of maternal mortality rates in rural areas of Malawi and increase the provision of better maternal and reproductive health services. We believe the findings of the present study shed light on how the community-led pathways can be exploited in influencing the decision to use herbal medicine among women in rural areas of Malawi.

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Conflict of interest

The authors have no conflicts of interest to declare.

Author contributions

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Investigation: Dziwenji Makombe and Alexander Mboma
Methodology: Dziwenji Makombe
Writing – original draft: All authors
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Ethics approval and consent to participate

Ethical approval for the study was obtained from the COMREC of the University of Malawi (reference number: P.10/20/3169). Verbal and written consent was obtained from the study participants.

Consent for publication

Not applicable.

Availability of data

The datasets used and/or analyzed during this study are available from the corresponding author on reasonable request.

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ACCSCIENCE PUBLISHING

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REVIEW ARTICLE

The landscape of physical sexual violence in Botswana, Ethiopia, Kenya, and Nigeria: A systematic review

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Abstract

The present study aimed to determine the trending country-specific common forms and patterns of sexual violence in Sub-Saharan African countries considering the multi-component nature of the menace. We systematically reviewed the population-based studies, obtained from PubMed, Medline, Scopus, and Google Scholar, that dealt with all-encompassing physical sexual violence in Botswana, Ethiopia, Kenya, and Nigeria. The quality and significance of the data obtained were assessed, and similar events were grouped and reported found to have inspired policy recommendations for non-sexual violence initiatives and respect for sexual and reproductive health rights in Sub-Saharan Africa. This systematic review revealed that sexual violence is captured as sexual harassment, sexual assault, sexual abuse, rape, coercive sex, incest, child sexual abuse, and intimate partner sexual violence. Botswana ranked first in worldwide rape statistics, while Nigeria and Kenya ranked 135th and 103rd, respectively. Ethiopia's global rape ranking was not available at the completion of writing this paper, and further statistical proof(s) on these ranks were also not established in this review. The historic record for Botswana on forced sex reads 10.3% while forced marriage for Ethiopia shows 58%. Across the four countries selected, intimate partner violence ranges between 9.0% and 58.6%. While completed rapes, attempted rapes, and forced sexual initiation were mentioned in a few studies, the lifetime sexual violence ranges between 45.4% and 56%. In addition, the generic sexual violence was between 9.6% and 61.2%. In summation, sexual violence is prevailing at the locations of study, regardless of age, gender, or community. However, since the actual or suspected dominant perpetrators of sexual violence are overrepresented in the male populations, enlightenment campaigns should be implemented for boys and men so that they grow more conscious of other gender's sexual rights in the conduct or pursuit of their sexual satisfaction and behavior. Effective community engagement (with parents, workers, academics, and students) should be prioritized by various governments and other stakeholders toward the achievement of improved sexual health, and well-being among the populace.

Keywords: Sexual violence; Rape; Intimate partner sexual violence; Sexual harassment; Sub-Saharan Africa; Systematic review

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1. Introduction

Sexual violence is one of the fastest growing global crimes with no geographical boundaries despite the widespread outcry over the menace. Despite the fact that it has constituted one of the trending news on social media, data documentation on the most prevalent forms of sexual violence within and across countries are harder to locate in the literature, especially as it relates to Sub-Saharan African countries. While the crime is under-reported, the multifaceted nature of sexual violence could befog the understanding of the specific forms and patterns and eventually hinder effective interventions (Adinew & Hagos, 2017), especially in the Sub-Saharan African region where sexual matters are sacred. In addition, the incessant vulnerability, rampancy of the incidence of sexual violence in different terminologies, and the expression of shock and disappointment by both the victims and the perpetrators whenever the damaging consequences ramp up signals that there could be inadequate understanding of the dimensions of sexual violence in gender relationship. It could also imply that there is an inadequate proper guidance in the field of sexual behavior, especially as it relates to sexual violence in the region. Knowing the prevailing types of sexual violence for a specific country could help policymakers understand the extent of the problem and guide them in implementing appropriate interventions for prevention and treatment.

Sexual violence has been described and contextualized diversely with potential, perhaps for proper understanding and expected reduction in the incidence. In the literature, sexual violence goes by different names such as harassment, assault, child sexual abuse, rape, incest, beating, and intimate partner sexual violence (IPSV). Each of these has different connotations. Sexual violence is sexual activity that is not freely given or where consent is not expressed by either party. It is a non-consensual contact or non-contact sexual activity, either completed or attempted (Basile *et al.*, 2020). Sexual violence widely occurs in both domestic areas and public places such as workspaces, campuses, schools, religious centers and may occur even during transit. The World Health Organization (WHO) defines sexual violence as any sexual act, attempted sexual act, unwanted sexual comments, sexual advances, or acts by any person, regardless of their relationship to the victim and in any settings, including the victim's home and place of employment (Lewis *et al.*, 2016; WHO, 2021). The WHO's description also depicts the the use of force or coercion to compel a person into commercial sex acts or labor against their will. The organization also highlighted that sexual violence encompasses all acts that range from verbal harassment to forced penetration (WHO, 2012). The United Nations Population Fund (UNFPA) also identified that one in every four adolescent girls aged 15 – 19 (almost 24% of the world's adolescents) have experienced either physical or sexual violence from either an intimate partner or husband (UNFPA, 2022).

For instance, sexual harassment is defined as "any unwanted or unwelcome sexual advances, requests for sexual favors, and any other physical or verbal harassment of a sexual nature" (WHO, 2012, p.2). Its common forms include: unwanted touching and/or grabbing, physical intrusion into someone's personal space, comments about an individual's body parts, and unsolicited sexual jokes aimed at a particular person (Buss, 2023). Sexual assault is defined as non-consensual sexual contact that could involve intentional sexual contact made through force, intimidation, coercion, or abuse of authority (Savino & Turvey, 2004). These may include unwanted contact (*e.g.*, kissing, touching) and groping (*i.e.*, the act of intentionally touching another person sexually without their consent). It also includes sexual slavery and lewd acts. Rape is described as sex without consent and it is likened to sexual robbery or burglary (Bourke, 2020; Savino & Turvey, 2004). Sexual violence may include stalking which includes willfully and repeatedly following or trailing someone in a manner that could be suspected for obtaining unwanted sexual attention or intentionally meant to secure unwanted sexual attention. This act may be either done physically or electronically (Basile *et al.*, 2011; Bourke, 2020; Savino & Turvey, 2004).

While the generic intimate partner violence (IPV) comes in different forms, *e.g.*, physical violence, sexual violence, stalking, and psychological aggression (Izugbara *et al.*, 2020), its nexus in this study is IPSV. This is defined as any form of unwanted sexual contact or activity from an intimate partner that exerts fear, threats, or violence on the partner (Gopalan, 2022; Izugbara *et al.*, 2020).

Another form of sexual violence is incest especially when it involves an adult and a child (Gusti & Agung, 2020). It is an abuse that has cultural diffusion in practices and perception. In certain cultures, while it is culturally tolerated for cousins to marry each other, with consensual sex between adults considered legal (Hörnle, 2014), it is a social taboo and often frowned on in some other communities (Bittles, 2015; Smit, 2021). In Nigeria, for example, incest is a sexually violent crime punishable by law (Uche & Azuonwu, 2022). Incest is sexual intercourse between first-degree relatives such as sex between mother and son, father and daughter, step-parent and step-child, brother and sister, uncle and niece; grand-uncle and grand-child, aunt and nephew; grand-aunt and grand-nephew, and so on (Bittles, 2015). Like the general sexual violence that is commonly silenced, accurate statistics on incest are largely unknown. Incest cases are often not reported,

perhaps because of the shame and stigma associated with it or the pressure to keep it a secret due to the fear of disrupting family dynamics (Babbel, 2013). However, without intervention, the trauma from incest can impact the health of a victim and subject such a victim to a state of sexual captivity (Babbel, 2013).

Investigation into sexual behavior dates back to the 18th century and has involved a variety of approaches including medical, demographic, psychological, and public health approaches (Mercer *et al.*, 2016; Mirzaei *et al.*, 2016). There are also current advancements in the study of sexual behavior with increasing interventions to improve sexual health globally. However, the dynamic nature of sexuality, intermediated by region- and culture-specific sexual behavioral diversities (related to sex), has made the research in this field inexhaustible. Studies have also suggested a multicomponent intervention for addressing sexual behavior to secure sustainable improvement in sexual health (Amoo *et al.*, 2018; Mercer *et al.*, 2016; Mirzaei *et al.*, 2016). This is due to the fact that a general approach might not be effective in all places (Amoo *et al.*, 2018; Mercer *et al.*, 2016; Mirzaei *et al.*, 2016).

Thus, this study is premised upon a multicomponent approach (MCA) that has the potential for addressing social concerns that are befogged with diverse boundaries but with pluralistic effects on individuals, families, and the community as a whole. Sexual violence is multifaceted (encompassing) social public concern with multiplier effects on society. Effective interventions could only be a coordinated multilevel approach. The MCA uses a coordinated set of core components, pillars, or infrastructure to promote health, safety, security, and personal and social development for sustainable human relationships with the environment (International School Health Network [ISHN], 2019; Jackson *et al.*, 2012).

The findings from this study could therefore serve as a guide for the youths (girls and boys, women and men) to understand the forms and behavioral tendencies that could spur sexual violence. The information could also empower them to avoid being violated and provide them with an understanding of why others should not be violated. Despite the concerted global efforts toward the elimination of sexual violence and the continuous underreporting of sexual violence, the true estimate may not be available. Furthermore, the paucity of literature on the subject could undermine the establishment of the magnitude and pattern of these criminal activities (Amoo *et al*, 2022; Amoo *et al.*, 2018; Bourke, 2020; WHO, 2012). However, the available information when pooled together could reasonably serve as insight for the parents, educators, caregivers, and health personnel, including other stakeholders in sexual and reproductive health and gender well-being. This paper reviewed extant literature to pinpoint the prevalence and forms of sexual violence across the selected countries in Sub-Saharan Africa. It is also an attempt to contextualize the risk factors and suggests plausible ways, not only toward reduction but also to eradicate sexual violence.

2. Data and methods

2.1. Information sources and search strategy

In this analysis, we systematically reviewed research studies obtained from PubMed, Medline, Scopus, and Google Scholar. Searches were strategically focused on the screening for population-based (cross-sectional or cohort) studies that dealt with sexual violence notwithstanding its presentation in different nomenclatures. The best quality data on sexual violence have been noted to be mostly domiciled in population-based surveys (WHO, 2012). We accessed studies on sexual harassment, sexual assault, sexual abuse, rape, coercive sex, incest, sex slave, child sexual abuse, domestic violence, and IPSV, and other studies that focus on its generic presentation as just sexual violence.

Specific attention was focused on studies on Sub-Saharan Africa, especially Botswana, Ethiopia, Kenya, and Nigeria. The region of Sub-Saharan Africa is profiled as a region with the highest rates of rape in the world perhaps due to political conflict, communal clashes, and poverty although there are no accurate data to support the claim (Wisevoter, 2023). Data gathered were synthesized qualitatively and quantitatively. Prevalence rates were established, and obvious consequences of the findings and our assumptions on further implications of the findings were discussed in line with the plausible achievements of improved sexual health, and well-being for men and women. These are expected to culminate in the delivery of Sustainable Development Goal 3 (SDG-3).

2.2. Inclusion and exclusion criteria

The articles describing population-based studies published from the post-millennium era (2016 till date) were obtained from PubMed, Medline, Scopus, and Google Scholar. All accessible published literature that relates to the search keywords and countries selected were reviewed. Other sources included are open-access resources, which can be used or adapted without permission. Published literature was included only if they were peer-reviewed, published in recognized outlets (*e.g.*, journals, books, gazettes, or other records), or published by acknowledged organizations such as the WHO, United Nations Development Program, and United Nations Children's Fund, with the exception of social media platforms. Non-human studies and studies without clearly defined study designs or methodologies

were excluded from the study. Notwithstanding, studies were selected based on the relevance of the title, the abstract, and the full text. Selected literature are resources that could help in highlighting the types and prevalence of sexual violence to propel practical suggestions for curbing sexual violence. This could enhance sustainable improvement in sexual health and well-being of the people. Figure 1 shows the article screening and selection procedures.

2.3. Data analysis

The data analysis followed a simple model in limiting our scope to only a systematic review that presents with descriptive rate and ratio statistics. This is done without subjecting the data obtained to meta-analysis (Amoo *et al.*, 2020). The descriptive data (rates and ratios) presented could enhance the understanding of individuals, community leaders, and other stakeholders who may not be statistically literate (Amoo *et al.*, 2020).

3. Results

3.1. Search results

Our search returned 255 publications. However, after screening the titles and abstracts for relevance, studies employing qualitative methods and those published pre-SDGs were excluded. A group of 108 studies was also excluded because they did not provide prevalence statistics, population figures, or relevant estimates on any of the keywords used. Other papers that are not specific to the four countries selected (*i.e.*, Botswana, Ethiopia, Kenya, and Nigeria) were removed. In addition, other studies that were not based on Sub-Saharan Africa were screened out. In the end, 64 full-text papers were obtained and reviewed.

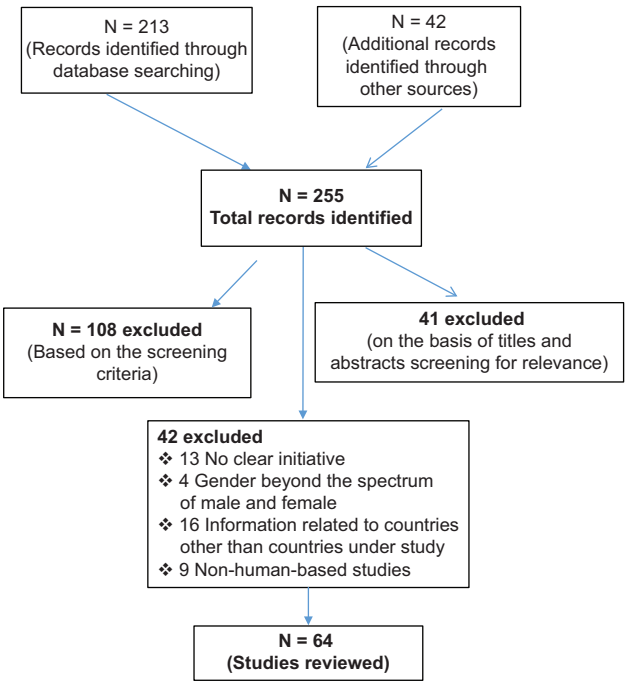

Figure 1. Flowchart depicting the article screening and selection procedures

3.2. Country-by-country findings

The review revealed different statistics on the subject across the four countries of study in Sub-Saharan Africa. The statistics indicated that the prevalence of the menace, and the general contents provided highlights of its dimensions. Furthermore, a cross-sectional study on associated factors of violence against sexual partner and gender minorities across other nine (9) African countries showed that out of 3798 respondents, 18% experienced forced marriage, 56% had lifetime physical or sexual violence, and 29% experienced the same in the year preceding the survey (Müller *et al.*, 2021).

3.2.1. Botswana experience

Notwithstanding the effort of Botswana government in legislating for the protection of victims of sexual violence and for setting punitive measures against the perpetrators, Botswana still remains one of the countries with the highest rate of rape cases in the world (Wisevoter, 2023). A record showed that worldwide official cases of rape (measured in 100,000) range from 0.2 (in Azerbaijan) to 92.2 in Botswana (Adabembe, 2022). While several organizations, including the WAR (Women Against Rape, a human rights organization), have relentlessly worked on reducing sexual violence, the reported historic prevalence rate of forced sex among women in Botswana stands at 10.3% (Jahanfar *et al.*, 2022). There is also a high prevalence of human immunodeficiency virus (HIV) infection rates including unintended pregnancies, especially among adolescents (Barchi *et al.*, 2022). This is happening in Botswana despite the national mandate for girls and women to access comprehensive sexuality education, youth-friendly health services, and sexual and reproductive health information (Barchi *et al.*, 2022). In a study where IPV and alcohol consumption are associated with major depressive disorders in Northwestern Botswana, 37% out of 469 women in the study reported recent physical IPV (Barchi *et al.*, 2021). Furthermore, out of the 3516 disabled young women (aged 15 – 29) that were included in one Botswana study, 21% have experienced IPSV and 8% with forced sex (Cockcroft *et al.*, 2018).

A retrospective survey based on Botswana data from 2013 – 2016 highlighted the prevalence of incest and defilement of children (under 16 years), though the study acknowledged a reduction in child defilement between 2013 and 2014 and a slight increase between 2014 and 2015 (Ramabu, 2020). Cases of rape (as reported) ranges from 3.8% to 4.5% among children aged 10 years and

below between the year 2003 and 2005. The prevalence was established to be 24.5% (2003), 30.0% (2004), but declined to 21.9% in 2005. Among the adult (18 years and above), cases of rape reported were 71.7% (2003), 65.4% (2004), and 73.5% (2005). The study summarized that the proportion of raped victims aged 11 – 17 years (21.9%) was more than that of children ≤10 years who had been raped (Ramabu, 2020). The study also reported that child sexual abuse rate is estimated at 82/500,000 population in 2015, amounting to 0.02% (Ramabu, 2020).

In another cross-sectional study on students' views and experiences on child sexual abuse in Botswana, out of the 300 randomly selected students from three secondary schools in Gaborone, 53% of the respondents agreed that child sexual abuse exists and 89% agreed that female students are most affected from this form of sexual violence (Diraditsile & Rankopo, 2018). The report indicated that a number of the students engage in sexual relationships with teachers perhaps for financial gain (93%), favorable treatment (48%), and good grades (41%) (Diraditsile & Rankopo, 2018). However, an overwhelming majority of the students claimed ignorance of the existence of the sexual harassment policy in the school (Diraditsile & Rankopo, 2018; Mogapaesi, 2019).

3.2.2. Ethiopia experience

Although Ethiopia is not among the nations highly ranked on the rape statistics (Wisevoter, 2023), there are numerous literature on the issue of sexual violence in Ethiopia. Despite a number of initiatives implemented to curb sexual violence in the country, including the launch of National Roadmap to End Child Marriage and backlash against female genital mutilation or cutting in 2019, there are many different perspectives about or dimensions to sexual violence experience in Ethiopia just like other low- and middle-income in Africa countries. As far as 2001, the recorded prevalence of completed rape and attempted rape against female students (aged 12 – 23) was 5% and 10%, respectively (Tadiwos, 2001). Approximately, as reported, 85% of the victims were aged ≤18 years (Tadiwos, 2001). A study conducted among female students (aged 18 – 26 years) of Wolaita Sodo University in South Ethiopia reported a lifetime sexual violence of 45.4% among the respondents (Adinew & Hagos, 2017). The study highlighted that on average, 36.1% of female students have ever experienced sexual violence, while 24.4% reported having the experience in the current academic year in which the study was conducted (Adinew & Hagos, 2017). The contributing factors to the menace of sexual violence include witnessing interparental violence, rural childhood residence, having regular boyfriend, alcohol consumption, and having friends who drink regularly.

Reported information confirmed the existence of workplace sexual violence (Worke *et al.*, 2020), noting evidence from Tigray area (22.0%) with the report identifying female university staff as the victims (Worke *et al.*, 2020; 2022). Another study related to Southern Ethiopia reported the prevalence of workplace sexual violence as 34.3% and considered age, educational status and night shift (working at night) as crucial correlates, among others (Galu *et al.*, 2020). Another study using 2016 Ethiopian Demographic and Health Survey data showed that 9.6% of the women aged 15 – 49 years had experienced sexual violence (Yitbarek *et al.*, 2019a).

The increase in IPV that gained momentum during the COVID-19 pandemic period did not spare Ethiopia. During the COVID-19 lockdown, many women and girls were at increased risk of experiencing sexual violence, as compared to the pre-COVID-19 era. A study conducted in the Amhara District of Ethiopia showed that 33% of the participants in the study were victims of sexual violence during the COVID-19 pandemic, which was higher than before the pandemic (Tesfaw *et al.*, 2021). Another study also found that the risk of sexual violence increases when the woman is unemployed, younger (aged ≤30 years), and married under arranged-marriage scheme (Gebrewahd *et al.*, 2020).

Academic investigation on sexual violence among 374 female students in Wolaita Sodo University, Ethiopia, using self-administered questionnaire highlighted that 23.4% have experienced attempted rape, 8.7% completed rape, and 11.3% forced sexual initiation (Tora, 2013). The study reported that the sexual violence was mainly experienced in high school and during enrolment year at the university (Tora, 2013). Identified perpetrators are boyfriends, close friends or colleagues, family members, and relatives. The list also included school and university teachers while strangers were also mentioned as the key perpetrators in the study (Tora, 2013).

A study among 339 randomly selected female nurses in Addis Ababa (Ethiopia) revealed that 46.6% have experienced sexual harassment, 49.3% (167) were involved with physical sexual harassment and 51.2% (79) ever experienced verbal sexual harassment (Weldesenbet *et al.*, 2022). The menace has 4.64 times more likely to occur in single female nurses compared to married nurses and 4.7 times more likely among nurses aged 20 – 25 years. Alcohol consumers were at a 4.5 times higher risk of being sexually harassed compared to non-alcohol consumers (Weldesenbet *et al.*, 2022). Another study that confirmed the prevalence of sexual violence in the country reported that relatively one out of 3 (33.3%) from a total of 367 girls interviewed had been raped, 20.4% had experienced

attempted rape, and 44% had been sexually harassed in North-west Ethiopia (Fitaw *et al.*, 2005).

In their study, Dagnaw *et al.* (2021) reported that 4.8% (11) of 503 health-care providers interviewed at Obstetrics and Gynecology Department of a regional hospital in Ethiopia had been victims of sexual violence. Overall, 44.5% of the health-care providers had reported workplace violence (Dagnaw *et al.*, 2021). Another study among 330 night-shift female college students (mean age of 24.9) in Hawassa city of South Ethiopia reported that 61.2% (202 out of 330 students) had experienced sexual violence in the past 12 months before the survey. The rate reported included 13.9% (46) that suffered rape, 6.9% (23) that experienced attempted rape, and 49.4% (163) that suffered sexual harassment (Esayas *et al.*, 2023). The independent predictors observed in the study included the consumption of alcohol by the victim. Other records showed that approximately 27% of women (aged 15 – 49 years) have experienced at least one form of sexual violence in their lifetime, the specific prevalence rate is 35.0% among ever-married women, 28.6% among students, and 46.3% among housemaids (Dufera *et al.*, 2021; Mekonnen *et al.*, 2022; Protection Cluster & UNFPA, 2022). The specific husband/partner sexual violence was recorded at 51.8%. As reported, gender-based violence (GBV) increased in Ethiopia from 3.5 million in 2021 to 5.8 million in 2022 (Dufera *et al.*, 2021; Mekonnen *et al.*, 2022; Protection Cluster & UNFPA, 2022).

Series of factors identified included the culture of silence over sexual violence, traditional treatment of women as men's property, and use of sex as a tool of procuring favor (Altinyelken & Le Mat, 2018). Other factors identified in another study included age difference between the partners, economic status of the household, and the employment status of the husband (Kaufman *et al.*, 2019; Yitbarek *et al.*, 2019b). Kaufman *et al.* (2019) also observed that education (on its own) could be limited in exerting the expected reduction in the risk and number of women facing violence (Kaufman *et al.*, 2019).

3.2.3. Kenya experience

There are various levels of interventions on sexual violence in Kenya, among which the potent is the Sexual Offences Act in Kenya that prohibits rape of any type (attempted rape, completed rape, compelled or induced indecent acts, and defilement). There are also a few seemingly institutional sensitization surveys (*e.g.*, Kenya National Demographic and Health Survey; National Violence Against Children Survey). Notwithstanding, there are records on sexual violence (from health, police, or court systems) including Human Rights Defenders. The country is also ranked 103th on the global ranking for rape prevalence (Wisevoter, 2023). While the findings from our review could not uphold the ranking, studies reviewed highlighted the prevalence of sexual violence (in various forms) in Kenya. One study confirmed that approximately 14% of women and girls aged 16 – 30, who are the usual targets of sexual abusers, have been subjected to sexual violence in Kenya (Rudolph *et al.*, 2022). Reported information showed that over 11 million women in Kenya have experienced sexual violence in their lifetime according to the National Monitoring and Evaluation Framework toward the Prevention of and Response to Sexual and Gender Based Violence in Kenya (Wambui, 2018).

The National Violence Against Children Survey indicated that one out of every three girls and one out of every five boys in Kenya experiences at least one form of sexual or physical violence before attaining 18th birthday. The survey report indicated that 47% of women (aged 16 – 30) have experienced physical or sexual violence while over 11 million women in Kenya are vulnerable to a lifetime sexual violence (Flowe *et al.*, 2020).

There are also pockets of information from Human Rights Defenders, obtained from the shared individual stories. A report from Stevens *et al.* (2022) indicated that almost 41% of women in Kenya have experienced either physical violence or IPSV in their lifetime and nearly 26% have experienced it in the past 12 months before the survey period (Stevens *et al.*, 2022). The Kenya Demographic and Health Survey 2013 was one of the first formal studies to characterize sexual violence in Kenya after the novel research agenda setting by the Population Council in 2008 (Stevens *et al.*, 2022). The report also added that sexual violence against women and girls in Kenya is committed mostly by intimate partners (boy-friends or husbands) and non-partners (Mathur *et al.*, 2018; Stevens *et al.*, 2022).

A study conducted in Nairobi, Kenya, among adolescent girls and young women highlighted that sexual harassment was prevalent before and during COVID-19, with 18.1% of the respondents reporting having experienced sexual harassment before the study year (August to October 2020) and 66.6% during and after COVID-19 (Bevilacqua *et al.*, 2022). The Wangu Kanja Foundation statistics as reported by other scholars have shown that more than 32% of female population have experienced sexual violence before their 18th birthday (Cherop, 2020)

Kosgei *et al.* (2021) examined the psychological outcomes of sexual assault among survivors seeking care at a gender-based clinic, Kenyatta National Hospital in Nairobi (Kosgei *et al.*, 2021). To understand this phenomenon, the authors adopted a mixed cross-sectional method to survey 44 sexual assault victims, yielding valuable results. Participants were 44 sexually assaulted females aged 16 – 30 years. The majority

of the survivors were single (85%), coming from different parts of the country. Those from within Nairobi (86.2%) were mainly from Kibera (42%), an urban slum, and those outside the capital came from Kiambu, Kitale, Kitengela, and Kitui (3.4% each). While the study did not adduce the reason for the prevalence of sexual violence in Kibera, the study showed that 50% of the sexual violence perpetrators are regular males living in the same neighborhood as the victims (Kosgei *et al.*, 2021). It is thus crucial to understand the social issues around the prevalence of sexual assaults against single females by known assailants within the communities.

3.2.4. Nigeria experience

Although there are a couple of studies on generic sexual violence in Nigeria, information on its different types and forms is relatively scanty. Nigeria is ranked 135th in the world's rape statistics (Wisevoter, 2023). An analysis of data covering 1766 females (aged 13 – 24) from a 2014 survey on violence against children in Nigeria reported that women who endorsed beliefs about patriarchal sexual decision-making or ever attended school were more likely to experience lifetime sexual violence (De Veauuse *et al.*, 2022). In a study on the trends of rape cases in Nigeria using a 2014 – 2016 survey report, Idoko *et al.* (2020) reported that the highest rape prevalence is common among young people aged 13 years and above and that out of the 463 individuals covered in the study, 89.7% had experienced rape or defilement, and 3.1% and 4.3% had experienced attempted rape and sexual assault, respectively (Idoko *et al.*, 2020). Another report indicated that one out of three girls and women are vulnerable to sexual abuse before they attained 25 years (Nextier Development Foundation[Reliefweb], 2023). Njoku & Akintayo (2021) reported vulnerability of girls and women to sexual exploitation even from supposedly defenders of their rights such as security force personnel including the aid workers (Njoku & Akintayo, 2021). Out of 350 female adolescent students (aged 10 – 19) who had participated in a self-administered questionnaire survey in Lagos (Nigeria), relatively half (42.9%) of them had had sexual intercourse (sexual debut = 17 years), 15.8% reported forced sexual initiation, 36.3% reported that first intercourse was coerced, and 18% who were sexually active (64.1% out of the 350 respondents) had been raped (Odeyemi *et al.*, 2016).

The rape prevalence cut across regions within Nigeria. Past records as at 2012 for Nigeria indicated that the South-South could be the region with the highest rape cases in Nigeria (10%), followed by North-East (6%), North-West (4%), and North-Central (3%) (Adabembe, 2022). In a study on workplace GBV among 339 female staff from public and private universities in Enugu, South-East Nigeria, Agbaje *et al.* (2021) reported bullying and sexual harassment rates of 53.5%, and 40.5%, respectively. Also reported from the same study are unwanted sexual attention (25.6%) and sexual coercion (26.6%). These statistics excluded other violence such as bullying, workplace incivility, and so on (Agbaje *et al.*, 2021). The descriptive cross-sectional study in 2018 among 412 healthcare workers at a University Teaching Hospital (in Nigeria) indicated that sexual abuse was reported by 8 (1.9%), with 114 (55.6%) reporting relatives as perpetrators, and 48 (23.4%) indicating staff members as perpetrators (Chinawa *et al.*, 2020). In Lagos state, one cross-sectional study identified sexual violence (54.6%), physical (52.3%), verbal assault (41.5%), and online sexual harassment (45.4%) among 130 female respondents (mean age 26.9 ± 8.7 years) in low-income communities in the state and that only one out of three victims had the courage to report their experiences to the police (Wada *et al.*, 2022).

In a study involving 178 gynecological cases conducted in Makurdi, Benue State in the North Central Nigeria, rape incidence was 25.8% (46 cases) with the majority of the victims under the age of 12 (39.1%). Those aged 13 – 18 years comprise 34.8% of the sample, with an overwhelming majority of the victims (84.4%) having a primary school education level and being residents with both parents in urban environment (Utoo *et al.*, 2018). Furthermore, only 4.3% of victims were married at the time of the survey, with 39.1% of them being single and 56.5% being children (Utoo *et al.*, 2018). In a household-based survey in two states of Nigeria, 22.0% of women in Cross River and 9.0% in Bauchi reported that they experienced IPV during their last pregnancy (Ansari *et al.*, 2017).

At the far north, a study highlighted that among the 393 female participants (aged 15 – 49) in an hospital-based study (General Out Patient Clinic of Aminu Kano Teaching Hospital, Kano, Nigeria), the prevalence of IPV before the survey period was 42.0% and sexual violence was 21.9% (Tanimu *et al.*, 2016). In addition, another study showed that among 240 antenatal pregnant women selected in clinics in Oyo state (Nigeria), 38.1% of them had been sexually harassed, not including the victims of other forms of abuses and violences (Ilori *et al.*, 2023).

3.2.5. Global context

While the study is exclusively meant for four countries in Sub-Saharan Africa, a global comparison might be insightful for understanding the general context of the topic. The literature highlighted that, globally, four out of five women and eight out of 10 men have experienced rape before they attained age 25 while half of the female victims

experienced their first completed rape before age 18 (Basile *et al.*, 2011; National Center for Injury Prevention and Control & Division of Violence Prevention, 2022). A report on the prevalence of lifetime sexual violence for US in 2010 highlighted that approximately one in five women (18.3%) and 1 in 71 men (1.4%) in the US have been raped in their lifetime as of 2010 (Basile *et al.*, 2011). One out of 8 women (13%) and 6% of men were reported to have had lifetime experience of sexual coercion amounting to 15 million women and 7 million men in the US (Basile *et al.*, 2011). In addition, 43.2% of female and 51.3% of male rape victims experienced their first sexual violence before 18 years old (Basile *et al.*, 2020). The global rate of sexual violence (for women) is 35%, indicating that one out of every three women have been sexually violated (WHO, 2021). The region of Oceania, Southern Asia, and Sub-Saharan Africa has been tagged as the regions with the highest prevalence rates of IPV (33% – 51%) among women (aged 15 – 49) worldwide (WHO, 2021). While the Oceania takes the lead (51%), followed by Southern Asia (35%), Sub-Saharan Africa takes the share of 33% (WHO, 2021). In 2012, the WHO reported that the prevalence rate of IPSV was 58.6% for Ethiopia (Province) and 16.5% for Namibia (city). The report also indicted that Brazil's prevalence rates were 14.3% for all areas and 10.1% for cities. The corresponding figures for Tanzania were 30.7% and 23.0%, and for Bangladesh were 49.7% and 37.4%, respectively.

4. Discussion

This review presents the landscape of sexual violence rates documented for four sovereign states in Sub-Saharan Africa, namely, Botswana, Ethiopia, Kenya, and Nigeria. The idea behind this research is to highlight the peculiarity of each country in terms of sexual violence (physical sexual violence) for the possible formulation of effective policy and prevention interventions on sexual violence. The overriding motivation is to ensure the protection of boys'/girls' and men's/women's sexual rights toward plausible realization of SDG-3, and SDG-5. While Goal-3 focuses on good health and well-being for all ages, the Goal-5 aims at achieving gender equality and empowerment of all women and girls. The statistics on the prevalence of rape, sexual harassment, child sexual abuse, and IPSV, including the places of occurrence as reported in the reviewed literature, are crucial insights for parents, young men and women, and school administrators. The statistics are also critical for effective government policy and other preventive interventions implemented by stakeholders. The reviews revealed that sexual violence is prevailing in the locations under study, regardless of age, gender, social class, or community. While there are public outcries over the incidence of sexual violence and efforts gearing toward achieving an improved sexual healthy society, including wide-range discourse over the topics of sexual violence in the literature, current and past studies have documented the existence of sexual violence in different forms and patterns in the studied countries (Botswana, Ethiopia, Kenya, and Nigeria).

The specific types/forms identified are rape, IPSV, harassment, workplace sexual violence, incest, and so on. However, the merging of all these types/forms under the generic terminology of sexual violence could be misleading and inform ill decisions, coupled with wrong approaches in proffering solutions to this menace that has deeply penetrated the fabric of the society. The different forms of sexual violence and their different prevalence rates as highlighted in this systematic review require addressing through broader prevention and control approaches. While sexual violence occurrence is irrespective of ages, genders, and sexual orientation of the victims, it is more pronounced among adolescents, young people, and especially the youth.

Specifically, each of the different kinds of sexual violence activities, practices, or behaviors revealed in this review would require distinct approaches, especially due to differential in cultural permissiveness, which of course is overshadowing the gravity of the implications of the violence. For example, the solution or intervention strategy required for addressing incest in a culture where sex is considered a rite of passage (Likupe *et al.*, 2021) would be different (both in type and application) from where such practice is abhorred. Furthermore, in a culture where wife is required to have sex with husband's visitor or where sex could be offered freely as a means of entertaining guests (Chiazor *et al.*, 2016) or communities that practice sexual cleansing (Amoo *et al.*, 2022), strategies to address wife raping through a legal sanction might not yield expected result. Distinctively, in any communities where misconception that having sex with a virgin could cure acquired immunodeficiency syndrome is prevailing (Chiazor *et al.*, 2016), which represents a crucial impetus behind the increasing incest and child sexual abuse rates, the relevance of cultural belief reorientation could be crucial.

In addition, in society where consanguineous marriages (*i.e.*, interfamilial union) are allowed (Ibrahim & Serakinci, 2020), intervention to discourage sexual relationship among the blood-related individuals could be difficult to implement compared to where such practice is likened to abomination. Thus, where legal form or societal sanction could work in one, a form of cultural dilution that discourages such practices is necessary in the others. Thus, modalities that could address sexual violence should be country- or community-specific. In most traditional settings in Sub-Saharan Africa, the treatment or a discourse on rape activity would need special focus on the culture as it relates to sexual relationship and behavior. The information

presented in this study suggests that the application of a public legal sanction on erring persons or parties could be effective in certain communities/regions. However, such sanctions could be unnecessary or constitute a wasted attempt, especially where sexual behaviors are not gauged, or where the society has sexual latitude. In a nutshell, a general pronouncement or intervention on sexual violence could be misleading and ineffective without touching base with the exact types of the sexual violence (rape, incest, child sexual abuse, partner sexual violence, and so on).

This review provides understanding into the specific common types of sexual violence in the selected countries. While Botswana, Kenya, and Nigeria were ranked for rape prevalence rates, the non-inclusion of Ethiopia in the ranking could suggest that there is no rape data available in Ethiopia. However, our review indicated the contrary, showing rape is prevalent in Ethiopia, with data not being officially captured. The highlight of the prevalence of child sexual abuse and sexual harassment in schools or academic institutions could help in monitoring educators' sexual misconduct and program intervention, especially on sexuality education. It specifically signaled the need for radical improvement in school administration and control over students' sexual conduct. Thus, appraisal of sexuality education in school and colleges is exigent, and boys'/girls' empowerment capability to report incidence of sexual harassment is extremely important. Legal treatment (*e.g.*, police intervention) is the most common way used to curb sexual harassment in schools, but it will not be effective if the victims are reluctant to report on the incidences. Notwithstanding, it is common knowledge that most incidences are not often reported or reported late when the damaging repercussion starts to take hold.

The reviewed studies highlighted that irrespective of the forms (or the patterns) sexual violence may take, the activity could impact lifelong health of the victim. The experience could negatively affect the well-being of both the victims and their families (De Veauuse *et al.*, 2022; Diraditsile & Rankopo, 2018; National Center for Injury Prevention and Control & Division of Violence Prevention, 2022). The reviewed works also shed light on the increased risk for substance use, injury, negative sexual health behaviors, feelings of sadness, hopelessness, suicidality, including negative effects on age at marriage, multiple sex partnership, and unintended pregnancy, among victims of sexual violence (Basile *et al.*, 2020). The economic repercussions include absenteeism from work or school, eventual dropping out from school, unemployment and increase in poverty level (Amoo *et al.*, 2016; 2017; 2018; Wellings *et al.*, 2006). Furthermore, sexual violence may stimulate unintended migration and forced displacement. While the victim may want to avoid shame or stigmatization where further vulnerability to sexual exploration is not impossible, the perpetrator may escape judgment by running away from the place of incidence. Survivors are often ashamed, face stigmatization, and in many cases, are often reluctant (if not totally refused) to tell the family, friends, or report to the law enforcement agents (National Center for Injury Prevention and Control & Division of Violence Prevention, 2022).

The consequences of sexual violence either in their physical or mental forms are often devastating. It is a threat to sexual rights and has both short- and long-time consequences, especially on the health and well-being of the victims, and the community at large. Irrespective of the victim's age, sexual violence involving penetration is often unprotected and could be an inroad to unintended pregnancy and sexually transmitted infections (STI), in addition to psychological trauma or symptoms including depression (de Souza Costa *et al.*, 2020). The consequence of unintended pregnancies that occur through sexual violence often end in abortion or out-of-wedlock births. In certain culture, where the boy/man involved is identified, the girl or woman victim will be married off to the boy or man because being pregnant in Nigeria is akin to consummation of marriage. Furthermore, sexual violence attracts physical, psychological, and social effects and could endure for a short or long term or permanently. The risks related to sexual health range from unwanted pregnancy, abortion, infection, risk-taking behaviors, including early onset of consensual sex and tendencies of having multiple sexual partners, to non-use of condoms (Buss, 2023; Gusti & Agung, 2020; Jejeebhoy & Bott, 2003; Odeyemi *et al.*, 2016). These risks exclude anxiety, depression, suicide attempts, drop in academic performance, and reduced work productivity.

The finding that the perpetrators of sexual violence are, oftentimes, known to the survivors underscores the need to extensively investigate the role of familial factors in sexual violence, especially in cases like rape and incest. The suspected perpetrators could include friends, current/former intimate partners, and family members (National Center for Injury Prevention and Control & Division of Violence Prevention, 2022). They may also include distant individuals such as coworkers, neighbors, and persons of authority, and sometimes, the perpetrators could be strangers, acquaintances, serial rapists, burglars, or attackers (National Center for Injury Prevention and Control & Division of Violence Prevention, 2022). In general, the identified or suspected perpetrators are described irrespective of the relationship or age, and they include parents, caregivers, acquaintances, strangers, and intimate partners, irrespective

of the age groups (Chinawa *et al.*, 2020; International Committee of the Red Cross [ICRC], 2023).

A major implication of IPSV is that the marriage or sexual partnership that is expected to be protected for both parties could result in ill health and an increase risk of compromising sexual health where violence is involved. While there may not be conspicuous law against marital rape (fondly called domestic violence), perhaps due to the Sub-Saharan African cultural permissiveness of men rights for sexual entitlement in a marriage, the ordeals inherent in the act should warrant official decision on the activity. Thus, it is imperative that everyone, especially the young girls and women be empowered with the relevant information that could build their capacity, not only to resist, but to overcome baits of sexual violence or other sexual rights violating tools.

While the study focused on the encompassing or multicomponent sexual violence, that is seemingly tilted toward traditional sexual violence, it disregarded the digital or electronically (web) acts of sexual violence, whose development is spurred on by internet-of-a-thing (INT). This omission could be regarded as a limitation for this analysis. These digital activities could appear in the form of pornographic posting, non-consented sexual pictures sharing, non-consensual sexting, or other form of cyber sexual bullying (Basile *et al.*, 2011; National Center for Injury Prevention and Control & Division of Violence Prevention, 2022). It is hoped that further study could combine or investigate the forms and types of digital sexual violence for comprehensive prevention.

5. Conclusions

The current systematic review revealed that sexual violence in the forms of rape, IPSV, harassment, workplace sexual violence, and incest are prevailing in the locations under study, irrespective of age, gender, social class, or community of the victims. The prevalence established in the extant literature reviewed supports that sexual violence is hyper-endemic in the locations of study, and by extension, the Sub-Saharan Africa in general. Information from the review identified girls and women as potential victims while men/boys are the malefactors or potential violators of other women's/girls' rights, through rape, harassment, and IPV. The authors therefore recommend that since the males are predominantly the actual or suspected perpetrators of sexual violence, an enlightenment campaign should be implemented for boys and men to make them acquainted with the sexual rights of females, so that they would control their conduct, sexual satisfaction, and behavior. Furthermore, effective legislation and community enlightenment campaign (targeting parents, workers, teachers, and students) should be prioritized by various governments in conjunction with other public health stakeholders towards improving sexual and reproductive health and well-being of both current and future generations.

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Availability of data

The dataset used and analyzed for this study is available from the corresponding author on reasonable request.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Associated factors of child wasting among children aged 0 – 23 months in India: Analysis of the National Family Health Survey-5

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Abstract

The enduringly high prevalence of child wasting (weight-for-height-2SD) in India is a significant cause for concern. The objective of this study is to identify areas with high incidence of wasting among children aged 0 – 23 months and to uncover the factors influencing wasting among young children in India. The analysis utilized individual and district-level data from the National Family Health Survey-5 in 2019 – 2021. The wasting prevalence exceeding 30% was found in 81 districts, with 501 districts surpassing 15%. Our analysis indicated that children from the poorest households (adjusted odds ratio [AOR] = 1.60, 95% confidence interval [CI] = 1.43 – 1.79), those lacking access to improved sanitation facilities (AOR = 1.18, 95% CI = 1.11 – 1.25), belonging to other backward class families (AOR =1.12, 95% CI = 1.04 – 1.20), and born to mothers with body mass index (BMI) <18.5 (AOR = 1.30, 95% CI = 1.23 – 1.37) faced higher odds of wasting. In addition, low birth weight (<2500 g) increased the odds of wasting by 27% (AOR = 1.27, 95% CI = 1.20 – 1.36). The study further found that a minimum acceptable diet and female gender had protective effects on wasting among children aged 6 – 23 months. These findings underscore the need for a comprehensive programmatic response to addressing wasting in young children. Urgent policies and programmatic actions are warranted, with a specific focus on strengthening the care of low birth weight and premature babies, as well as promoting optimal child feeding practices. There is a call for intensified nutrition services as an integral component of routine health services for mothers. Early identification and management of wasting and counseling during pre-conception and pregnancy should be prioritized.

Keywords: Child wasting; Undernutrition; Early childhood development; National Family Health Survey; India

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1. Introduction

Nutrition serves as the cornerstone of human development, essential for optimal growth, cognitive abilities, learning capacity, and economic productivity. Recognized as a highly cost-effective intervention, nutrition plays a pivotal role in poverty reduction,

enhancing economic growth, and building social capital (United Nations, 2015). India, marked by significant economic growth and increased agricultural productivity, stands among the world's fastest growing economies (World Economic Forum, 2023). Despite noticeable improvements in poverty, health services coverage, education, and agricultural production, persistent malnutrition and suboptimal child growth poses a greatest societal challenge in the country (Singh, 2020).

Child wasting, defined as "weight for height < -2 SD z-scores of the median World Health Organization (WHO) growth standards," serves as a vital indicator of measuring child growth failure linked with acute events (the WHO Multicentre Growth Reference Study Group, 2006). This condition carries both long- and short-term implications, including an elevated risk of mortality, increased susceptibility to diseases, impaired cognitive and motor development, limited educational accomplishments, and diminished productivity that perpetuates poverty (Aguayo *et al*., 2016; Black *et al*., 2008; Black *et al*., 2013; Dewey & Vitta, 2013). Emerging evidence underscores wasting as a precursor of stunting, with episodes of wasting heightening the risk of linear growth retardation (Khara & Dolan, 2014; Richard *et al*., 2012).

According to the framework proposed by the United Nations Children's Fund (UNICEF) (2020), child malnutrition results from the interplay of enabling environments, underlying, and immediate factors. Immediate factors linked to wasting include dietary intake, nutrition, and health-care support during illness, while underlying factors involve maternal and child characteristics such as prematurity, antenatal care, education, occupation, height, and body mass index (BMI). In addition, basic facilities such as water and sanitation, access to welfare services, food security, household wealth, and socio-cultural practices are also correlated with child wasting (De Wagt *et al*., 2019; Stobaugh *et al*., 2018; UNICEF, 2020; Wali *et al*., 2021).

Globally, approximately 45.4 million children under the age of five are affected by wasting, with 13.6 million experiencing severely wasting. South Asia, particularly India, bears substantial proportion of this burden (Kinyoki *et al*., 2020; UNICEF & WB, 2021). In India, malnutrition accounts for 68.2% of under five deaths (Swaminathan *et al*., 2019), with prevalence of wasting reaching at 19.3% in 2019 – 2021, surpassing the threshold set by the WHO (De Onis *et al*., 2018; IIPS & ICF, 2021; WHO, 1995). Child wasting leads to substantial economic losses, with estimated at US$48 billion in disability-adjusted life years due to the loss of lifetime productivity (Global Panel, 2016).

Wasting in India exhibits unique characteristics including high prevalence at birth and a peak occurred during the period of 12 – 18 months after birth, with maternal nutrition and health playing a significant role (De Wagt *et al*., 2019). NFHS data indicate that the highest proportion of wasting occurs among children aged 0-23 months (WHZ-2SD-22.3%), emphasizing the critical period spanning from conception to the age of 2 years (Aguayo *et al*., 2016; De Onis *et al*., 2018; Harriet & Minh, 2020; Wali *et al*., 2021). Efforts to combat child wasting in India have experienced sluggish progress, with the proportion of wasting remaining nearly stagnant from 2005 – 2006 to 2019 – 2021. With significant variations across districts and states, the latest National Family Health Survey (NFHS-5) data indicate an increase in wasting proportions in 15 out of 36 states during the period of 2019 – 2021 (IIPS & ICF, 2021).

This study aims to identify hotspots of child wasting in Indian districts and understand the socioeconomic, maternal, and child-level factors associated with wasting among children aged 0 – 23 months. The rationale behind this research is the sluggish progress of wasting indicators over the years, impacting under-five mortality and World Health Assembly nutrition targets in India. Analyzing immediate and underlying factors will provide a comprehensive understanding of wasting during the first 1,000 days and address existing evidence gaps. Furthermore, this study utilizes the latest NFHS (NFHS-5 2019-21) data collected in two phases (phase one from June 17, 2019, to January 30, 2020, and phase two from January 2, 2020, to April 30, 2021), offering valuable insights into the predictors of wasting before the COVID-19 pandemic and aiding in understanding the prevailing drivers of wasting irrespective of emergencies (IIPS & ICF, 2021).

2. Data and methods

2.1. Data sources

The most recent NFHS (NFHS-5 in 2019 – 2021) was utilized for the study (IIPS & ICF, 2021). NFHS-5 is the largest nationally representative survey, providing a comprehensive understanding of the health and nutrition status of children, parents, and households. The survey employed a two-stage stratified sampling approach to collect information. In the first stage, districts were divided into rural and urban strata. Within each rural stratum, a sample of villages was selected as primary sampling units (PSUs) while in urban areas, a sample of census enumeration blocks were selected as PSUs. Subsequently, in the second stage, 22 households per cluster were selected for interview. NFHS-5 covered 636,699 respondents from 707 districts, 28 states, and 8 union territories. For the present study, the individual and household-level datasets were downloaded from the demographic and health survey

(DHS) website. Analysis was restricted to 75550 children aged 0 – 23 months (IIPS & ICF, 2021).

2.2. Study variables

The primary outcome of the study was child wasting (low weight-for-height), reflecting current nutritional status measured in terms of body weight relative to height. As per the WHO growth reference, "children with weight-for-height Z-scores below minus two standard deviations (-2 SD) below the mean of the WHO child growth standards are considered wasted or acutely malnourished" (WHO Multicentre Growth Reference Study Group, 2006, p83).

2.2.1. Independent variables

The selection of independent variables was guided by the UNICEF conceptual framework (UNICEF, 2020). In addition, outcome indicators from both nutrition-specific and nutrition-sensitive programs were incorporated aligning with the conceptual framework of intervention suggested by the Lancet series on maternal and child nutrition in 2013 (Black *et al.*, 2013; UNICEF, 2020). Independent variables were categorized into socioeconomic factors. Sociodemographic characteristics included wealth index, caste, place of residence, and access to an improved sanitation. Maternal factors comprised years of education, antenatal visits during the last pregnancy, place and mode of delivery, interval between two pregnancies, BMI, and the status of anemia. Maternal BMI (kg/m^2) was classified into three categories (<18.5, 18.5 – 24.9, >25). Children's factors encompassed sex, birth weight, birth order, breastfeeding, vaccination status, episode(s) of diarrhea in the past 2 weeks, and adherence to minimum acceptable diet. Original categories of the variables were utilized for analyses.

2.3. Statistical analysis

A choropleth map (heat map) was generated to illustrate the prevalence of wasting (WHZ <-2 SD) among children aged 0 – 23 months across districts in the country. This involved merging the prevalence data with the spatial data to generate the map. R software and relevant R packages such as *ggplot2*, *sf*, *rvest*, *dplyr*, *viridis*, *ggrepel*, *and ggthemes* were used to generate the map.

Child wasting was expressed as a dichotomous variable with category 1 denoting "wasting" and category 0 representing "no wasting." The analysis employed survey "SVY" commands of Stata to accommodate the multistage-stratified sampling design, estimating standard errors and confidence intervals (CIs) around the prevalence estimates.

The analysis process commenced with bivariate analysis, exploring the association between the outcome of interest with independent variables. Subsequently, stepwise logistic regression analysis was conducted to identify significant factors associated with wasting for children aged 0 – 23 months. All statistical analyses were carried out using STATA version 15 (Stata Corp. 2017. Stata Statistical Software: Release 15. College Station, TX: Stata Corp LLC.)

3. Results

3.1. District level mapping of wasting

Spatial analysis was conducted to identify the hotspots of wasting among children aged 0 – 23 months at the district level. In 2019 – 2021, the wasting prevalence ranged from 4 to 46.7% across 707 districts (Figure 1). Dhule district in Maharashtra reported the highest prevalence (46.7%), followed by the Dangs district of Gujarat (45%). Notably, 81 districts had a prevalence rate exceeding 30%, while 501 districts exceeded 15%, and 400 districts surpassed the national average of 19.3%. A substantial number of districts in Maharashtra, Uttar Pradesh, Jharkhand, Gujarat, and Bihar exhibit a high prevalence rate of wasting.

Table 1 outlines the socioeconomic, maternal, and child factors for children aged 0 – 23 months with weight for height <-2SD. The analysis included 16836 children, revealing a wasting prevalence of 22.3%. More than 75% of children were residing in rural areas; about one-third were from the poorest 20% of households and 75% lacked access to safe sanitation. Nearly 39% of children belonged to scheduled caste/scheduled tribe (SC/ST) families and 45.7% were from other backward-class households. Over 50% of mothers had schooling up to 6 – 9 years, 62% were underweight (BMI <18.5), and over 60% of mothers were anemic. More than 93% of mothers reported receiving

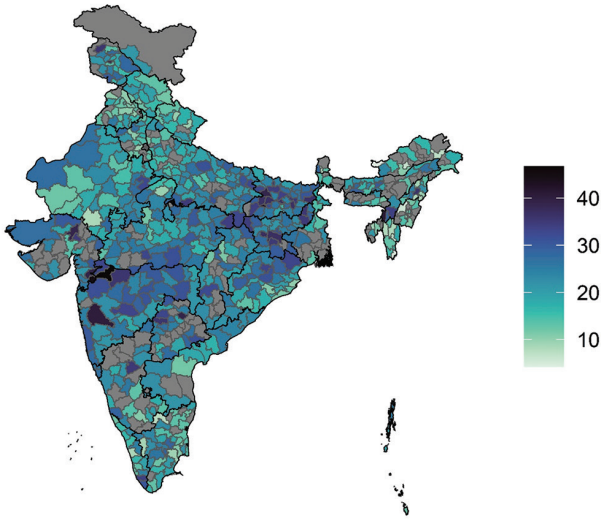

Figure 1. Child wasting (<-2 SD) during 0-23 months in India (%)

Table 1. Profile of study participants and association of individual factors with weight for height of children aged 0 – 23 months

Subgroups*	N	Children aged 0 – 23 months (*n*=16836)
Place of residence		
Urban	19,017 (25.2)	3,880 (23.0)
Rural	56,533 (74.8)	12,956 (77.0)
Wealth quintile		
Lowest	18,154 (24.0)	4,906 (29.1)
Second	16,454 (21.8)	3,787 (22.5)
Middle	15,192 (20.1)	3,219 (19.1)
Fourth	14,179 (18.8)	2,873 (17.1)
Highest	11,571 (15.3)	2,051 (12.2)
Access to improved sanitation (*n*=75546)		
No	59,115 (78.3)	12,592 (75.0)
Yes	16,431 (21.7)	4,244 (25.0)
Caste (n=71471)		
SC/ST	25,300 (35.4)	6,133 (38.5)
Other backward class	32,945 (46.1)	7,283 (45.7)
Others	13,226 (18.5)	2,520 (15.8)
Maternal education		
Primary/No education	22,495 (29.8)	5,648 (33.6)
Middle (≥6 – 9 years of schooling)	39,943 (52.9)	8,740 (51.9)
Higher (>10years)	13,112 (17.4)	2,449 (14.5)
Maternal BMI (kg/m^2) (*n*=75210)		
Normal (18.4 – 24.9)	16,297 (21.7)	4,399 (26.2)
Undernourished (<18.5)	46,460 (61.8)	10,367 (61.9)
Overweight or obese (≥25.0)	12,453 (16.6)	1,995 (11.9)
Maternal anemia[$]		
Non-anemia	30,552 (40.4)	6,553 (38.9)
Anemia	44,998 (59.6)	10,283 (61.1)
Birth interval (in months) (*n*=45250)		
<12	576 (1.2)	156 (1.5)
12 – 23	10,852 (24.0)	2,485 (24.0)
≥24	33,822 (74.8)	7,702 (74.5)
Antenatal visits to health facility		
No visit	4,091 (5.7)	1,118 (6.9)
≥1 visit	68,140 (94.3)	15,090 (93.1)
Place of delivery		
Home birth	6,980 (9.2)	1,842 (10.9)
Institutional birth	68,570 (90.8)	14,994 (89.1)
Mode of delivery		
Caesarean section	18,007 (23.8)	2,432 (20.3)
Normal vaginal	57,544 (76.2)	9,543 (79.7)
Gender		
Male	38,830 (51.4)	9,027 (53.6)
Female	36,720 (48.6)	7,809 (46.4)
Birth weight		
<2500 g	12,911 (17.1)	3,443 (20.5)
≥2500 g	62,640 (82.9)	13,393 (79.5)
Birth order		
1	30,019 (39.7)	6,414 (38.1)
2	25,669 (34.0)	5,549 (33.0)
3	11,354 (15.0)	2,749 (16.3)
≥4	8,508 (11.3)	2,124 (12.6)
Early initiation of breastfeeding (n=73070)		
Within 1 h of birth	64,302 (88.0)	14,406 (87.9)
After 1 h of birth	8,768 (12.0)	1,988 (12.1)
Diarrhea in last 2 weeks (n=75481)		
No	67,543 (89.5)	14,901 (88.6)
Yes	7,938 (10.5)	1,918 (11.4)
Minimum acceptable diet (n=73239)		
No	66,305 (90.5)	15,057 (91.7)
Yes	6,934 (9.5)	1,361 (8.3)
Basic vaccination		
No	14,949 (38.0)	3,095 (39.8)
Yes	24,435 (62.0)	4,676 (60.2)

Note: [$]Hemoglobin levels ≤10.9 g/dL if pregnant; ≤11.9 g/dL if not pregnant. *P<0.05

Abbreviations: BMI: Body mass index; SC/ST: Scheduled caste/ Scheduled tribe.

one or more antenatal care visits. About 20% of wasted children were born through cesarean section. More boys were presented with wasting than girls (53.6% boys vs. 46.4% girls). Furthermore, 21% of wasted children had low birth weight, and 88% were breastfed within 1 h of birth, while 92.6% did not receive a minimum acceptable diet. In addition, nearly 40% of wasted children were not fully vaccinated.

3.2. Predictors of child wasting – results of multivariable analysis

Table 2 presents the results of the analysis of factors associated with wasting among children aged 0 – 23 months. Bivariate analysis demonstrated a significant association of wasting among children with household wealth, caste, access to improved sanitation, mothers' education, maternal BMI, maternal care during pregnancy,

Table 2. Factors associated with wasting (weight for height <-2SD) in children aged <2 years

Subgroups*	COR (95% CI)	*P*-value	AOR (95% CI)	*P*-value
Place of residence				
Rural	1.16 (1.08 – 1.24)	<0.001	0.92 (0.86 – 0.99)	0.02
Wealth quintile				
Lowest	1.72 (1.57 – 1.88)	<0.001	1.60 (1.43 – 1.79)	<0.001
Second	1.39 (1.26 – 1.53)	<0.001	1.32 (1.19 – 1.47)	<0.001
Middle	1.25 (1.13 – 1.37)	<0.001	1.28 (1.16 – 1.42)	<0.001
Fourth	1.18 (1.07 – 1.30)	0.001	1.16 (1.04 – 1.28)	0.005
Improved sanitation				
No	1.28 (1.22 – 1.36)	<0.001	1.18 (1.11 – 1.25)	<0.001
Caste				
SC/ST	1.36 (1.26 – 1.47)	<0.001	1.01 (0.94 – 1.10)	0.6
Other backward class	1.21 (1.12 – 1.30)	<0.001	1.12 (1.04 – 1.20)	0.002
Maternal education				
Primary/No education	1.46 (1.35 – 1.58)	<0.001		
Middle (≥6 – 9 years of schooling)	1.22 (1.13 – 1.32)	<0.001		
Maternal BMI (kg/m^2)				
Undernourished (<18.5)	1.29 (1.22 – 1.36)	<0.001	1.30 (1.23 – 1.37)	<0.001
Overweight or obese (≥25.0)	0.66 (0.62 – 0.72)	<0.001	0.80 (0.74 – 0.85)	<0.001
Maternal anemia[$]				
Non-anemia (reference)	1.0		1.0	
Anemia	1.08 (1.03 – 1.14)	0.001	1.11 (1.05 – 1.15)	<0.001
Antenatal visits to health facility				
No visit	1.11 (0.99 – 1.23)	0.05		
Place of delivery				
Home birth	1.28 (1.19 – 1.38)	<0.001		
Mode of delivery				
Cesarean section	0.82 (0.77 – 0.88)	<0.001		
Gender				
Female	0.89 (0.85 – 0.93)	<0.001	0.89 (0.85 – 0.93)	<0.001
Birth weight				
<2500 g	1.34 (1.26 – 1.42)	<0.001	1.27 (1.20 – 1.36)	<0.001
Birth order				
3	1.18 (1.11 – 1.26)	<0.001		
≥4	1.22 (1.13 – 1.32)	<0.001		
Early initiation of breastfeeding				
After 1 h of birth	1.10 (0.95 – 1.27)	0.1		
Diarrhea in the previous 2 weeks				
Yes	1.13 (1.05 – 1.21)	0.002	1.13 (1.05 – 1.21)	0.002
Minimum acceptable diet				
Yes	0.83 (0.76 – 0.90)	<0.001	0.82 (0.76 – 0.89)	<0.001

Note: AORs were based on the model adjusting all variables in the table. *P<0.05, [$]$P$<0.05
Abbreviations: AOR: Adjusted odds ratio; BMI: Body mass index; COR: Crude odds ratio; SC/ST: Scheduled caste/Scheduled tribe.

maternal anemia, home birth, child gender, low birth weight, high birth order, minimum acceptable diet, and vaccination status.

The adjusted analysis revealed a higher burden of wasting in rural areas compared to urban areas. Children from the poorest households had a 60% higher likelihood of wasting (adjusted odds ratio [AOR] = 1.60, 95% CI = 1.43 – 1.79), and those from other backward class families had a 10% higher chance of being wasted (AOR = 1.10, 95% CI = 1.01 – 1.20). Lack of access to improved sanitation increased the odds by 18% (AOR = 1.18, 95% CI = 1.12 – 1.25). Maternal factors such as low BMI increased the odds of wasting by 30% (AOR = 1.30, 95% CI = 1.23 – 1.37), while higher maternal BMI (BMI >25) reduced the odds by 20%. Girls had an 11% lower likelihood of wasting (AOR = 0.89, 95% CI = 0.85 – 0.93), while low birth weight increased odds by 27% (AOR = 1.27; 95% CI = 1.20 – 1.36). Having diarrhea in the previous 2 weeks raised the odds of wasting by 13% (AOR = 1.13, 95% CI = 1.05 – 1.21), and receiving an adequate diet decreased odds by 18% (AOR = 0.82; 95% CI = 0.76 – 0.89).

4. Discussion

Utilizing data from NFHS -5 (2019-2021), we mapped the spatial distribution of wasting (weight for height <-2 SD) among children aged 0 – 23 months across districts. Individual-level variables were analyzed to identify significant predictors of wasting among young children (0 – 23 months) in India. Our findings reveal substantial variation in wasting prevalence across districts, with no state completely free from child wasting. The prevalence of wasting has indeed risen in many districts over the past 5 years, consistent with findings of a parallel study on severe wasting (WHZ-3SD) conducted utilizing the same dataset (Ulahannan *et al*., 2022).

Our findings suggest that the age-specific prevalence of wasting in India among children aged 0 – 23 months surpassed the national average for children under 5 years. The adjusted analysis reveals that infants up to six months faced the highest risk of wasting and that this elevated risk persisted until the age of 23 months. These findings emphasize the critical importance of focusing on the period of 1000 days (conception to 2 years) as a pivotal window of opportunity to achieve a child's potential for growth (Wrottesley *et al*., 2016).

Household wealth emerged as a major contributor to acute malnutrition, with a significantly higher likelihood observed among children of the poorest households. Proximate factors mediated through poverty such as caste-based social deprivation and lack of access to amenities play a crucial role in determining children's nutritional status (NIN, 2017). Higher wasting prevalence among children belonging to backward classes, STs, and SCs points to the persistent inequalities and disparate access to nutritional services among marginalized communities (Karlsson *et al*., 2021; Nakkeeran *et al*., 2020; Ulahannan *et al*., 2022).

Lack of access to sanitation was the most significant predictor of wasting, and its effect was mediated through episodes of communicable diseases. Open defecation was a leading contributor to diarrhea and other water and foodborne diseases, exacerbating nutritional status of children (Nuzhat *et al*., 2020). The findings emphasize the need for prioritizing access to clean water and sanitation particularly among underserved communities (Budge *et al*., 2019; Chambers & Von Medeazza, 2013; Curtis et al., 2000; Dangour *et al*., 2013; Gera *et al*., 2018; Spears, 2020). It is widely acknowledged that the utilization of maternal health-care services contributed to improved care practices. Studies conducted in Nigeria demonstrated the association of child malnutrition with the utilization of maternal health-care services (Hamel *et al*., 2015). However, the association between antenatal care check-up and wasting was not significant in our study. The findings showed that maternal BMI <18.5 and low birth weight were strong predictors of child wasting. Maternal low BMI contributed to preterm and low birth weight, emphasizing the urgent need to address maternal malnutrition (Porwal *et al*., 2021; Subramanian *et al*., 2009; Wali *et al*., 2021).

Children receiving an adequate diet (*e.g.*, timely introduction, frequency, quantity, and diversity of complementary feeding) had significantly lower odds of wasting. Evidence from India and other countries consistently demonstrated the positive effects of appropriate complementary feeding, underscoring the importance of promoting and supporting optimal feeding practices (Aguayo *et al*., 2016; Ahmad *et al*., 2018; Petrikova, 2022).

While policies and programs to address undernutrition among young children exist nationwide, the low coverage of essential nutrition interventions hinders the impact (Nguyen *et al*., 2022). The study calls for the prioritized program actions in high-burden districts. First, prioritized care and follow-up of low birth and preterm babies in the communities through promotion of optimal feeding practices, strong referral, and coordination at various levels of health system are needed. Second, the findings emphasize the need to prioritize maternal nutrition within program settings such as conducting nutritional assessments of both mothers and children in the community during Village Health, Sanitation and Nutrition Days, providing nutritional counselling, and promptly identifying children with wasting. Third, accurate measurement of height and weight at Anganwadi centers is pivotal to identify and track children

with wasting. Fourth, integrating the screening of children for growth faltering into the routine health care for children in public health centers is recommended. This ensures to maximize the opportunities to identify and manage wasting among children. Finally, it is crucial to recognize child malnutrition resulting from the cumulative effect of various factors, including macro-level economic shocks, weak social protection, and structural issues, which necessitates active engagement with other sectors (De Wagt & GuerreroSaul, 2019; Ulahannan *et al*., 2022; Wali *et al*. 2021).

The strength of the study is the use of a nationally representative survey with a relatively large sample size that enables us to include a comprehensive set of independent variables in modeling for more robust findings. This study, however, has also some inherent limitations because of the use of secondary data that excluded certain relevant factors of child wasting. The self-reported questions in NFHS-5 related to key variables in this research may also involve recall biases. In addition, the changes in the trend of wasting due to economic distress and disruption in services during the COVID-19 pandemic were not accounted for in the analysis. The NFHS-5 data were collected in two rounds, and thus, the accuracy of the outcome estimation may vary between two rounds.

5. Conclusions

Findings of the study suggest the need for comprehensive program response to addressing wasting among children aged 0 – 23 months. Prioritizing care of low-birth-weight babies in the community, enhancing maternal nutrition, and ensuring effective screening and interventions at community and health facilities are critical. Moreover, addressing the cumulative impact of various factors on child wasting requires cross-sectoral engagement to accelerate improvements in child nutrition.

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Conflict of interest

The authors declare no conflict of interest.

Author contributions

Conceptualization: Shivam Pandey, Jyoti Sharma
Formal analysis: Shivam Pandey
Investigation: Mumtaj Ali
Writing – original draft: Jyoti Sharma
Writing – review & editing: All authors

Ethics approval and consent to participate

Not applicable as the dataset used in this research is publicly available.

Consent for publication

Not applicable.

Availability of data

The NFHS-5 data are available freely on DHS website (https://dhsprogram.com/data).

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RESEARCH ARTICLE

The COVID-19 pandemic and fertility decline in Costa Rica: A deep plunge in the first pandemic month, a decelerated decline, and a baby bust due to fleeing migrants

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(This article belongs to *Special Issue: Worldwide Impacts of COVID-19 Pandemic on Populations' Mortality and Fertility)*

Abstract

Using microdata from the administrative birth registry maintained by the electoral authority of Costa Rica, this paper aims to address the knowledge gap concerning childbearing during the COVID-19 pandemic in the context of rapid fertility decline since before the pandemic, as compared to the scenario in the highly developed countries. Monthly fertility rates for the period between 2018 and 2022 were estimated. The outcome of interest was a year-on-year change in these rates. The major findings of this study are as follows: (i) A short-lived baby bust in the first full month of the pandemic that is similar to falls observed in other countries (the year-on-year decrease of fertility in January 2021 was as high as 24% for some groups); (ii) a pandemic-associated deceleration in the fertility decline, which could be interpreted as a baby boom if the counterfactual were a continuation of the recent pre-pandemic declining trend; (iii) hints of a baby boom later in the pandemic in communities with low socioeconomic status, and especially, in families with several children, which could come from unwanted pregnancies; and (iv) an anomalous drop in births from foreign-born mothers delivered during the first 9 months of the pandemic, which probably stemmed from pandemic-motivated migration out of the country. The fertility plunge in January 2021 seems to be a response to the hardships caused by pandemic mitigation measures in April 2020, as well as by the uncertainties and fears concerning COVID-19, rather than the response to the physiological harm of the disease itself. The native-born Costa Ricans saw some of the lowest total birth rates in the world during the pandemic: 1.14 and 1.13 births per woman in 2021 and 2022, respectively. These rates would have been even lower if the sharp birth decline observed before the pandemic had continued during the two pandemic years under study.

Keywords: COVID-19 pandemic; Fertility changes; Migrants; Costa Rica; Baby bust; Baby boom

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1. Introduction

Early evidence from most high-income countries shows that childbearing rate dropped during the first few months of the pandemic, a direct reflection of declining birth rates

9 months later (Sobotka *et al.*, 2021; Aassve *et al.*, 2021; Cozzani *et al.*, 2023; Pesando & Abufhele 2023). This initial baby bust was reversed in subsequent months in what has been called a "pandemic roller-coaster in births" (Sobotka *et al.*, 2023).

However, among middle- and low-income populations, the early baby bust could be counteracted by increases in unwanted pregnancies that resulted from a lack of access to contraception during the pandemic (Aassve *et al.*, 2020; Bailey *et al.*, 2022). The exclusion of women from the labor market and an increase in home-based female work could also raise fertility rate (Osiewalska *et al.*, 2022; Lappegård *et al.*, 2023).

Using microdata from the administrative birth registry maintained by the electoral authority of Costa Rica – a middle-income country located in Central America with a population of five million people, this paper aims to address the knowledge gap concerning childbearing during the COVID-19 pandemic, as compared to the scenario in highly developed countries. It has a strictly descriptive purpose of documenting the fertility trends in Costa Rica during the pandemic period from 2020 to 2022 in comparison with trends in previous years. Analytic methods are deliberately kept as simple as possible.

The COVID-19 pandemic in Costa Rica began on March 20, 2020, when the country had documented a benchmark of 100 cumulative cases. The government declared a public health state of emergency on March 16 and ordained measures to contain the spread of the disease, which essentially led to the closure of the country during the Easter week, from April 5 to 12, 2020. The measures included sealing the borders; prohibiting gatherings; closing schools, churches, theaters, parks, stores, restaurants, and bars; restricting circulation; and transitioning jobs to home-based formats. The outbreak was essentially contained during the April-May period. The first wave of the pandemic peaked in September and the number of cases remained high until November 2020; a second pandemic wave, caused by the deadlier Delta variant peaked in mid-2021, and a third wave (Omicron variant) peaked at the end of 2021 and the beginning of 2022 (Ritchie, 2020; Rosero-Bixby & Jiménez-Fontana, 2021; Rojas & Romero 2022).

The policies implemented to contain the virus in April were successful in holding back the pandemic but greatly affected the lives and livelihoods of the population (PEN, 2021). The official unemployment rate increased from 12% to 24%. Households below the poverty line increased from 21% to 26%. Growth in gross domestic product fell to −4% in 2020, compared to the positive rates of 3 – 5% during the previous decade. Costa Ricans suffered a major economic shock, especially in April 2020, and their living, commuting, and socializing arrangements underwent dramatic changes, against a backdrop of precarity and panic shaped by a flood of alarming news.

The occurrence of the COVID-19 pandemic coincided with the time when Costa Rica's fertility rate was already declining rapidly toward very low levels. The total fertility rate (TFR) decreased from 1.95 to 1.56 between 2009 and 2019 (INEC, 2020). The TFR fell again to 1.41 in 2020, the 1st year of the pandemic, but with almost all births conceived before the pandemic started in late March. This pre-existing declining trend in fertility must be noted when assessing the pandemic's impact. In the first 2 years of the 9-month lagged impact of the pandemic, 2021 and 2022, TFR was 1.31 and 1.29 (INEC, 2018, 2019, 2020, 2021, 2022).

It is noteworthy that the sizable contribution to the national birth rate by immigrants, mostly Nicaraguans, holds significant relevance to the overall fertility in Costa Rica. In 2019, 22% of births were contributed by foreign-born mothers. In fact, a higher fertility rate has been recorded in the immigrant women from Nicaragua compared to the native Costa Ricans (Rosero-Bixby *et al.*, 2002).

2. Data and methods

The data analyzed and presented in this paper were derived from the administrative micro-database of registered births in Costa Rica through December 2022, maintained by the Supreme Electoral Court (*Tribunal Supremo de Elecciones* in Spanish, TSE). Although the TSE is an electoral agency, it is, according to the 1949 Constitution, the office in charge of registering births, deaths, and naturalizations and of keeping the corresponding ledgers and databases. The TSE also issues a unique identification number to each Costa Rican linked to the birth record. This is the number of "*cédula*," the ubiquitous identification card that all Costa Ricans carry.

It must be noted that official data concerning vital statistics are issued by the Costa Rican National Institute of Statistics and Census (INEC), which is a different agency from the TSE. However, this paper was not based on INEC data due to availability issues, as well as issues regarding the denominators to compute rates in subpopulations. The TSE databases are public by law, but the INEC microdata is not. The birth counts reported by the two databases are almost identical (INEC reported 0.2% fewer births than TSE from 1918 to 2022).

The TSE database includes little information regarding each birth, comprising the date, place of delivery, and, importantly, the identity (the *cédula* number) of the

newborns and their parents. Using the mother's *cédula*, each birth record can be linked to the mother's birth record in the same data set to obtain two key data: the mother's age and birth order. It also provided a complete birth history of every woman. Linking the mothers' records to the electoral roll database (*padrón electoral*) can help unveil their potential communities (*distritos*) of residence. The *distrito* is the smallest administrative unit in Costa Rica; there are close to 500 *distritos*, each with an average population of approximately 10,000 people.

The birth histories were complemented with information on a censoring date for women who died or disappeared from the voting rolls (they probably emigrated). This information was obtained by linking this database with those of death registries and the 2018 and 2022 voting rolls using the *cédula* number. The data file was then organized as a "survival-time" data set with multiple exit events (births) using the Stata software (StataCorp, 2020). Monthly counts of births and exposure (woman months) were aggregated into a data file covering the period from January 2015 to December 2022. Fertility rates were computed as the ratio of births to exposure multiplied by 12,000. The aggregate data are presented in Supplementary File. Access to the micro-databases was granted by the TSE after signing an inter-institutional agreement. Since non-native mothers have neither a *cédula* nor a birth record, it is not possible to obtain exposure and fertility rates using their birth information recorded in the database; therefore, the fertility rates of non-native mothers were not included in the analysis.

We amassed a total of 235,000 valid birth records and 789,000 valid records of native-born women aged 15 – 49 years registered during the period between 2018 and 2022. It has previously been established that the registration coverage of birth is 100% in Costa Rica (Pérez-Brignoli & López-Ruiz 2017). The outcome variables of interest were year-on-year variations in birth counts and fertility rates, similar to those measured in Sobotka *et al.*'s study (2021). Rates, or counts, during a period, were compared to those from an equivalent period 12 months earlier to compute annual variations that are free of seasonal variations. For example, the change in the fertility rate of January 2021 was determined by comparing it to the rate in January 2020, or the change in the fourth quarter of 2021 was computed by comparing its rate to that in October to December 2020.

The month of delivery relative to the pandemic timeline was treated as another outcome variable of interest. Births were categorized as occurring in four distinct periods: (i) *Pre-pandemic*, which included births in the year before March 2020, the month when the pandemic began; (ii) *quasi-pandemic*, which included births likely conceived before the pandemic and delivered during the first 9 months of the pandemic, from March to November 2020; (iii) *pandemic*, which included births that were likely conceived during the first 12 months of the pandemic and delivered in 2021 (December 2020 was an unclassifiable transitional month); and (iv) *late-pandemic*, which included births conceived in the second (and essentially final) year of the pandemic and delivered in 2022.

Four characteristics of mothers were analyzed as effect modifiers: (i) Native or immigrant status; (ii) age, which was categorized into two groups with a cutoff at 25; (iii) parity (nulliparous women having their first births, one-child mothers having their second births, and mothers of two or more children); and (iv) socioeconomic status (SES) of the community as measured by the proportion of adults with a high school diploma in the mother's home *distrito* according to the 2011 census, which was categorized into three groups of approximately similar size or terciles: low if <28%, medium if 28% to 42%, and high if 43% or above. The 2011 census data concerning SES were utilized in this analysis under the assumption that there were no SES tercile changes in the surveyed communities over the nine years between 2011 and the pandemic. This was validated through a comparison between the 2000 and 2011 census data depicting a very minor shift in the SES tercile occurring in only 4 out of 472 *distrito*.

The discussion section includes a sensitivity analysis of the choice of an alternate econometric method adapted from the "interrupted time series" method (McDowall *et al.*, 1980). Pre-pandemic trends in the monthly general fertility rate (GFR) were estimated using Poisson regression models for the period between 2015 and November 2020. These trends were then treated as counterfactual (expected fertility in the absence of the pandemic) to identify its potential impact of the pandemic on fertility. For presentation purposes, the monthly fertility rates were first adjusted for seasonal fluctuations, as had been done by Bailey *et al.* (2023).

3. Results

3.1. Drops in fertility and birth counts of native-born and immigrant women

The TFR for the native-born Costa Rican population reached a very low level of 1.22 births per woman in 2020 (Table 1), falling below the so-called threshold of "lowest-low fertility" of 1.3 births (Kohler *et al.*, 2002). Considering that the gestation of newborn babies usually takes 9 months, it is our deduction that almost all births in 2020, analyzed in this study, were conceived before the pandemic onset, which in Costa Rica occurred in late March 2020. In 2021, the TFR of native women fell to 1.14 births,

recording an annual reduction of 7%. A layman observer may regard this birth reduction as an outcome of the pandemic. However, a more nuanced approach notes that even larger drops had occurred during the previous year (9%) and in the year before (8%); therefore, the 7% TFR drop in 2020 seems to be a continuation of the declining trend in fertility rather than an outcome of the pandemic (Note that these TFR figures, which are determined from the native-born population only, are slightly lower than the official figures mentioned in the introduction, which are computed from a larger population that includes the more fertile immigrants.)

In 2022, the 2nd year of the pandemic, a clear break in the trend of rapid fertility decline can be observed (Table 1), with a deceleration leading to only a 1% annual drop. The TFR in 2022 was 1.13, essentially the same as in the previous year.

More than one-fifth of newborns in Costa Rica are from foreign-born mothers. The birth count trend of this population, however, shows an intriguing irregularity in 2020, with a drop of approximately 11% (Table 1) that is unusually high considering that the previous decline was a mere 1% in 2019 and that the reduction of birth count in the native-born population in 2020 was not as high. Given that almost all births in 2020 were conceived before the pandemic, this dramatic drop is not likely a result of pandemic-related childbearing decisions. Since there are no objective reasons that could motivate migrants to increase birth control in the months previous to the pandemic either, the only plausible reason accounting for this birth count drop from the immigrant mothers is the pandemic hardships (especially high unemployment) that had driven a substantial number of already pregnant immigrant mothers to flee the country. A relatively higher drop in births from foreign-born mothers occurred also in 2021: a 10% drop compared to 7% among native Costa Ricans. Unfortunately, there is no reliable data on the number of migrants in Costa Rica (denominators) to compute fertility rates for this population.

Table 1. Annual birth count and fertility rates of Costa Rica, 2018 – 2022.

Indicators	2018	2019	2020	2021	2022
Birth counts					
All births	69,396	64,961	58,948	54,446	53,476
Immigrant mothers	14,573	14,444	12,800	11,500	11,165
Native-born mothers	54,823	50,517	46,148	42,946	42,311
TFR of native women	1.46	1.34	1.22	1.14	1.13
Annual variation					
All births		−6.4%	−9.3%	−7.6%	−1.8%
Immigrant mothers		−0.9%	−11.4%	−10.2%	−2.9%
Native-born mothers		−7.9%	−8.6%	−6.9%	−1.5%
TFR of native women		−8.2%	−9.0%	−6.7%	−1.1%

Note: TFR: Total fertility rate. Source: Microdata files from the TSE.

3.2. Drops in the fertility of native-born women by month

Figure 1 shows the variable of interest in this study—the year-to-year drop in the GFR in the four previously defined periods. Following an analysis strategy used in other studies (Sobotka *et al.*, 2021), the first pandemic year 2021 was disaggregated by month. The monthly data figure reveals that an exceptional fertility decrease of 21% occurred in January 2021, which echoes a decrease in conceptions in April 2020, the first full month since the pandemic. This decrease almost doubles the 13% reductions observed in the previous 2 years.

The extraordinary decrease in January 2021 signifies an ephemeral baby bust. It was counterbalanced with smaller reductions occurring over the subsequent months, and the overall GFR decline for 2021 (11%) was slightly lower than the previous periods. The progressively smaller fertility declines in the later months of 2021 continued into 2022 with a 6% decrease, which is less than half of those observed in the pre-pandemic periods and 71% lower than that of January. This finding suggests that the pandemic might decelerate declining fertility in Costa Rican. In other words, it seems that after the short-lived initial shock of the pandemic, Costa Ricans had more babies than one would expect if the pre-pandemic fertility decline trend had continued.

An interesting detail shown in Figure 1 is the second dive in fertility happening in April and May 2021, with recorded rates of −17% and −15%, respectively, which were less severe reductions compared to the figure in

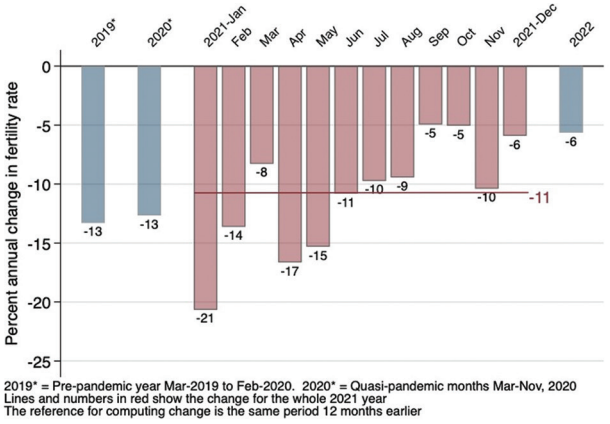

Figure 1. Year-on-year change in fertility rate of native women aged 15 – 49 in Costa Rica by pandemic month and year from 2019 to 2022

January. These declines mirror falls in conceptions in July and August 2020, when a new array of containment measures were rolled out, including mandatory use of masks in public places and more stringent road restrictions (Rosero-Bixby & Jiménez-Fontana 2021). These 2 months saw exponential growth in the number of cases and deaths, forcing authorities to adopt measures to "flatten the epidemic curve," but were far from being the worst in terms of COVID-19 incidence and mortality.

3.3. Fertility decline with age

Figure 2 shows the relative year-on-year variations in the GFR for two large age groups: younger group (aged 15 – 24) and older group (aged 25 – 49). Mothers who were younger than 25 years accounted for approximately 40% of births during the study period (Supplementary File).

Women aged 25 and older show in clearer terms the pandemic-associated fertility behavior just described for all women: a nosedive of 23% in January 2021 and a clear deceleration of the fertility decline in subsequent months and in 2022.

Collectively, young women under 25 years were characterized by a sharper fertility decline before—and in the first year of—the pandemic. For example, their fertility fell 16% in the quasi-pandemic period of 2020 compared to the 12% drop among the older group. However, their fertility decline became slower in the late-pandemic period of 2022: 5% compared to 7% of their older counterparts. The pandemic-associated deceleration of fertility decline is thus more evident among young women.

Notwithstanding the above, the plunge associated with the shock of the first pandemic month is less clear, if any, in the younger group. Its GFR fell 18% in January 2021, which is not that different than the 16% of the previous period or the 19% and 20% of April and May 2021, respectively.

3.4. Fertility decline by birth order

Figure 3 shows the changes in conditional fertility rates by women's parity, considering first, second, and third births. For simplicity, monthly bars were grouped into quarter periods (Q2, Q3, and Q4) starting in April 2021. The fertility changes were computed by comparing the fertility rates to those in the corresponding quarters in 2020.

Figure 3 depicts clear gradients by birth order developed in the pandemic periods: fertility decreased less at higher-order births. The 1st-year pandemic fertility decline (2021) was 13% for firstborns, 7% for second births, and a mere 0.5% for third- or higher-order births; the fertility shocks in the first pandemic month of January were 23%, 17%, and 13%, respectively. Moreover, the late-pandemic fertility of 2022 declined by only 5% for firstborns and increased by 1% for higher-order births. Third-order or higher birth rates even increased by 2% in the second half of 2021, which is symbolic of a baby boom given the circumstances of generalized fertility declines. In other words, the deceleration in the fertility decline during the pandemic was more evident at higher-order births (Figure 3).

3.5. Fertility decline by SES

Upon categorizing communities into SES terciles (Figure 4), the deceleration in fertility decline appears more

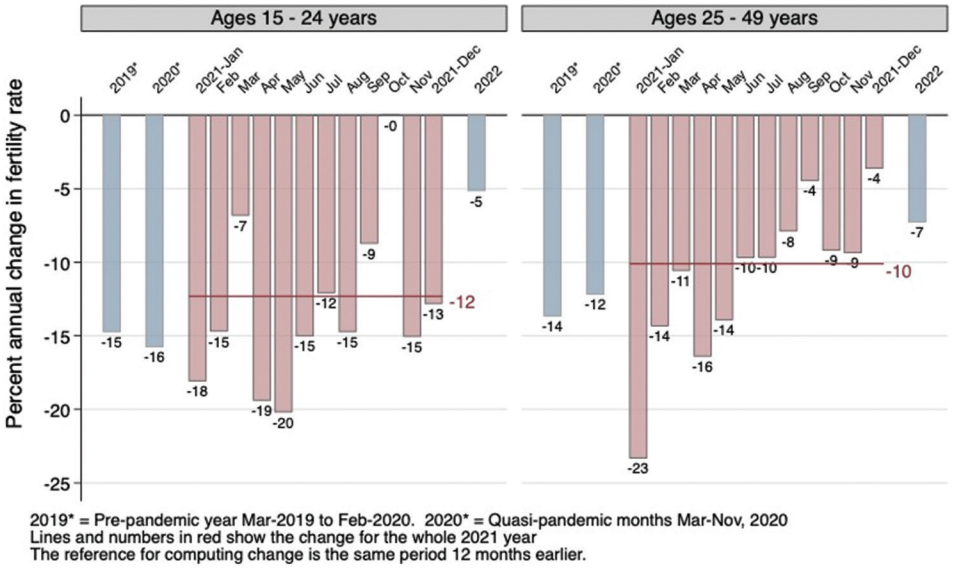

Figure 2. Year-on-year change in fertility rates among native women aged 15 – 24 and 25 – 49 in Costa Rica by pandemic month and year from 2019 to 2022

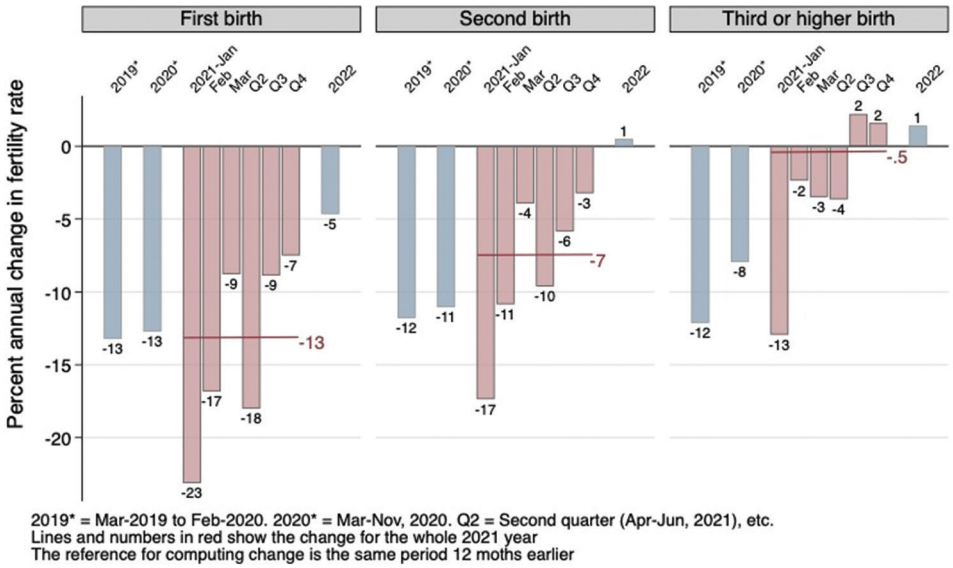

Figure 3. Year-on-year change in conditional fertility rates among native women in Costa Rica by birth order and pandemic month and year from 2019 to 2022

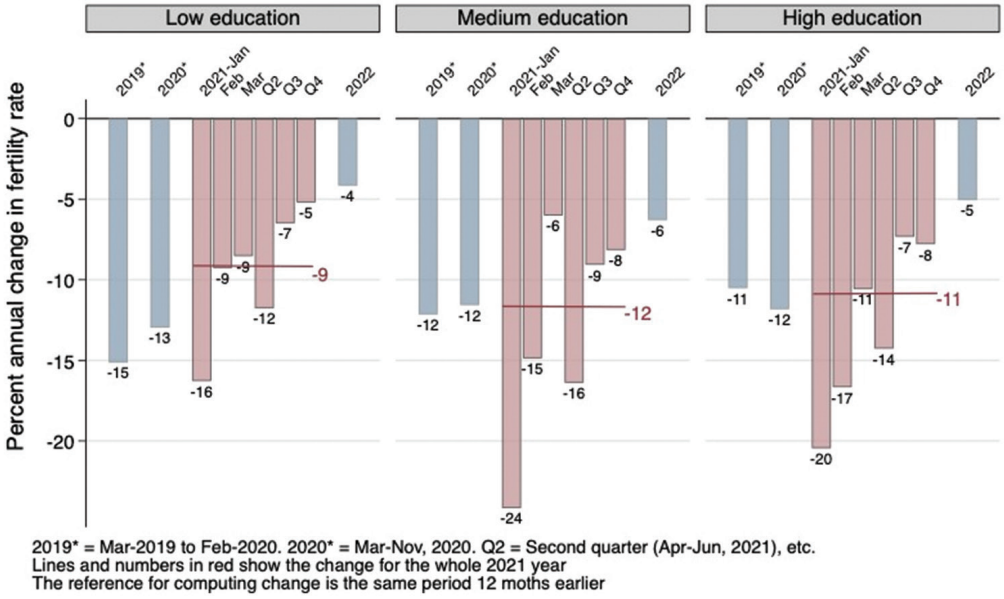

Figure 4. Year-on-year change in fertility rates among native women in Costa Rica by level of education in the community and pandemic month and year from 2019 to 2022

evident in the lowest stratum: the GFR fell by 9% in the first pandemic year (2021) and 4% in the second pandemic year, compared to 15% and 13% reductions during the two pre-pandemic periods.

In middle- and high-SES communities, the short-lived baby bust of the first pandemic month (in January 2021) was extreme, featured by 24% and 20% reductions, respectively. Fertility in low-SES communities seems less affected by the shock of the first pandemic month with a 16% reduction.

4. Discussion

TFR of native-born Costa Ricans fell 7% in 2021, the first pandemic fertility year after discounting the nine-month gestation. This considerable drop appears to be a continuation of the declining trend in fertility carried forward from before

the pandemic rather than an outcome of the pandemic since it is similar in size to drops observed before the pandemic.

Four findings stemming from the data in a context where fertility was sharply declining before the pandemic are as follows:

(i) There was a short-lived fertility plunge or baby bust in the first month of the pandemic.
(ii) There was a pandemic-associated deceleration in the fertility decline.
(iii) A baby boom occurred later during the pandemic, especially contributed by families that already had children.
(iv) An anomalous baby bust (11% drop) took place among immigrants, with a reduction in births delivered the first 9 months of the pandemic (*i.e.*, among mothers who were already pregnant at the pandemic onset).

The initial pandemic shock stemming from the first full month of the pandemic, which decreased the fertility rate for January 2021 by as much as 24% among some groups, has been also observed in high-income countries (Sobotka *et al.*, 2021, Aassve *et al.*, 2021). Given this commonality with other populations and that this decrease was substantially larger than previous and subsequent declines, it is reasonable to link it causally to the onset of the pandemic.

The deceleration of fertility decline after the plunge of early 2021 could be triggered by the pandemic, but could also be induced by other causes, or could even be a determinist development that had to happen: since all downturns must end at some point, perhaps it was the time for fertility in Costa Rica to stop declining. All of these speculations were made based on the counterfactual chosen to represent the absence of the pandemic. If there are reasons to believe that the declining trend in fertility would have ceased in 2021, the fertility decline observed in 2021 would be a baby bust caused by the pandemic. If, on the contrary, the chosen counterfactual is that the previous declining trend would have continued at the same pace, there would be more observed than expected births and, therefore, a baby boom caused by the pandemic. No data were available to test in this study the plausibility of these counterfactuals.

The latter counterfactual is the one often used in the literature estimating pandemic impacts (Aassve *et al.*, 2021, Bailey *et al.*, 2023, Cozzani *et al.*, 2023, Kearney & Levine 2023). Some variation of the "interrupted time series" approach is often used to estimate a pre-pandemic time trend over several years. Said trend is then extrapolated as counterfactual (or expected outcome) to the pandemic period. Figure 5 shows the results of applying this approach to the monthly GFRs since January 2015, as a sensitivity check to the simpler analytic method

Figure 5. Monthly general fertility rate of native-born women in Costa Rica adjusted for seasonality from 2015 to 2022

used in this study. Fitting a six-year pre-pandemic trend as counterfactual seems problematic since fertility decline accelerated substantially starting in late 2018. A 6-year trend overestimates fertility in 2020 and will probably also overestimate the fertility during the pandemic years. In contrast, the three-year trend in the figure fits well with the monthly rates in 2020 and shows similar pandemic-associated results to those described in this article: a fertility plunge in early 2021, a rebound in late 2021, and a deceleration of decline in 2022.

The decision to exclude births delivered in December 2020 from the "pandemic period" may be questionable given that about 5% of preterm babies were conceived in April or even May and that about 50% were probably conceived after the declaration of a public health emergency by the government on March 16. Figure 5 shows that the GFR in December 2020 is halfway between the GFRs of the two adjacent months, suggesting a partial pandemic effect. January 2021 is definitely the first full pandemic month for fertility analyses.

A recent study of the lowest-low fertility (1.3 TFR) of Costa Rica in 2021 and 2022 postulates that it might be driven by the decision to postpone pregnancies among young people. The study showed that if young couples were going to have a cohort TFR of close to two children, period fertility should stop falling soon and would even increase (Rosero-Bixby, 2023). In this scenario, the deceleration of fertility decline observed in 2022 would not be a pandemic outcome but a rebound of postponed births. There is no recent research about childbearing preferences among younger generations in Costa Rica with regard to the postponement hypothesis.

The subtle baby boom contributed by families already having several children—and, to some extent, also by

low-SES communities—counterbalances the drastic deceleration in fertility decline in these groups. Fertility rates even increased for third- or higher-order birth or in late 2021 and 2022. This baby boom could be a consequence of the reduced access to contraception (unwanted pregnancies) or volitional decisions triggered or not by the pandemic. However, there is no data in Costa Rica to test this plausible hypothesis.

The anomalous reduction in births to foreign-born mothers in 2020 (an 11% reduction compared to a 1% decline in the previous year) can be peculiarly linked to the pandemic. However, this reduction is not caused by the pandemic-induced childbearing decisions, since mothers were already pregnant at the onset of the pandemic in April. It likely stemmed from pandemic-motivated migration decisions of the immigrants to flee Costa Rica due to lack of jobs or fear of COVID-19. A similar baby bust from foreign-born mothers was also observed in the United States in 2020, which has been attributed to reduced immigration of pregnant women (Bailey, Currie *et al.*, 2023, Kearney & Levine 2023). This strand of explanation, however, is hardly applicable to the context in Costa Rica since there is no evidence of important inflows of pregnant immigrants.

5. Conclusions

The 1-month nosedive in childbearing at the onset of the pandemic seems to be a response to hardships in conjunction with the measures initially imposed to contain the disease and to uncertainties and fears related to a new menace. This decrease was not a physiological response to COVID-19 (the number of cases and deaths were still minuscule in April 2020) but a response to psychosocial and economic factors. It has previously been determined that the duration between September and November 2020 accounted for the most numbers of incidence, hospitalization, and deaths during the first pandemic wave (Rosero-Bixby & Jiménez-Fontana 2021). By the same logic, if these challenges had significantly influenced the childbearing decisions, the 2021 birth count reduction should have been sharper in the third quarter, which is however not portrayed in the data. In the same vein, the additional severe waves of the Delta and Omicron variants were not associated with baby busts 9 months later in 2022. Whether the pandemic-related deceleration in fertility was caused by the pandemic or by other circumstances remains to be elucidated. Nevertheless, given the current findings, we conclude with an interesting insight that the pandemic may indirectly reduce the immigrant population and correspondingly curtail the number of births.

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Not applicable.

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The micro-databases provided by the *Tribunal Supremo de Elecciones* (TSE) cannot be made public for safeguarding subject anonymity (Costa Rican Law N. 9694). TSE granted the University of Costa Rica the access to these databases for research purposes only. Other organizations that have signed inter-institutional agreements could access the micro-databases maintained by TSE. The aggregated data by month are presented in the Supplementary File.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Interstate outmigration in India and the COVID-19 pandemic: Challenges and emerging perspectives

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Abstract

Interstate migrants from less developed states seek better livelihoods in more developed ones, yet encounter challenges such as loss of state benefits and workplace mistreatment. Drawing data from the Indian Census of 1991, 2001, and 2011, this paper examines interstate outmigration in India and the challenges faced by migrants in their destination areas. The results revealed that low-income states such as Uttar Pradesh, Bihar, Rajasthan, and Odisha are among the top migratory states in the country. This result aligns with developmental theories, which believe that migration helps both sources and destination areas through optimal allocation of factors of production. Further, an analysis of female outmigration for economic reasons revealed disparities between the top female outmigratory states and total outmigratory states. Hence, it can be inferred that female interstate migration for economic reasons is not simply an association with their male counterparts. The paper then highlights common problems faced by migrants at destination points and underscores the 2020 migrant crises that the country experienced due to lockdowns amid the COVID-19 pandemic. In conclusion, by analyzing the existing policy measures of the government, the study proposes short-term (also to address current migrant crises) and long-term policy measures to mitigate challenges associated with outmigration.

Keywords: Outmigration; Low-income states; India; COVID-19; Policy response

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1. Introduction

Migration from one area to another is often seen as a development strategy among impoverished populations. It allows the poor to diversify their income sources and elevate their standard of living through improved consumption, good health, and education. Theoretically, this nexus of migration and development has been supported by neo-classical and developmental theories. These theories hold optimistic views and believe that migration helps both sources and destination areas through optimal allocation of factors of production. Specifically, the individualistic approach to migration by Todaro (1969) and the extension of this approach to the household approach by Stark (1980; 1991) considered migration as essentially an economic phenomenon with positive

consequences (Awasthi & Mehta, 2020). Moreover, these developmental theories are supported by the present empirical research by linking migration with development through remittances (De Haas, 2010).

In the case of India, the optimistic views or the development potential of migration are best fitted, as supported by various empirical analyses (Pedi & Adabar, 2018). Various studies (Datta, 2016; Dupont, 1992; Mishra, 2016; Parida *et al.,* 2015; Srivastava & Sutradhar, 2016; Sundari, 2005) have demonstrated that migration improves the living conditions of households receiving remittances, which is evident from their increased expenditures on food, housing, healthcare, and children's education. Furthermore, migration has facilitated better wages for non-migrant laborers in their native places due to the tightening labor market.

There were 450 million internal migrants in India as per the 2011 Census data (this is the latest data available so far), with 396 million being intra-state migrants and 54 million being inter-state migrants. This data highlights that migration in India is largely an intrastate phenomenon. However, from the perspective of labor mobility, inter-state migration holds significance (Bell *et al*., 2015; Kone *et al*., 2018; Srivastava, 2011). Moreover, given India's economic development, analyzing inter-state migration (labor movement within the country) becomes essential. Certain studies (Kumar & Kumar, 2020; Mahapatro, 2012; Pedi & Adabar, 2020) indicated that inter-state migration occurs from low-developed to highly developed states. In other words, net interstate migration is positively related to developed states in the country. This observation implies that individuals from less developed/underdeveloped states choose to migrate to more developed states as a means of improving their livelihoods (Nayyar & Kim, 2018).

However, these interstate migrants encounter various challenges, including the loss of benefits from the state government's development programs (Dreze & Khera, 2013) and mistreatment in the workplace (Srivastava, 2020b) on crossing state boundaries. In addition, they receive less recognition and understanding from the central government in terms of policies (Aggarwal *et al*., 2020). The migrant crisis of 2020 that happened in the country due to the lockdown imposition exposed the scale and severity of issues faced by interstate migrants (Srivastava, 2020b). We visualized the grief and desperate situations of migrants across railway stations, bus stations, highways, and roads in different parts of the country while they were trying to return home after losing their livelihoods. This issue took center stage in national-level political discussions, prompting the government to announce aid packages for affected migrants. However, the underlying structural problems of the migrants remained largely unaddressed (Mishra, 2021).

Against this backdrop, this paper analyzes the magnitude of interstate outmigration in India and the challenges encountered by migrants when crossing state borders. Moreover, it delves into the current migrant crisis to formulate better policy measures to address the migrant issues in the country.

Given the development trajectory of the country, inter-state migration has occupied an important place in India. In general, interstate outmigration takes place in search of better opportunities in the destination area. This development prospect of migration has been proved/studied by many scholars, as mentioned at the beginning of this study. However, the issue is that these migrants, especially those with meager means and networks and at the lower end of the labor market, face various difficulties at their destination. While some previous studies, such as Bhattacharjee (2020), have discussed internal outmigration and its socioeconomic determinants, they have not discussed the specific challenges encountered by migrants at their destination. Similarly, other studies, like Srivastava & Sasikumar (2003) and Srivastava (2020a), have discussed migrants' problems in general.

Keeping this in mind, the present study attempts to provide a comprehensive examination of interstate migration and the problems in their destination area with the policy response of the government. Moreover, the study delves into the impact of the COVID-19 pandemic on migrants. In this way, the present study aims to offer a fresh perspective on the study of interstate migration in India, contributing to the ongoing academic work in this field.

The study seeks to answer two fundamental questions: (i) "What are the problems faced by interstate migrants at the destination area?" and (ii) "What existing policies are in place to address the plight of the migrants in general, particularly those who returned due to the COVID-19 pandemic?"

Based on the aforementioned research questions, four objectives have been formulated for the current study. The first objective is to analyze the magnitude of interstate migration in the country. The second objective is to discuss the problems often encountered by migrants when they cross state boundaries. The third objective is to discuss the current migrant crisis in COVID-19. The fourth objective is to discuss existing policies to meet the problems of migrants in general and COVID-19-induced migrant crises in particular.

The paper is structured into four sections. The second section discusses the data and methodology employed

in the analysis. In the third section, key findings and interpretations are presented, which encompasses an overview of interstate outmigration, the associated challenges, government responses, and the plight of migrants during the COVID-19 pandemic. Finally, the fourth section encompasses concluding remarks, including policy implications, conclusions drawn from the study, and its limitations.

2. Methods

Migration is the movement of individuals from one location to another, often involving crossing administrative boundaries for various reasons (voluntary or involuntary) within a given period (United Nations, 2002). Migration is categorized into two types: internal and international migration. Movement among/between the countries is known as international migration, while movement within the country is known as internal migration. Internal migration, in turn, is divided into inter-state migration and intrastate migration. Interstate migration refers to migration among/between the states, whereas intrastate migration explains migration within the state, including interdistrict and intradistrict migration.

Until 1951, migration in India was primarily defined at the district level. In 1961, revenues village, or urban settlement, was a separate unit. This implies that an individual is considered a migrant if their birthplace differs from the place of enumeration (Lusome & Bhagat, 2020). While migration data were initially provided based solely on place of birth until 1971, since then, the Census of India has provided data based on both place of birth (POB) and place of last residence (POLR). Consequently, an individual is considered a migrant if either their place of birth or place of last residence differs from the place of enumeration. Notably, migration data based on the place of last residence is generally considered a more accurate measure. Therefore, in this paper, the place of last residence has been utilized.

In this paper, we referenced data from the Census of India as the source for migration data, given its status as the largest repository of information on internal migration (Lusome & Bhagat, 2020). For employment data, we utilize information from the Reserve Bank of India (RBI). Our analysis employs simple statistics, such as percentages and coefficients of variation, to examine the data.

3. Results and discussion

3.1. Interstate outmigration in India

Over the past two and a half decades, migration within India has become a common occurrence. Regardless of caste, gender, or class hierarchy, thousands of individuals migrate to different parts of the country for various reasons (Mishra, 2016). According to the Census of India 2011, there were an estimated 54.4 million inter-state migrants (Figure 1), constituting 12.09% of the total internal migration in the country. However, the Economic Survey of India 2017 estimated that an average of 5 to 6 million Indians migrated annually between 2001 and 2011, leading to an inter-state migrant population of approximately 60 million (Government of India, 2017). Although the latest migration data is unavailable, it is believed that the inter-state migration population may have increased due to the socio-political and economic conditions of the country. The central government has introduced several urbanization policies, such as the Smart Cities Mission, Swachh Bharat Mission, Atal Mission for Rejuvenation, and Urban Transformation, which might have promoted migration. A recent study by Rajan & Bhagat (2022) predicted a migrant population of 600 million people in 2021 based on the trends observed in the 2001 and 2011 censuses.

The unequal distribution of income and the concentration of industries in some states have induced migration from low-income states (Uttar Pradesh, Bihar, Odisha, Jharkhand, and Rajasthan) to high-income states (Maharashtra, Gujarat, Tamil Nadu, Punjab, and Haryana) (Srivastava, 2020a; Rajan & Bhagat, 2022). In Table 1, we have presented the top 10 interstate out-migrating states of the country from the 1991 to 2011 Census. As depicted in Table 1, Uttar Pradesh and Bihar are the topmost migrating states, accounting for 30% to 35% of interstate outmigration in the country. Various economic factors, including chronic poverty, a high unemployment rate (Table 2), lower agricultural output, skewed land distribution, higher dependency on agriculture, or lack of industrialization, have explained the heavy outmigration from these states (Sharma, 2005). Moreover, outmigration will continue to increase as long as there are economic incentives to move and the ownership and operation of agricultural land are no longer the predominant source of households' income. On examining the table, we can observe that Rajasthan is the third-largest migrating state in the country across

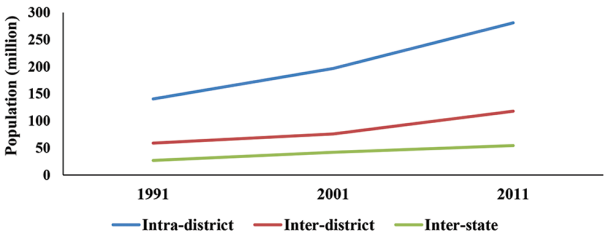

Figure 1. Internal migrants in India from 1981 – 2011 (Census of India, 1981 – 2011)

Table 1. Top 10 outmigration states in India (1991, 2001, and 2011)

1991			2001			2011		
Both sexes	**Male**	**Female**	**Both sexes**	**Male**	**Female**	**Both sexes**	**Male**	**Female**
UP (21.6)	UP (25.0)	UP (18.7)	UP (22.5)	UP (25.8)	UP (19.6)	UP (22.7)	UP (26.1)	UP (19.9)
BR (11.3)	BR (13.4)	BR (9.6)	BR (12.8)	BR (15.9)	BR (10.0)	BR (13.7)	BR (16.1)	BR (11.8)
RJ (7.3)	RJ (6.4)	RJ (7.9)	RJ (6.3)	RJ (5.7)	RJ (6.8)	RJ (6.9)	RJ (6.3)	RJ (7.3)
MH (6.6)	TN (6.0)	MH (7.1)	MH (5.2)	MH (4.5)	MP (5.9)	MH (5.6)	MH (5.0)	MP (6.5)
MP (5.6)	MH (5.9)	MP (7.0)	MP (4.9)	TN (4.2)	MH (5.8)	MP (5.4)	MP (4.1)	MH (6.1)
TN (5.5)	PB (5.0)	HR (6.5)	KA (4.5)	KA (4.1)	HR (5.3)	KA (4.6)	KA (4.1)	HR (5.2)
KA (5.3)	KA (4.8)	KA (5.7)	HR (4.2)	WB (3.9)	KA (4.8)	WB (4.4)	WB (4.0)	KA (4.9)
HR (5.3)	AP (4.3)	PB (5.2)	WB (4.1)	MP (3.6)	PB (4.3)	HR (4.2)	TN (3.8)	WB (4.7)
PB (5.1)	KL (4.2)	TN (5.0)	TN (4.0)	PB (3.5)	WB (4.2)	AP (3.7)	AP (3.5)	AP (3.9)
AP (4.5)	HR (3.8)	AP (4.8)	PB (3.9)	AP (3.4)	JH (4.0)	TN (3.6)	HR (3.0)	JH (3.7)
Total: 26,689,595	Total: 11,883,886	Total: 14,805,709	Total: 41,166,265	Total: 19,098,082	Total: 22,068,183	Total: 54,264,749	Total: 23,869,812	Total: 30,394,937

Note: Values in parentheses show the percentage of interstate outmigration of the state from total interstate outmigration. Sources: Census of India (1991, 2001, and 2011).
Abbreviations: AP: Andhra Pradesh; BR: Bihar; HR: Haryana; JH: Jharkhand; KA: Karnataka; KL: Kerala; MH: Maharashtra; MP: Madhya Pradesh; PB: Punjab; RJ: Rajasthan; TN: Tamil Nadu; UP: Uttar Pradesh; WB: West Bengal.

Table 2. Unemployment rate in Uttar Pradesh and Bihar

Area	Gender	State	Year						
			1993–1994	**1999–2000**	**2004–2005**	**2009–2010**	**2011–2012**	**2017–2018**	**2018–2019**
Rural	Male	Bihar	19	22	18	21	27	72	106
		Uttar Pradesh	9	10	7	12	10	62	48
	Female	Bihar	6	5	2	13	82	23	17
		Uttar Pradesh	3	3	3	5	7	15	18
	Both sexes	Bihar	16	18	15	20	32	70	102
		Uttar Pradesh	7	8	6	10	9	55	43
Urban	Male	Bihar	68	73	67	63	45	92	104
		Uttar Pradesh	32	43	35	29	42	96	112
	Female	Bihar	92	81	41	160	165	62	123
		Uttar Pradesh	11	33	25	34	37	105	61
	Both sexes	Bihar	71	74	64	73	56	90	105
		Uttar Pradesh	29	41	33	29	41	97	106

Note: The unemployment rate is expressed as total unemployment out of 1000 population. Sources: Handbook on statistics on Indian Economy, RBI.

successive Census years, followed by Maharashtra and Madhya Pradesh in third and fourth place, respectively. However, there appears to be inconsistency observed regarding other migrating states.

The coefficient of variation analysis across states (Figure 2) reveals a wide variation in outmigration levels. In 1991, the variation of outmigration was relatively high for all agents of migration (total, male, and female), and it rose continuously till 2011. The maximum coefficient of variation observed for all the census periods is male outmigration.

Here, we have also presented economic-related (migration for work/employment and business) outmigration using Census data in Table 3 to support the above discussion on the causes of migration. There is no difference observed in the case of Uttar Pradesh and Bihar, as these states account for the majority of interstate outmigration for economic reasons. Furthermore, Tables 1 and 3 highlight that Rajasthan is the third-largest source of inter-state outmigration for both economic and non-economic reasons. One interesting fact is that Odisha, which was not on the list of top 10 inter-state migrating states, appears on the list of top 10 migrating states for economic reasons. This indicates that a large section of individuals from Odisha are migrating to other parts of the country in search of livelihood opportunities.

When analyzing female migration for economic reasons, we observed inconsistencies across different census years. As we can see, in the 2001 Census, Rajasthan is the top female migrating state for economic reasons, while Uttar Pradesh held this position in both the 1991 and 2011 Censuses. Similarly, in the 1991, 2001, and 2011 Censuses, Tamil Nadu, Kerala, and Madhya Pradesh were the three most female-migrating states, respectively, for economic reasons. This inconsistent position of states regarding female migration persists throughout the table. A critical point of discussion is that, in most cases, the top female migrating states differ from the top male migrating states. This difference between top male and female migrating states is the opposite of the traditional belief that female migration is associational migration with their male counterpart. The previous studies by Srivastava (2011), Verick (2017), Rajan & Sivakumar (2018), Rajan & Sumeetha (2019), and Rajan *et al.* (2020) have pointed out that female migration is often linked to marriage or associational migration, which is expected. In addition, other studies (Agnihotri *et al.*, 2012; Mehrotra & Parida, 2017; Parida & Madheswaran, 2020; Rajan *et al.*, 2020) have also pointed out that female migration differs from male migration in terms of employment orientation, as it is significantly influenced by social, economic, political, and policy issues.

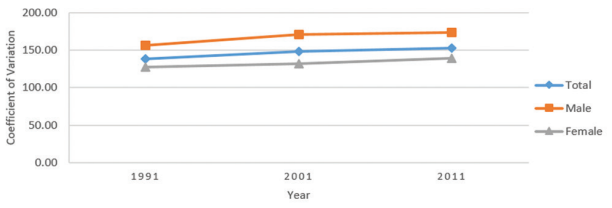

Figure 2. Coefficient of variation of outmigration of Indian states from 1991 – 2011. Note: Coefficient of variation represents the variation of states in terms of outmigration. Source: Author's calculation based on 1991, 2001, and 2011 Census.

3.2. Issues with inter-state outmigration

The constitutional guarantees free mobility, but until recent decades, migration in our country was very low, mainly driven by social reasons such as marriage and family movement (Mishra, 2021). Moreover, people with high skills, education, or resource endowments migrated between states in a country (Srivastava, 2020a). However, it is believed that since the economic reforms in 1991, migration of all kinds (skilled and unskilled, educated and uneducated, male and female, temporary and permanent, etc.) has increased as connectivity, communication, and opportunities (Bhagat, 2010; Rosenzweig & Munishi, 2009). Nonetheless, migrants, especially those with meager means and networks, and those at the lower end of the labor market, encounter various difficulties on reaching their destination. These challenges are explained in the following sub-heads.

3.2.1. Poor living conditions

Interstate migrants, especially interstate circular migrants, live in the most deplorable conditions at their destination (Deshingkar & Akter, 2009; Rani & Shylendra, 2001; Srivastava & Sutradhar, 2016). These migrants enter the labor market through contractors/middlemen, or networks and are engaged in various industries such as agriculture, brick manufacturing, quarrying, and construction. The characteristics of these migrants include an absence of civic identity and citizenship at the destination, limited access to housing and basic amenities, poor entitlements, unfavorable working conditions, and discrimination in the labor market. According to Srivastava (2020b), there were 52 million interstate vulnerable migrants in the country in 2018. These vulnerable migrant workers are in lower occupational categories, ranging from five to nine, according to the National Classification of Occupations (NCO) classification.

3.2.2. Health issues

Migrants suffer from various health issues as they work in harsh circumstances and live in unhygienic conditions (Srivastava & Sasikumar, 2003). They generally undergo various problems such as obesity, diabetes, tuberculosis, and febrile illness. Moreover, studies highlighted that

Table 3. Top 10 economic-related interstate outmigrating states in India

1991			2001			2011		
Both sexes	Male	Female	Both Sexes	Male	Female	Both sexes	Male	Female
UP	UP	UP	UP	UP	RJ	UP	UP	UP
(28.2)	(29.6)	(15.8)	(28.3)	(29.4)	(15.2)	(28.8)	(30.1)	(18.5)
[35.6]	[65]	[4.1]	[35.7]	[64]	[9.6]	[31.4]	[57.6]	
BR	BR	BR (10.6)	BR	BR	BR	BR	BR	BR
(14.7)	(15.2)	[5.4]	(17.5)	(18.2)	(9.1)	(17.9)	(18.7)	(11.4)
[35.4]	[62]		[38.7]	[64]	[2]	[32.3]	[58.3]	[4.47]
RJ	RJ	TN	RJ	RJ	KL	RJ	RJ	MP
(6.8)	(6.8)	(9.5)	(5.5)	(5.6)	(7.5)	(6.0)	(6.1)	(6.2)
[25.2]	[57]	[9.2]	[24.8]	[54]	[14]	[21.6]	[48.5]	[4.5]
TN	TN	MH	TN	WB	AP	WB	WB	TN
(6.4)	(6.0)	(8.9)	(4.5)	(4.2)	(6.7)	(4.7)	(4.6)	(5.9)
[31.5]	[54]	[6.1]	[31.3]	[60]	[7.2]	[26.22]	[58.5]	[8]
MH	MH	KL	WB	TN	KA	MP	MP	KA
(5.2)	(4.8)	(7.6)	(4.2)	(4.2)	(6.4)	(4.2)	(3.9)	(5.9)
[21.2]	[44]	[12]	[29.1]	[55]	[5.7]	[18.8]	[47.1]	[5.5]
KL	KL	KA	KA	KA	JH	MH	MH	RJ
(5.0)	(4.7)	(7.1)	(3.9)	(3.6)	(6.2)	(3.8)	(3.6)	(5.5)
[37.6]	[60]	[6]	[24.3]	[49]	[6.6]	[16.8]	[35.9]	[3.5]
KA	PB	RJ	MH	MH	CG	TN	TN	MH
(4.4)	(4.2)	(6.7)	(3.6)	(3.5)	(5.6)	(3.8)	(3.5)	(5.5)
[22.4]	[45]	[4.1]	[19.7]	[43]	10.3	[25.8]	[46.5]	[4.2]
PB	KA	MP	MP	AP	WB	KA	AP	AP
(4.21)	(4.11)	(5.53)	(3.37)	(3.18)	(5.59)	(3.41)	(3.13)	(5.19)
[22.2]	[46]	[3.8]	[19.5]	[51]	[5.7]	[18.2]	[44.8]	[6.2]
AP	AP	AP	AP	MP	MH	AP	KA	WB
(3.8)	(3.7)	(4.9)	(3.3)	(3.2)	(5.4)	(3.3)	(3.1)	(4.9)
[22.5]	[50]	[5]	[25]	[49]	[4.0]	[22.1]	[37.7]	[4.9]
WB	HR	PB	KL	JH	MP	OR	OR	KL
(3.4)	(3.4)	(3.9)	(3.2)	(2.9)	(5.1)	(2.9)	(2.9)	(4.7)
[21.91]	[49]	[3.6]	[35.4]	[55]	[3.7]	[31.4]	[59.2]	[9.7]
Total	Total	Total	Total	Total	Total	Total	Total	Total
7,254,481	6,524,756	729,725	11,681,769	10,718,699	963,070	13,420,989	11,973,661	1,447,328
[27.18]	[54.90]	[4.93]	[28.38]	[56.1]	[4.36]	[24.73]	[50.16]	[4.76]

Notes: Values in parentheses show the percentage of interstate outmigration for the economic reasons of the state from total interstate outmigration for economic reasons. Values in square brackets represent the percentage share of economic migrants from total migrants. Sources: Census of India (1991, 2001, and 2011).

Abbreviations: AP: Andhra Pradesh; BR: Bihar; HR: Haryana; JH: Jharkhand; KA: Karnataka; KL: Kerala; MH: Maharashtra; MP: Madhya Pradesh; OR: Odisha: PB: Punjab; RJ: Rajasthan; TN: Tamil Nadu; UP: Uttar Pradesh; WB: West Bengal.

single, unskilled, and illiterate daily wage laborers with extended years of migration and lacking housing and proper sanitation facilities suffer mental health problems (Firdaus, 2017). Further, children accompanying their families in migration are exposed to various health hazards due to dust exposure at work sites (Srivastava & Sutradhar, 2016). In addition to these, migrants frequently face barriers to accessing health-care programs due to their temporary status.

3.2.3. Migrant children's education

The education of children who migrate with their families is negatively affected due to their transient enrollment in schools as they move from one location to another with their families, and the schooling system does not consider their temporary status (Srivastava & Sutradhar, 2016). Hence, dropout among their children is very high, and they get involved in child labor (Smita, 2008; Roy *et al*., 2015).

3.2.4. Issues of women migrants

Issues concerning women migrants or women labor migrants have not been adequately discussed in the literature, as women migrants are often categorized within marriage or associational migration (Rajan *et al*., 2020). However, recent studies by Mehrotra and Parida (2017) and Parida and Madheswaran (2020) argue that women's

employment status after marriage migration is frequently misunderstood and incorrectly measured. According to these studies, although women report marriage as the reason for migration, they immediately transition into employment within the newly migrated area. However, some studies suggest that the challenges faced by women migrants are more complex than their male counterparts, as they are more likely to face gender-based violence, including trafficking, sexual exploitation, and coercion into prostitution or marriage (Ghosh, 2017).

3.2.5. Inaccessible social security provisions

As discussed above, migrants are prone to various problems for which they need social security protection measures. However, our institutional structure creates formidable difficulties in designing suitable schemes for migrants (Sharma & Arora, 2015; Srivastava, 2012). Although we have various schemes (food-based schemes for the distribution of subsidized food items targeted public distribution system; schemes for mid-day meals for children; nutritional supplemental schemes such as the Integrated Child Development Scheme; social security schemes for the poor and informal sector workers; social assistance schemes including pension schemes for the elderly, physically challenged, and widows; public employment schemes; elementary education; health care; health insurance for the poor; etc.) that are supposed to address vulnerable migrants, the vast array of schemes financed and delivered by various levels of government hinders their accessibility. Moreover, the working conditions of migrants and their inability to provide domicile identity in destination areas further obstruct their access to social protection schemes (Srivastava, 2020a).

3.3. COVID-19 and inter-state outmigration

The initial response to COVID-19 was a nationwide lockdown announced by the Prime Minister, on March 24, 2020. This sudden announcement created panic among migrant workers as they lost their jobs and found themselves stranded at their destination. Being unemployed in the city, having no guarantee of further employment, and having limited access to transportation facilities to return home (which were later arranged by the central government) caused migrants to be economically and psychologically insecure. As a result, many resorted to the extreme step of returning home on foot, resulting in untold hardship, tragedy, and even death (Rajan & Heller, 2020). In the subsequent days and months, the nation witnessed some of the grimmest scenes due to the unpreparedness of civic authorities and government agencies to deal with a crisis of such magnitude, garnering attention both domestically and internationally (Mishra, 2021).

Despite the challenges, many migrants managed to return to their native places from major cities, such as Delhi, Mumbai, Ahmedabad, Pune, Bangalore, Hyderabad, and Chennai, as the lockdown was extended. However, the exact number of returnees is unknown due to the lack of comprehensive migration data and the diverse means of transportation used by returnees (vehicle, cycle, or on foot). According to the data cited by the Lok Sabha, Parliament's lower house, on September 14, 2020, 10.5 million migrants utilized government-arranged transportation, including buses and Shramik trains. The state-wise distribution of return migration is presented in Figure 3, with Uttar Pradesh, Bihar, West Bengal, Rajasthan, Madhya Pradesh, and Odisha having the maximum return migration.

3.4. The policy response of the government

In this section, we will discuss the policy response of the government in two parts. In the first part, the existing policies of the central government regarding migration in general will be discussed. In the second part, both the central and state governments' schemes/policy responses for migration to deal with the COVID-19 crises, in particular, will be discussed.

3.4.1. Existing policies of central government

At the central level, the only law to protect the rights of migrants in the country is the Interstate Migrant Workmen's Act of 1979, which primarily focuses on contractor-driven migration (Rajan & Bhagat, 2022). Although the central government has enacted some welfare laws for informal workers intended to cover migrant workers' rights, non-implementation of these laws has often led to migrants being denied access to their rights in the cities (Bhagat, 2017a). Furthermore, recommendations from the Working Group of Migration (increased weightage on social protection programs; enforcement of labor laws; registration of migrant workers; ensuring adequate food security through portability of public distribution system;

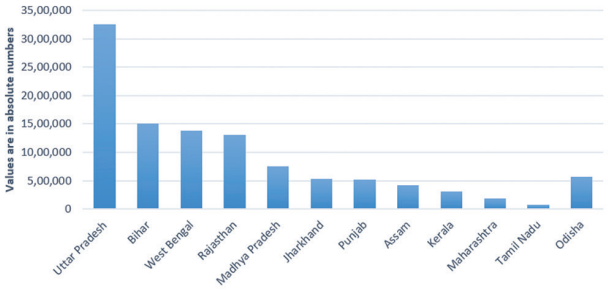

Figure 3. State-wise returned migration after the outbreak of COVID-19, selected states, India. Sources: Unstarred Question No. 197, Lok Sabha, answered on September 14, 2020; PRS. The data of Odisha have been taken from the COVID-19 dashboard of Odisha.

ensuring adequate access to healthcare and education for migrant children; increased opportunities for skill development; ending the requirement for state domicile to acquire government jobs; and implementing policies aimed at integrating migrants into the formal financial system) and the proposals from the National Commission for Enterprises in the Unorganized Sector, 2006, advocating for a unified social protection component have been implemented partially (Srivastava, 2020a).

Considering social protection schemes, the central government has a minimal exclusive domain (Srivastava, 2020a). Our institutional structure allows states, either individually or in collaboration with the center, to undertake various programs to protect migrants from social, political, and economic vulnerabilities. Consequently, the central government can only bear a larger share of the schemes coming under the concurrent subject of the Indian constitution. Over recent decades, the central government has increased its funding share for social protection programs such as elementary education, primary health, and public employment.

3.4.2. The policy response of central and state governments for migrants during COVID-19

The sudden imposition of lockdown exposed migrants to economic, social, psychological, and emotional issues, as discussed earlier. Following these deplorable conditions for migrants, the government implemented a series of measures to help severely affected migrant workers. The central government's policy response is presented in Table 4 across various categories.

Table 4. Policy response of the central government

Policy response	Date	Announcement
Directive policies	March 27, 2020	The central government ordered the states to provide food and shelter to the migrants using the National Disaster Response Fund (NDRF)
	March 29, 2020	The government requested state governments to set up immediate relief camps for the migrant workers returning to their home states
	May 16, 2020	To streamline the movement of migrant workers, the government created a database named the National Migrant Information System (NMIS)
	July 14, 2020	The government requested the state government to create a database for migrated children in rural areas
Relief measures	March 26, 2020	The government announced 1.7 trillion relief packages, which include cash transfers and steps to ensure food security
	May 13, 2020	The government announced 20 trillion (10% of GDP) COVID-19 relief packages, which ₹11,092 crores released to states and union territories (UTs) under the NDRF, to fund food and shelter arrangements for migrants, ₹35 billion released to provide free food grain to migrant workers. Grib Kalyan Yojana initiated with an initial funding of 50,000 crore to tackle the impact of COVID-19 on migrants
	May 14, 2020	An additional 10 billion was allocated from the PM CARES Fund was allocated for the support of migrant workers
Transport arrangement	May 1, 2020	The central government launched the "Shramik Special" train for the migrants and others stranded

Sources: Information taken from various newspapers, websites, and research articles.

However, the effectiveness of the policy measures has been criticized by many. Rajan & Mishra (2020) pointed out the ambiguity surrounding the distribution of additional relief funds for migrant welfare among the states as per government guidelines. The finance minister announced the distribution of an additional 10 billion rupees for migrant welfare, with each state receiving a minimum of 10% or 1 billion (US$ 13.4 million), with additional grants allocated based on the state's population (50% weight) and the number of positive coronavirus cases (40% weight). Similarly, Sengupta & Vardhan (2020) stated that the package will fall short and require enhancement. Moreover, a significant component of the package constitutes monetary actions that are unlikely to be effective.

The institutional and federal structure of our country allows states to intervene or take policy measures concerning migrants and workers. Hence, various state governments (both migrant-receiving and sending states) followed various strategies on their own (however, the central government provided limited amounts to the states under the Special Disaster Relief Fund) to address the migrant problem (Srivastava, 2020b). In this regard, the states of Kerala and Odisha emerged as outliers by taking significant steps to save the lives and livelihoods of migrant workers (Das, 2020; Rajan & Bhagat, 2022; Srivastava, 2020b). Both the state government's experiences and investments in handling past natural disasters (Kerala: floods in 2018 and Nipah virus outbreak in 2019; Odisha: Phailin in 2013, Fani in 2019, and Amphan in 2020, etc.) helped them to understand the seriousness of the problem and to take necessary steps in general and for migrant workers in particular (Das, 2020; World Health Organization,

2020). The Kerala state government announced relief packages, opened shelter homes, and provided free meals through community kitchens, initiated through the local self-government department (LSGD) with the support of *Kudumbasree* (women's self-help group), which provided more than 8,651,627 free meals to the migrant laborers, those who are in quarantine, isolation, destitute, and other needy individuals. Even before COVID-19, the Kerala government's welfare schemes for migrants (i.e., Apna Ghar Housing Scheme, Aawaz Insurance Scheme, and Interstate Migrant Workers Welfare Scheme 2010) were well recognized (Peter *et al.,* 2020). On the other hand, the Odisha state government opened a registration portal for migrants and arranged 14-day quarantine facilities at the panchayat level (Pedi & Adabar, 2020). Moreover, it announced a cash transfer of 2000 rupees to all migrants who completed the 14-day quarantine period, a commendable initiative (Rajan & Sami, 2020).

Similarly, other state governments such as Maharashtra, Gujarat, Uttar Pradesh, Bihar, and Rajasthan were prominent in providing support to the migrant workers. The Maharashtra and Gujarat governments released funds from the State Disaster Relief Fund to address the issues of stranded immigrants. The states of Uttar Pradesh, Bihar, and Rajasthan implemented steps to ensure adequate food and shelter for migrants.

4. Conclusion

The literature and our analysis underscore that interstate migration happens from low-income to high-income states. Hence, people with low economic opportunities use migration as a strategy to diversify their income or improve their living standards (Datta, 2016; Mishra, 2016; Parida *et al.,* 2015). However, the issue is that these migrants face many challenges both at their destination and their places of origin. Most of the time, they fail to get/enjoy their fundamental rights. From a government policy perspective, these migrants receive inadequate recognition, as highlighted by recent migrant crises. Now, the time has come to recognize the importance of migration in economic development and poverty reduction (Bhagat, 2017b) and to implement necessary socioeconomic policy measures to mitigate the long-term and short-term problems of migrants (Rajan *et al.,* 2020).

To address the current crisis of COVID-19, both central and state governments must implement measures to ensure employment guarantees for migrants in their hometowns, as witnessed in the large-scale exodus of migrants, thereby instilling confidence in them to return to urban areas for work (Behera *et al.,* 2021). Furthermore, extending free ration distribution for food security until economic normality is restored is crucial. The other short-term measures undertaken by the government during the initial period of COVID-19 were somewhat insufficient (Srivastava, 2020b).

In the long term, several policy measures require attention. First, the government needs to ensure food security for all migrants through portable ration cards linked to the Public Distribution System (PDS). In this regard, the central government announcement of the "One Nation, One Ration Card" initiative is a good step, which is yet to be implemented. Second, the country should have reliable and real-time data on migrants to avoid further migrant crises. According to Kundu (2020), the government (state or central) should collaborate with industries, non-government organizations (NGOs), and other state governments to identify migrants. Moreover, the government should replicate scientific sample surveys such as the Kerala Migration Survey to identify migrants and protect their rights (Rajan & Sami, 2020). Third, the rural economy can be revived by strengthening the MSME sector. Strengthening the MSME sector could absorb more labor, decrease unemployment, and increase production in rural areas (Behera *et al*., 2021). Finally, apart from this specific measure, there are some general measures, such as creating rural employment opportunities through MGNREGA, ensuring social protection in terms of the best wage rate, strengthening agricultural marketing, and so on, that need to be implemented to mitigate the migration problem in the country.

Internal migration has been normalized in India over the years and occupies an important place, given the nature of the country's development. Since 1991, the trend of internal migration in the country has increased rapidly and is expected to increase further as many urban development policies (Smart Cities Mission, Swachh Bharat Mission, Atal Mission for Rejuvenation and Urban Transformation, etc.) have been introduced in recent years. The economic-related outmigration in the country is mainly determined by the developmental force. This means that the development of the state is the main reason for the attraction of migrants to the country. However, outmigration has also been seen from developed states. States such as Maharashtra, Tamil Nadu, and Karnataka have immensely contributed to the outmigration of the country. However, migrants from developed states are not distressed migrants. This trend of outmigration has also been analyzed by Bhattacharjee (2020) in his study.

This study highlights that economically poor states such as Uttar Pradesh, Bihar, and Rajasthan are the top sources of outmigration in the country. Various economic reasons, such as lower agricultural output, skewed distribution of land, higher dependency on agriculture,

and lack of industrialization, have explained the heavy outmigration (economic-related) from these states. Unless these problems are promptly addressed, the trend of outmigration, primarily in the informal sector, will continue. As a result, informality in economic activities will increase. The problem is that these migrants within our country struggle with various challenges ranging from housing to mental health, which has not been a serious discussion from the perspective of policymakers. Migrants, particularly women and children, endure a multitude of difficulties (physical assault, mental illness, forced child labor, etc.) at their destinations.

Despite the pressing issues faced by migrants, there remains a conspicuous absence of specific policies aimed at addressing their challenges. Although the previous studies by Srivastava (2012; 2020a), Roy *et al.* (2015), and Srivastava and Sutradhar (2016) have extensively examined various migrant-related issues, a tangible and comprehensive policy solution remains elusive. The current crises involving migrants, both in general and interstate migrants in particular, have become a highly debated topic among politicians and policymakers. Consequently, both central and state governments have implemented a range of short-term policy measures, coupled with the announcement of long-term strategies such as "One Nation, One Ration Card," in an effort to alleviate the migrant problem.

Nevertheless, certain critical areas necessitate more effective policy measures from the government, including the compilation of migrants' data, provision of housing, healthcare, and educational facilities for migrants and their children, creation of rural employment opportunities, and bolstering the agricultural sector. Despite the initiatives undertaken, there is a recognized need for enhanced policy implementation in these specific domains.

The present study extensively delves into the issue of interstate outmigration based on available literature. However, it is imperative to acknowledge two specific limitations within this study. First, an age-specific analysis of migrants has not been undertaken. Second, the absence of a field-based survey represents a potential limitation, as such an approach could have added significant value to the depth and comprehensiveness of the analysis.

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The authors declare that they have no competing interest.

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Methodology: Manas Kumar Pedi
Writing – original draft: Manas Kumar Pedi
Writing – review & editing: Manas Kumar Pedi

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Data can be accessed through the respective ministries of the Government of India (https://censusindia.gov.in/census.website/).

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REPORT

Impact of COVID-19 pandemic on 24-hour movement behaviors among preschoolers from Brazil

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Abstract

Healthy habits during early childhood are essential for a healthy adolescence and adulthood. Before the COVID-19 pandemic, the number of children who met the 24-h movement behavior (physical activity [PA], sedentary behavior, and sleep) guidelines was low worldwide. Despite a lack of evidence, the restriction measures imposed during the COVID-19 pandemic are claimed to have further reduced the number, especially among preschoolers. Thus, this study was designed to compare the time spent on movement behaviors before and during the COVID-19 pandemic in low-income preschoolers from the Northeast Region of Brazil. Forty mothers provided data on their preschoolers' sleep, sedentary behavior, and outdoor and indoor PA. To compare indoor and outdoor PA, sleep duration, and sedentary time during the weekdays and weekends, before and during the pandemic, generalized estimation equations were used. During the weekdays, a significant increase in sleep duration (553.7 vs. 627.0; $p < 0.01$) and sedentary times (225.0 vs. 409.5; $p < 0.01$) were observed. Further, an increase in the sedentary time during the weekend (319.5 vs. 406.5; $p < 0.01$) and the total time between the pre-pandemic and pandemic periods (249.0 vs. 409.5; $p < 0.01$) was observed. Our findings also unveiled that preschoolers were seven times more likely to be active outdoors for an hour or more before than during the pandemic (OR = 6.55; 95% CI = 2.07 – 20.73). In summary, the pandemic has altered preschoolers' routines, leading to changes in their health behaviors over time.

Keywords: Preschool child; Sleep; Sedentary behavior; Physical activity

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1. Introduction

Coronavirus disease 2019 (COVID-19) pandemic is widely recognized as a contagious disease outbreak of enormous magnitude unprecedented in the preceding decades

(WHO, 2020a). With the rapid increment of daily cases and dissemination of COVID-19 throughout the country, Brazil swiftly clinched the second spot in the ranking of infections and deaths attributed to the infectious disease (WHO, 2020b). Moreover, from the beginning of the pandemic until June 2023, more than 37 million confirmed cases were documented in Brazil (Brazil, 2023a). However, the prevalence of COVID-19 in Brazilian children is unknown. Considering the Brazilian continental dimensions, a study carried out in 2021 analyzed social and demographic inequities in the prevalence and the number of deaths caused by COVID-19 in Brazilian children and adolescents. The results highlighted that the lowest-income and most socially vulnerable populations were more susceptible to death. Further, it has been found that the children and adolescents (approximately 2 per 100,000 inhabitants) in the Northeast region of Brazil had the second-highest COVID-19-related mortality rate (Martins-Filho *et al.*, 2021).

There is a prevailing belief that such dire consequences in Brazil could have been alleviated if, during the pandemic, the countermeasures formulated by political representatives were grounded in science. Without sufficiently relying on scientific evidence, the Brazilian government adopted the COVID-19 Kit as a measure to combat COVID-19, which included a framework of unproven and ineffective therapies (Correia *et al.*, 2022). Furthermore, the rising anti-vaccine narrative highlights the negative roles played by denialism, conspiracy theories and disinformation at the highest level (Fonseca *et al.*, 2021). Even today, such denialist policies have important negative repercussions on pandemic control, with one of them being the low vaccination rate among the child population against COVID-19 (Brazil, 2023b).

The high infectivity of COVID-19 has severely impacted the normal lifestyle of many individuals and forced governments worldwide to implement social distancing and isolation measures. The roll-out of social distancing strategies for constraining COVID-19 was accompanied by the tightening regulation of non-essential activities in places such as schools, parks, industries, and commercial venues. The implementation of remote lessons and working and the longer time spent at home had dramatically changed many families' routine, as well as their way of living. In this sense, maintaining a routine of healthy behaviors in an atmosphere under the menace of COVID-19 pandemic became an additional challenge. Particularly, this became a more tricky challenge for families with preschool children. Habits acquired in this phase tend to grow until adulthood (Gabel *et al.*, 2017; Telama, 2009; Van de Straat *et al.*, 2020).

The 24-h movement behavior guidelines recommend that preschoolers should accumulate at least 3 h/day in physical activity (PA), including at least 1 h in moderate to vigorous activities, spend no more than 1 h using digital devices, and have a quality sleep lasting 10 – 13 h/day (WHO, 2019; Tremblay *et al.*, 2017). Previous studies conducted before the pandemic underscored the importance of complying with the recommendations to improve preschoolers' executive function (Bezerra *et al.*, 2020), global cognitive indicators (Walsh *et al.*, 2018), fundamental motor skills (Mota *et al.*, 2020), and social relationships (Cliff *et al.*, 2017) and to reduce impulsive behaviors (Guerrero *et al.*, 2019). A low percentage of Brazilian preschoolers comply with each movement behavior recommendations, namely 43% for PA, 35% for sleep time, and only 15% for screen time (Martins *et al.*, 2020).

Previous data from high-income countries showed that during the COVID-19 pandemic, there was a decrease in preschoolers' PA, an increase in screen and sleep time, and a reduction in sleep quality (Alonso-Martínez *et al.*, 2021; Aguilar-Farias *et al.*, 2020). Children from low-income families have limited built and natural environment opportunities for healthy behaviors (Buck *et al.*, 2019). These children may be the main victims of the negative effects of pandemic in terms of movement behaviors. Data covering preschoolers' movement behaviors during the pandemic is scarce, especially from the low-income ones. However, such information is critical to guide strategic planning to reduce the harmful effects of lockdown. In light of this, this study was designed to compare the time spent on movement behaviors before and during the COVID-19 pandemic among low-income preschoolers.

2. Data and methods

2.1. Study design

This study is part of the Movement's Cool study, which aims to analyze the association between movement behaviors and health outcomes in typically children with any type of delay or physical and mental restriction. The pre-pandemic measures were part of the Movement's Cool protocol, performed from March to April 2020 (Martins *et al.*, 2020). The study was conducted in compliance with the Helsinki Declarations' ethical aspects, and the methods and procedures were approved by the Research Ethics Committee of the Health Science Center (protocol no. 4.102.806). The assessments conducted during the pandemic included the same instrument used in the pre-pandemic project and were carried out between May and June 2020. All the children's parents were informed about the study's protocols and procedures through mobile message and agreed to participate in this study.

2.2. Setting and participants

This study was conducted in João Pessoa, located in the Northeast of Brazil (7.1195°S, 34.8450°W), and data were obtained from 3- to 5-year-old preschoolers who were registered in public preschools before the pandemic. For the purpose of this study, 120 parents of children from three Reference Centers in Early Childhood Education (CREIs), located in low socioeconomic areas of three different educational zones that were involved in the main project were invited to participate in the during-pandemic phase, through mobile message. The human development index (HDI) of the neighborhoods where CREIs are located ranges from 0.4 to 0.5. The HDI compares country indicators in terms of wealth, literacy, education, life expectancy, birth rate, and others to evaluate the well-being of a population, especially children. It varies from zero to one and is published by the United Nations Development Program (UNDP) in its annual report. Countries with HDI up to 0.499 have low human development, and those with indexes between 0.50 and 0.799 have medium human development (Souza, 2008).

A total of 40 parents were invited and agreed to participate. Of those participating, 50.5% of the mothers or fathers were unemployed, and over 71.8% of the mothers had not finished high school.

Before the pandemic, the parents were queried about the 24-h movement behaviors of their children through a face-to-face interview. During the pandemic, parents were requested to answer a similar pre-pandemic questionnaire related to their children's movement behaviors, with some adaptations tailored for the pandemic period (inclusion of the term "during pandemic," before each question), through forms sent through WhatsApp.

2.3. Variables

2.3.1. Sociodemographic variables

Demographic data, sex, age, mothers' educational level, and residence type (house or apartment) were collected before the pandemic through interviews with preschoolers' parents at the preschool. During the pandemic, the parents were asked to answer the same set of questions through WhatsApp.

2.3.2. Movement behaviors

The pre-pandemic level of PA among the children was subjectively determined based on parental recollection. Parents were asked to indicate the length of outdoor and indoor time spent by their children during weekdays and weekends; for instance, (i) on a typical weekday, how much time does your child spend playing outdoors (streets, squares, sidewalks); (ii) on a typical weekend day, how much time does your child spend playing outdoors (streets, squares, sidewalks); (iii) on a typical weekday, how much time does your child spend playing indoors (home, garage, service area); and (iv) on a typical weekend day, how much time does your child spend playing indoors (home, garage, service area). The possible answers include none, <1 h, and more than 1 h (Larouche *et al.*, 2017). The questions were separately set, targeting outdoor and indoor activities on weekdays and weekend days, and reintegrated for analyses. These questions were restructured for the during-pandemic survey by inserting the term "during pandemic" at the beginning of each sentence to cover the period during which most families were confined to their houses due to the lockdown. Parents were invited to answer the new questions tailored to the pandemic.

Parents were also asked to recall the total average hours their child spent sleeping with questions as follows: "on a typical weekday, what time does your child sleep?" and "on a typical weekday, what time does your child wake up?" Questions were also separately set for weekends, before and during the pandemic, and reintegrated for analysis. Sleep hours were calculated as follows: ([sleep on weekdays × 5] + [sleep on weekend days × 2])/7.

Sedentary time was determined based on screen time (TV, tablet, computer, and smartphone) during weekdays and weekends, and a similar procedure was followed. Parents were firstly asked to answer: "does your child have access to a TV?" An positive response to this question was followed by a subsequent question: "on a typical weekday, how many hours does your child spend watching TV?" and "on a typical weekend day, how many hours does she spend watching TV?" Pandemic-tailored questions concerning sedentary time were then adopted during the pandemic period. These questions were set to inquire about the time spent on all types of screens during the weekdays and the weekends. For analysis purposes, the total daily hours spent on each type of screen was calculated. The total time on sedentary behavior was calculated as follows: ([screen time on weekdays × 5] + [screen time on weekend days × 2])/7.

2.4. Statistical analysis

The sample's characteristics are presented as absolute and relative values, stratified before and during the pandemic periods. Concerning the absence of preliminary assumptions, such as normal distribution of the dependent variable (outcome) in each group and homogeneity of variance or sphericity, generalized estimation equations were used to analyze the time trends of sleep time, screen time, and outdoor and indoor PA mean values, before and during the pandemic. This method gives a robust analysis

even with small samples. To choose the correlation structure, the quasi-likelihood under the independence model criterion (QIC) was utilized (Pan, 2001). A lower QIC value indicated the best correlation matrix to be chosen for the model. Therefore, the gamma family, the log link function, and the autoregressive correlation (AR) matrix were used for all the models. Beta coefficients (β) were estimated for continuous data, and odds ratio (OR) and their respective confidence intervals were determined for categorical data. Analyses were performed using the Statistical Package for the Social Sciences (SPSS; version 26.0 for Windows), and the level of significance was set at $p < 0.05$.

3. Results

Our findings revealed that the time spent by preschoolers on sleeping and sedentary activities, on weekdays and weekends, had significantly lengthened during the COVID-19 pandemic. The percentage of preschoolers who were not engaged in any or in <1 h of outdoor PA during weekdays also increased during the pandemic. Nonetheless, the percentage of those who engaged with more active, outdoor activities (more than 1 h) during weekdays decreased. Similar results were observed for the same variable during the weekends, except for the reduction in the percentage of preschoolers engaged in <1 h of outdoor PA during the pandemic. The percentage of children that spent 1 h on indoor PA increased on weekdays and weekends during the pandemic. Conversely, the percentage of those who spent more than 1 h on indoor activities decreased (Table 1).

When comparing time spent on movement behaviors before and during the pandemic, the results highlighted that during the pandemic: (i) sleep time increased 73.3 min/day (β = 0.12; $p < 0.01$); (ii) screen time during weekdays increased 184.5 min/day (β = 0.59; $p < 0.01$); 87.0 min/day during weekend days (β = 0.26; $p < 0.01$); and 160.5 min/day, when considering the average amount of time for the entire week (β = 0.50; $p < 0.001$) (Table 2).

Findings about outdoor PA during weekdays showed that: (i) the preschoolers were almost seven times more likely to spend more than 1 h on outdoor PA before than during the pandemic (OR = 6.55; 95% CI = 2.07 – 20.73);

Table 1. Comparison of time spent in movement behaviors before and during the COVID-19 pandemic

Movement behaviors	Before pandemic	During pandemic	Δ
	Mean (95% CI)	Mean (95% CI)	
Sleep (min/day)	553.7 (529.8 – 577.8)	627.0 (608.4 – 645.6)	73.3
Screen time-weekdays (min/day)	225.0 (171.0 – 274.8)	409.5 (349.8 – 469.2)	184.5
Screen time-weekend days (min/day)	319.5 (248.4 – 393.0)	406.5 (339.6 – 473.4)	87.0
Screen time-total (min/day)	249.0 (205.8 – 294.6)	409.5 (353.4 – 456.6)	160.5
	n (%)	*n* (%)	Δ (%)
Outdoor activities on weekdays			
None	4 (10.0)	15 (37.5)	27.5
<1 h	6 (15.0)	13 (32.5)	17.5
≥1 h	30 (75.0)	12 (30.0)	−45.0
Outdoor activities on weekend days			
None	0 (0)	7 (17.5)	17.5
<1 h	5 (12,5)	3 (7.5)	−5.0
≥1 h	35 (87.5)	30 (75.0)	−12.5
Indoor activities on weekdays			
None	3 (7.5)	12 (30.0)	22.5
<1 h	5 (12.5)	1 (2.5)	−10.0
≥1 h	32 (80.0)	27 (67.5)	−12.5
Indoor activities on weekend days			
None	2 (5.0)	4 (10.0)	5.0
<1 h	2 (5.0)	6 (15.0)	10.0
≥1 h	36 (90.0)	30 (75.0)	−15.0

Notes: *n*: Absolute value; %: Relative value; Δ: Differences between mean values before and during the pandemic; Δ (%): Differences between percentage values before and during the pandemic.

Table 2. Comparison of movement behaviors before and during the COVID-19 pandemic

Model – behavior×time			
Variables	**β**	**95% CI**	***p***
Sleep	0.12	0.08 – 0.16	<0.01
Screen time (weekdays)	0.59	0.34 – 0.83	<0.01
Screen time (weekend days)	0.26	0.06 – 0.46	<0.01
Screen time (weekly)	0.50	0.31 – 0.70	<0.01
	OR	**95% CI**	***p***
Outdoor activities (weekdays)[a]			
≥1 h	1		
<1 h	2.22	1.12 – 4.41	0.02
None	0.62	0.34 – 1.13	0.12
Outdoor activities (weekend days)[b]			
≥1 h	1		
<1 h	0.14	0.05 – 0.38	<0.01
None	0.36	0.17 – 0.72	<0.01
Indoor activities (weekdays)[b]			
≥1 h	1		
<1 h	0.34	0.17 – 0.67	<0.01
None	0.53	0.27 – 1.02	0.06
Indoor activities (weekend days)[b]			
≥1 h	1		
<1 h	0.12	0.05 – 0.30	<0.01
None	0.32	0.16 – 0.66	<0.01

Note: 1 h as the reference category.
Abbreviations; β: Beta coefficient; OR: Odds ratio; CI: Confidence interval (95%).

(ii) the children were approximately twice more likely to be active for <1 h, when compared to those who played for more than 1 h during the pandemic (OR = 2.22; 95% CI = 1.12 – 4.41). During the weekend, children who spent 1 h on outdoor PA daily or who did not engage with outdoor PA had approximately 86% (OR = 0.14; 95% CI = 0.05 – 0.38) and 64% (OR = 0.36; 95% CI = 0.17 – 0.72) higher chance of maintaining these behaviors during the pandemic, when compared to those who engaged with outdoor PA for more than 1 h daily (Table 2).

Children who were active indoors for <1 h during weekdays were 66% less likely stay active when compared to children who were active for more than 1 h (OR = 0.36; 95% CI = 0.18 – 0.72). During the weekend, children who were active for <1 h showed 88% less likely of being active when compared to children who were active for more than 1 h (OR = 0.12; 95% CI = 0.05 – 0.30). Preschoolers who had no indoor PA time had 68% less chance of remaining in this condition when compared to those who spent more than 1 h indoors (OR = 0.32; 95% CI = 0.16 – 0.66) during the weekend (Table 2).

4. Discussion

The present study analyzed the difference in time spent sleeping, exposure to screens, and indoor and outdoor PA in low-income preschoolers before and during the pandemic. The main results showed an increase in sleep and sedentary time and a decrease in time spent on indoor and outdoor PA during the pandemic.

For health reasons, preschoolers should spend 10 – 13 h on good-quality sleep daily (WHO, 2019). In João Pessoa, which is geographically proximal to the equator, the sun rises between 4:30 am and 5:30 a.m. all year round. Before the pandemic, the assessed preschoolers were used to arriving at preschools at 6:30 a.m., as their parents usually start working at 7 a.m. We argue that a shift in family routine due to the social restrictions imposed accounts for the observed increase in children's sleep time following an alteration to the behavioral rules set by the parents for their children. In fact, a prior study has shown that preschoolers reported negative experiences regarding sleep during the pandemic (Liu *et al.*, 2020). In fact, children from low-income families go to bed later (Blair *et al.*, 2012), but during the lockdown period, parents staying home due to the social restrictions had positively driven an early sleep time for their children. Nonetheless, it is also important to highlight that despite the increased length of sleep, no information about sleep quality has been assessed.

As seen in the current study, social isolation increases children's exposure to risky behaviors, such as longer screen time. Preschoolers increased their average screen time both on weekdays and on weekends. It is worth mentioning that when children were at preschool, screen exposure was limited, as usage of digital devices was disallowed in these settings. The prohibition may, at least partially, explain the increased amount of time children were exposed to screens during the pandemic. Actually, making preschoolers comply with screen recommendations has been one of the most challenging endeavors even before the lockdown (Cliff *et al.*, 2017; De Craemer *et al.*, 2018) and could become much more difficult after having experienced such a long-period isolation at home.

The results also demonstrated a significant decline in outdoor PA time. The reduced access to neighborhood leisure facilities, associated with parental decision to restrict outdoor activities for their children, may have contributed to such findings. Indeed, the outdoor environment has a key impact on preschoolers' PA, contributing to PA recommendation compliances (An *et al.*, 2019). International guidelines have underscored

the need to create strategies to allocate time for replacing sedentary activities with PA that can be conducted in the home environment (WHO, 2019). Nonetheless, conditions imposed by the COVID-19 pandemic on Brazilian families can accentuate social differences, with predominant effects on the low-income populations, whose opportunities for nurturing healthy behaviors have been limited or even curtailed. The limitations inherent in the home environment that are unfavorable for physical activities (Guan *et al.*, 2020), and the low access to electronic devices at home (Tandon *et al.*, 2012), have a direct impact on preschooler's PA (Buck *et al.*, 2019). In addition, the low educational level may be a great barrier for parents to implement strategies to keep their children active in unattractive environments (Lindsay *et al.*, 2017) and socially unstable settings (May *et al.*, 2018).

The exact impact of the pandemic on human behaviors is hitherto unknown, though the premise that physical inactivity and sedentary behavior have become the new norms of our daily lives due to social isolation has started to gain traction (Hall *et al.*, 2020). Thus, social and educational measures to provide families with strategies for maintaining healthy behaviors are of utmost importance.

One of the prominent limitations of this study is the adoption of subjective parent-reported assessment, which might diminish the accuracy of data due to the associated memory bias. Nonetheless, the bias was controlled in this study by assessing the baseline measures 1 month before the pandemic and evaluating measures related to the pandemic period at the peak of social isolation in the city of João Pessoa. On a separate note, the assessment of low-income preschoolers is a strength that should be highlighted, considering that these families are the most affected and deserve greater attention from public authorities. Another limitation that we should acknowledge is the low parent response rate. However, it is noteworthy that obtaining data and questionnaire responses from socioeconomically vulnerable populations against the backdrop of a pandemic, which had further exacerbated the social inequalities exposing them to more precarious health conditions, are an uphill challenge. As such, this reflects a considerable strength of the current study.

5. Conclusions

The COVID-19 pandemic had a negative impact on screen time exposure and PA of low-income Brazilian preschoolers. Considering the length of the current pandemic, developing strategies to promote preschoolers' health behaviors, especially increasing PA and reducing screen time, should be the focus of attention, as behaviors established at young ages tend to be tracked throughout life.

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Conflict of interest

The authors declare they have no competing interest.

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Ethics approval and consent to participate

The Helsinki Declarations' ethical aspects were followed, and the methods and procedures were approved by the Research Ethics Committee of Health Science Center of the Federal University of Paraiba (protocol n. 4.102.806).

Consent for publication

All the children's parents were informed about the study´s protocols and procedures and authorized the participation of their children in writing before the pandemic. During the pandemic, the parents approved the participation through electronic form.

Availability of data

Data are available from the corresponding author upon reasonable request.

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RESEARCH ARTICLE

Gender differences in mental health outcomes amid the COVID-19 pandemic and a collapsing economy: A Lebanese cross-sectional study

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Abstract

Response plans to control the transmission of the severe acute respiratory syndrome coronavirus 2 that causes coronavirus disease 2019 (COVID-19) overlooked the repercussions of the combined economic and public health crisis among the most vulnerable populations, including women and people who have experienced abuse. This paper primarily aimed to assess the effects of the COVID-19 pandemic and economy-related variables on Lebanese adults' mental health, focusing on gender differences. A cross-sectional study was conducted in May 2020 using an online survey with validated scales created on Google Forms. A total of 502 adults living in Lebanon with access to the internet were enrolled in the study, irrespective of age, socioeconomic status, race, ethnicity, nationality, sex, gender identity, religion, location, education, and culture (n = 502). The multivariate analysis, adjusted on sociodemographic characteristics, economic, and coronavirus-related variables, showed that women exhibited higher distress, anxiety, and post-traumatic stress symptoms (PTSSs) levels than men. Moreover, violence at home was associated with more distress and insomnia, with borderline results for anxiety and well-being. No significant difference was found for PTSSs. In the context of combined health and economic crises, mental health outcomes are not equally felt across genders. Additional studies in a few months would help better understand the long-term impact, especially on PTSS and quality of life,

which might not be perceptible during the crisis. Focused public health strategies are warranted to support and protect the most vulnerable populations.

Keywords: Confinement; COVID-19; Domestic violence; Economic hardship; Gender differences; Mental health

1. Introduction

Since the first positive case of coronavirus disease (COVID-19) in Lebanon was reported on February 21, 2020, the government and the Ministerial Committee for Coronavirus Prevention implemented a response plan to contain the spread of the disease, resulting in a lockdown on March 15, 2020 (Ministry of Public Health and Ministry of Information, 2020). These measures placed Lebanon among the countries that were initially successful in dealing with "immediate healthcare problems" related to COVID-19 (Diwan & Abi-Rached, 2020). However, some gender experts in Lebanon considered that the action plan failed to account for the repercussions of the combined economic and sanitary crisis on the most vulnerable populations, including women and abused people, who may have been disproportionately affected (Chbaro, 2020).

Indeed, women and men may not experience in the same way the negative consequences of prolonged confinement, fear of infection, frustration, boredom, inadequate supplies, flawed information, financial loss, and stigma. In Lebanon, in particular, it is estimated that 58% of working women are subject to informal, unregulated, or unprotected labor laws, thus exposing them to both infection and poverty, with the looming threat of unemployment (Hivos, 2020). Moreover, the pandemic-related confinement of families at home has led to an increased domestic chores workload on women, which could drain them physically (United Nations Women, 2020). Finally, since the closure of schools on February 28, 2020 (Reuters, 2020), women have had to take responsibility for their children's homeschooling and ensure a state of tranquility, whether for children learning or men online working (United Nations Women, 2020). As a result, women might not be able to engage and deliver their formal jobs, which may limit their economic opportunities (Wenham *et al.*, 2020).

Domestic violence is another major issue that may have severe downstream mental and physical health outcomes on women, especially when they are forced into confinement with a potentially violent partner (Anurudran *et al.*, 2020; Bradbury-Jones & Isham, 2020; Chandan *et al.*, 2020; Neil, 2020; van Gelder *et al.*, 2020). Studies have shown that reported domestic violence often substantially increases after a catastrophic event (Parkinson, 2017). Furthermore, several reports shed light on a global increase in domestic violence and women abuse during this pandemic (Boserup *et al.*, 2020; Taub, 2020; The Guardian, 2020). In Lebanon, few studies have examined the prevalence of violence against women (Awwad *et al.*, 2014; Rahme *et al.*, 2020; Usta *et al.*, 2007). In large sample sizes, research identified rates of up to 35% of overall domestic violence (in 2002) (Usta *et al.*, 2007), 37.1% of physical violence, and 49.4% of non-physical violence (in 2020) (Rahme *et al.*, 2020).

Soon after the COVID-19 outbreak, Abaad, a not-for-profit organization, reported that home violence complaints had doubled over the first months of 2020 compared to the year prior (reaching 500 versus 270 in the same period of 2019) (Hivos, 2020). Several reasons underlie this increase in violence, including confinement and movement restrictions, isolation, frustration, overcrowding, and psychological factors such as stress and anxiety (Anurudran *et al.*, 2020; Chandan *et al.*, 2020; Neil, 2020; van Gelder *et al.*, 2020; the World Health Organization [WHO], 2020). The WHO published a statement calling for action to protect and support vulnerable persons in overcoming such "hidden crises of the COVID-19 pandemic." These recommendations should be further reinforced in a country like Lebanon, where growing economic vulnerability is thought to increase the threat of potential harm (Anurudran *et al.*, 2020; WHO, 2020).

Recent studies have shown that the female gender was significantly associated with a higher risk of developing coronavirus-related sleep disorders (Casagrande *et al.*, 2020), distress (Casagrande *et al.*, 2020), anxiety (Ozdin & Bayrak Ozdin, 2020), and post-traumatic stress symptoms (PTSSs) (Liu *et al.*, 2020). Interestingly, several studies from Lebanon highlighted that mental symptoms are more frequently reported among women and young adults (Bou-Hamad *et al.*, 2021; Salameh *et al.*, 2020) and that the fear of COVID-19 and financial hardships were significantly associated with higher distress and anxiety (Salameh *et al.*, 2020). Based on these observations, one could stipulate that the added effect of the economic and pandemic crises impacted genders differently.

To the best of our knowledge, no previous studies have yet evaluated the relationship between gender, domestic violence, economic hardship, and sociodemographic-adjusted health outcomes, that is, sleep, anxiety, distress, PTSS, and well-being. Therefore, this study aimed to assess

the effects of COVID-19 and economy-related variables on the mental health of Lebanese adults, focusing on gender differences. The secondary objective was to evaluate the role of domestic violence in that context.

2. Data and methods

2.1. Study design and sampling

This cross-sectional study was conducted between May 10 and 20, 2020, using an online questionnaire created on Google Forms. Due to the government-mandated lockdown, participants were recruited by snowball sampling. The survey was shared on Facebook, Instagram, and WhatsApp groups. All adults with internet access and living in Lebanon were eligible to participate, regardless of their age, socioeconomic status, race, ethnicity, nationality, sex, gender identity, religion, location, education, and culture. A total of 502 respondents completed the 20-min questionnaire.

2.2. Sample size calculation

The minimum sample size was calculated using the G-Power software, version 3.0.10. The calculated effect size was 0.0526, expecting a squared multiple correlation of 0.05 (R^2 deviation from 0) related to the omnibus test of multiple regression. The minimum necessary sample was $n = 454$, considering an alpha error of 5%, a power of 80%, and allowing for 25 predictors to be included in the model.

2.3. Questionnaire

The online questionnaire was available in Arabic, the native language of Lebanon. It consisted of three parts. The first part assessed the sociodemographic features of the participants, such as age, gender, marital status, educational level, employment status, region, and current household monthly income, divided into five levels, according to the official exchange rate (1 USD = 1500 LBP): No income, low <675,000 LBP (450 USD, the official lowest wage in Lebanon), moderate 675,000 – 1,500,000 LBP (450 – 1,000 USD), high 1,500,000 – 3,000,000 LBP (1,000 – 2,000 USD), and very high income >3,000,000 LBP (2,000 USD). It also included questions about medical coverage, smoking, alcohol consumption, self-perception of the financial situation, having been infected or in contact with people contaminated with coronavirus, and physical activity before and during the COVID-19 pandemic. Violence was self-evaluated based on the answer to the following questions with four possible answers (1-Yes; 2-No; 3-No answer; and 4-Does not apply):

(i) Is there any form of verbal violence in your home?
(ii) Is there any form of physical violence in your home?
(iii) Is there any form of sexual violence in your home?
(iv) Is there any form of any other type of violence in your home?

The second part of the questionnaire consisted of a set of 20 work-related questions intended for working people and those seeking employment. These questions explored to what extent current jobs were affected by either the economic crisis or the COVID-19 pandemic. Examples of questions: Do you have to go out to make a living despite the sanitary lockdown? Are you able to apply social distancing while working (1.5 – 2 m safety distance)? Did your company change the working hours because of the economic crisis or the COVID-19 pandemic? Has your salary/income been affected by the economic crisis or the COVID-19 pandemic? Are you worried about the long-term impact of the economic crisis or the COVID-19 pandemic on your business/job? Did the economic crisis or the COVID-19 pandemic result in a decrease in the salaries of employees? Did the economic crisis or the COVID-19 pandemic cause the dismissal of some employees? What were the criteria used to lay off employees? The fear of poverty was assessed using a one-item scale rated from 0 (I have no fear of my own poverty) to 10 (I have a great fear of my own poverty) (Kacmarova & Babincak, 2019).

Finally, the third part of the questionnaire included several validated scales:

2.3.1. The fear of COVID-19 scale

This seven-item tool measures the extent of fear of COVID-19 in adults (Ahorsu *et al.*, 2020). The total score, ranging from 1 to 35, is calculated by summing the answers to all questions graded from 1 (strongly disagree) to 5 (strongly agree) on a 5-point Likert scale. Higher scores indicate a greater fear of COVID-19 ($\alpha_{Cronbach}$=0.893).

2.3.2. The Beirut Distress Scale-22 (BDS-22)

The BDS-22, validated in Lebanon (Barbour *et al.*, 2012), evaluates the level of distress in the general Lebanese adult population. It consists of 22 questions exploring six different domains: depressive symptoms, demotivation, psychosomatic symptoms, mood deterioration, intellectual inhibition, and anxiety. Responses are rated on a 4-point Likert scale from 0 (not at all) to 3 (all of the times), with higher scores indicating higher distress levels ($\alpha_{Cronbach}$=0.965).

2.3.3. The Lebanese Anxiety Scale-10 (LAS-10)

The LAS-10 is a 10-item scale validated in Lebanon (Hallit *et al.*, 2020), used to screen for anxiety in the general Lebanese adult population. Questions 1 to 7 are scored on a 5-point Likert scale from 0 (not present) to 4 (very

severe), while items 8 – 10 are graded on a 4-point Likert scale from 1 (never/almost never) to 4 (almost always). Higher scores indicate high anxiety ($\alpha_{Cronbach}$=0.919).

2.3.4. The Post-Traumatic Stress Disorder (PTSD) Checklist for DSM-5 (PCL-5)

This 20-item tool evaluates the 20 DSM-5 symptoms of PTSD in the past month. It is available in Arabic and validated in Syria (Ibrahim *et al.*, 2018). Responses are rated on a 5-point Likert scale from 0 (not at all) to 4 (extremely). The total symptom severity score (range 0 – 80) is obtained by summing the responses for each of the 20 items. Higher scores reflect higher symptoms resulting from a stressful experience ($\alpha_{Cronbach}$ = 0.971). As online surveys do not permit an accurate diagnosis of PTSD but instead assess PTS symptoms, this paper employs the term PTSS to refer to this evaluation.

2.3.5. The Lebanese Insomnia Scale (LIS-18)

This 18-item tool, recently validated in Lebanon (Hallit *et al.*, 2019), was used to screen for insomnia. Answers are graded on a 5-point Likert scale from 1 (never) to 5 (always), with higher scores indicating more insomnia ($\alpha_{Cronbach}$ = 0.847).

2.3.6. The Family Adaptation, Partnership, Growth, Affection, and Resolve (APGAR) index

This instrument evaluates satisfaction with the global family function (Good *et al.*, 1979). It consists of five questions graded on a 3-point Likert scale: 0 (hardly ever), 1 (some of the time), and 2 (almost always). Each corresponds to a component of family function, that is, APGAR. The total, ranging from 0 to 10, is obtained by summing the answers to all items. Higher scores indicate higher satisfaction with family function ($\alpha_{Cronbach}$ = 0.927).

2.3.7. The WHO-Five Well-Being Index (WHO-5)

This short-version questionnaire, validated in Lebanon (Sibai *et al.*, 2009), consists of five questions graded from 0 to 5 assessing mental well-being in the past month. The total score ranges from 0 to 25; higher scores indicate better mental well-being ($\alpha_{Cronbach}$ = 0.796).

2.3.8. The InCharge Financial Distress/Financial Well-Being Scale (IFDFW)

This tool includes eight items assessing the perceived financial distress/financial well-being on a 1-to-10 linear scale (Prawitz *et al.*, 2006). Lower scores reflect higher financial distress and lower well-being ($\alpha_{Cronbach}$ = 0.925). Since this tool is copyrighted, written permission was obtained from the authors to use it and validate it in Lebanon.

2.4. Translation procedure and piloting

Three of the scales (fear of COVID-19, the Family APGAR Index, and the IFDFW), not validated nor available in Arabic, were translated into this language. Three authors performed the forward translation, and the other three did the back translation. Discrepancies between the original English versions and the translated ones were resolved by consensus. The final version was pilot-tested on ten people unfamiliar with the study. The final dataset did not include their answers.

2.5. Ethics approval and consent to participate

The Institutional Review Board of the American University of Science and Technology approved this study protocol (AUST-IRB-20200527-01), as this work has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The topic was explained to all participants in the introductory section of the survey, and consent to participate was implicit. The anonymity of participants was guaranteed throughout the process of data collection and analysis.

2.6. Statistical analysis

Data were collected using Google Forms, a tool that automatically generates an Excel database, then transferred to IBM SPSS®, version 23.0, for analysis. Before the analysis, data were weighted according to gender, age, and dwelling region, based on the figures of the Central Administration of Statistics (Central Administration of Statistics [CAS], 2021; Salameh *et al.*, 2020). The descriptive analysis used frequencies and percentages for categorical variables and means and standard deviations (SD) for quantitative variables. For dependent variables (BDS-22, LIS-18, LAS-10, PCL-5, and WHO-5), the distribution was considered normal based on the visual inspection of the histogram and the skewness and kurtosis (lower than 1). These conditions are compatible with normality in a sample size larger than 300 (Mishra *et al.*, 2019).

For the bivariate analysis of continuous variables, the Student's *t*-test was used to compare the means between two groups (mainly gender) after checking for homogeneity of variances using Levene's test. In case the variances were not homogeneous, the corrected T-test was applied. The Chi-square test was used for dichotomous and multinomial variables comparison between groups. When calculated values per case were <5, the Fisher exact test was performed. In all cases, *p*-value lower than 0.05 was considered significant.

Afterward, a multivariate analysis employing the General Linear Model was performed, using the mental

health-related dependent variables; the ENTER method was applied to come up with the appropriate model with proper assumptions. This method allowed for a MANCOVA (multivariate analysis of covariance) analysis and the calculation of the estimated marginal means for mental health measures among men and women and among subjects with and without declared domestic violence, after adjustment over potential confounders, such as age, marital status, education level, health coverage, chronic disease, having a family member with a chronic disease, worrying for a family member with a chronic disease, fear of not having access to chronic disease treatment, domestic violence, professional status, socioeconomic status, APGAR family index, financial wellness scale, and fear of COVID-19 scale. As for comparing groups with or without declared domestic violence, the following potential confounders were used for adjustment: gender, age, marital status, education level, health coverage, chronic disease, having a family member with a chronic disease, worrying for a family member with a chronic disease, fear of not having access to chronic disease treatment, professional status, socioeconomic status, APGAR family index, financial wellness scale, and fear of COVID-19 scale.

3. Results

3.1. Sociodemographic characteristics and gender distribution

A total of 503 participants were included in our study, with slightly more females (52.68%) than males (average age 42.47 ± 14.06). The majority had a university degree. However, males were significantly more educated (92% vs. 85% university degree; $p = 0.018$); they reported more domestic violence than females (8.4% vs. 3.8%; $p = 0.038$). Higher percentages of previous, occasional, and regular cigarette and waterpipe smokers were found. Moreover, significantly more women (17%; $p < 0.001$) had never worked, as compared to men (2.9%) (Table 1).

3.2. Economic characteristics and gender distribution

The subjective assessment before COVID-19 did not significantly differ between males and females; however, regarding the post-COVID-19 evaluation, more males classified themselves in poorer classes than females. A further economic impact on males was thus noticed, although more males initially belonged to households with higher revenues. Overall, socioeconomic quartiles were equally distributed between males and females. There were significantly more males with no health coverage (Table 2).

Table 1. Demographic characteristics and gender distribution

Characteristics	Males *N*=238 (100%)	Females *N*=265 (100%)	*p*-value
Marital status			0.114
Single	92 (38.8%)	97 (36.6%)	
Married	139 (58.6%)	151 (57.0%)	
Widowed/Divorced	6 (2.5%)	17 (6.4%)	
Level of education			**0.018**
Less than university	19 (8.0%)	39 (14.7%)	
University degree	219 (92.0%)	226 (85.3%)	
Dwelling region			0.671
Beirut (capital)	39 (16.4%)	45 (17.0%)	
Lebanon	110 (46.2%)	112 (42.3%)	
South Lebanon	35 (14.7%)	34 (12.8%)	
Beqaa	19 (8.0%)	29 (10.9%)	
North Lebanon	35 (14.7%)	45 (17.0%)	
Household size			0.973
<4 persons	77 (32.5%)	84 (31.8%)	
4 persons	66 (27.8%)	70 (26.5%)	
5 persons	56 (23.6%)	66 (25.0%)	
6 and more	38 (16.0%)	44 (16.7%)	
Number of dependent children			0.357
None	101 (42.6%)	105 (39.8%)	
1 child	16 (6.8%)	29 (11.0%)	
2 children	66 (27.8%)	66 (25.0%)	
3 children or more	54 (22.8%)	64 (24.2%)	
Number of rooms			0.611
<5 rooms	79 (33.2%)	88 (33.3%)	
5 rooms	70 (29.4%)	69 (26.1%)	
6 rooms	53 (22.3%)	56 (21.2%)	
7 rooms or more	36 (15.1%)	51 (19.3%)	
Alcohol consumption			<0.001
Previous	11 (4.6%)	3 (1.1%)	0.001
None	70 (29.4%)	127 (48.1%)	Ref
Occasional	30 (12.6%)	14 (5.3%)	0.001
Regular	127 (53.4%)	120 (45.5%)	<0.001
Cigarette smoking			0.059
Previous	11 (4.6%)	10 (3.8%)	
None	145 (61.2%)	189 (71.1%)	
Occasional	37 (15.6%)	23 (8.6%)	
Regular	44 (18.6%)	44 (16.5%)	
Waterpipe smoking			<0.001
Previous	22 (9.3%)	5 (1.9%)	<0.001
None	153 (64.6%)	210 (79.2%)	Ref
Occasional	22 (9.3%)	11 (4.2%)	0.168
Regular	40 (16.9%)	39 (14.7%)	0.007
Self-reported domestic violence			0.031
No violence reported	215 (90.7%)	247 (93.6%)	Ref
Violence reported	20 (8.4%)	10 (3.8%)	0.038
No answer given	2 (0.8%)	7 (2.7%)	0.188

(Cont'd...)

Table 1. ***(Continued)***

Characteristics	Males N=238 (100%)	Females N=265 (100%)	*p*-value
Professional status			<0.001
Works currently	184 (77.3%)	161 (60.8%)	Ref
Housewife/never worked	7 (2.9%)	45 (17.0%)	<0.001
Student	21 (8.8%)	29 (10.9%)	0.134
Retired	17 (7.1%)	23 (8.7%)	0.194
Looking for a job	9 (3.8%)	7 (2.6%)	0.819
	Mean (SD)	**Mean (SD)**	***p*-value**
Age in years	42.72 (14.62)	42.26 (16.56)	0.717

Abbreviation: SD: Standard deviation.

Notes: *p*-values in bold refer to statistically significant results. ref: Group of reference used to compare other groups within the same variable.

3.3. COVID-19 exposure, health characteristics, and gender distribution

More males were in contact with COVID-19 cases (6.7% vs. 0.8%), knew someone infected with coronavirus (36.3% vs. 22.3%), and were visiting/receiving friends and relatives during the lockdown; also, more males were doing physical activity (69% vs. 59%), and more had a chronic disease (25% vs. 17%). More females were afraid to go out to get treatment (19% vs. 11%), and more were worried about a family member contracting the disease (Table 3).

3.4. Gender effects on self-declared measures

In the bivariate analysis, when compared to males, females had significantly higher fear of COVID-19 (12.03 vs. 10.58; $p = 0.007$), fear of poverty (7.23 vs. 6.53; $p = 0.003$), distress (BDS-22 scores of 18.49 vs. 13.42; $p < 0.001$), anxiety (LAS-10 scores of 16.1 vs. 14.4; $p = 0.032$), and PTSS (PCL-5 scores of 21.29 vs. 13.57; $p < 0.001$), but similar insomnia, financial wellness, and family satisfaction scores ($p > 0.05$ for the latest three variables). Furthermore, women had lower mental well-being (WHO-5 scores of 14.08 vs. 15.61; $p < 0.001$) (Table 4).

Based on the multivariate analysis, the adjusted estimated marginal means showed lower means for distress (BDS-22), anxiety (LAS-10), and PTSS (PCL-5) in men after adjustment for sociodemographic characteristics, economic, and coronavirus-related variables. However, mental well-being was not significantly different between men and women (Figure 1A). Further, details of the MANCOVA results are presented in the Appendix.

3.5. Violence effects on self-declared measures

Participants with domestic violence at home had a lower fear of COVID-19 (8.67 vs. 12.74; $p = 0.04$), lower mental well-being (WHO-5 scores of 11.37 vs. 15.06; $p < 0.001$), and higher distress (BDS-22 scores of 23 vs. 15.52; $p = 0.03$),

Table 2. Economic characteristics and gender distribution

Characteristic	Males N=238 (100%)	Females N=265 (100%)	*p*-value
Subjective assessment of the economic status before COVID-19			0.124
No answer	0	5 (1.9%)	**0.021**
Wealthy	14 (5.9%)	17 (6.4%)	0.235
Middle class	213 (89.9%)	234 (88.6%)	0.162
Middle to low	4 (1.7%)	6 (2.3%)	0.188
Below poverty line	6 (2.5%)	2 (0.8%)	Ref
Subjective assessment of the economic status after COVID-19			**0.018**
No answer	4 (1.7%)	9 (3.4%)	**0.016**
Wealthy	0	5 (1.9%)	**0.006**
Middle class	151 (63.7%)	176 (66.7%)	0.020
Middle to low	68 (28.7%)	69 (26.1%)	0.049
Below poverty line	14 (5.9%)	5 (1.9%)	Ref
Current health coverage			<0.001
No health coverage	32 (13.5%)	20 (7.6%)	Ref
Private insurance	69 (29.1%)	86 (32.6%)	0.252
Social security	108 (45.6%)	97 (36.7%)	0.034
Other public coverage	28 (11.8%)	61 (23.1%)	<0.001
Household income			**0.029**
<675,000 LP	3 (1.3%)	12 (4.5%)	Ref
675,000 – 1,500,000 LP	23 (9.7%)	41 (15.5%)	0.362
1,500,000 – 3,000,000 LP	76 (32.1%)	73 (27.5%)	0.022
More than 3,000,000 LP	135 (57.0%)	139 (52.5%)	0.027
Socioeconomic quartile			0.356
Quartile 1	55 (23.3%)	78 (30.1%)	
Quartile 2	70 (29.7%)	72 (27.8%)	
Quartile 3	62 (26.3%)	57 (22.0%)	
Quartile 4	49 (20.8%)	52 (20.1%)	

Notes: *p*-values in bold refer to statistically significant results. ref: Group of reference used to compare other groups within the same variable.

anxiety (LAS-10 scores of 20.57 vs. 14.92), and insomnia (LIS-18 scores of 53.89 vs. 43.96; $p < 0.001$); there was no significant difference for fear of poverty, financial wellness, and PTSS (Table 4). In the multivariate analysis, those who reported violence at home had higher distress ($p = 0.041$) and insomnia ($p = 0.002$), with borderline results for anxiety and well-being (0.078 and 0.065, respectively) and no significant difference for PTSS (Figure 1B). Further details of the MANCOVA results are presented in the Appendix.

4. Discussion

Our study showed that women reported significantly higher levels of distress, anxiety, and PTSS than men after adjustment for sociodemographic, economic, and coronavirus-related factors, suggesting that the impact of the current situation is worse on women. A gender-specific understanding of COVID-19 effects is thus highly relevant

Table 3. COVID-19 exposure, health characteristics, and gender distribution

Characteristic	Males *N*=238 (100%)	Females *N*=265 (100%)	*p*-value
No COVID-19 infection	236 (99.2%)	263 (99.6%)	0.606
COVID-19 infection	2 (0.8%)	1 (0.4%)	
Contact with COVID-19 (work, family, store)	16 (6.7%)	2 (0.8%)	**<0.001**
No contact with COVID-19	222 (93.3%)	263 (99.2%)	
Knows someone infected	86 (36.3%)	59 (22.3%)	**<0.001**
Does not know anyone infected	151 (63.7%)	206 (77.7%)	
Visiting/receiving friends	71 (30.0%)	38 (14.3%)	**<0.001**
Not visiting/receiving friends	166 (70.0%)	227 (85.7%)	
Visiting/receiving family	160 (67.5%)	151 (57.0%)	**0.015**
Not visiting/receiving family	77 (32.5%)	114 (43.0%)	
Physical activity	165 (69.3%)	157 (59.2%)	**0.019**
No physical activity	73 (30.7%)	108 (40.8%)	
Chronic disease	58 (24.5%)	45 (17.0%)	**0.038**
No chronic disease	179 (75.5%)	220 (83.0%)	
Regular treatment for chronic disease			0.004
Yes	66 (27.8%)	61 (23.0%)	0.067
No regular treatment	28 (11.8%)	13 (4.9%)	Ref
Does not apply	143 (60.3%)	191 (72.1%)	0.002
Fear of lack of access to treatment	74 (31.1%)		0.651
No	68 (28.6%)	80 (30.2%)	
Yes	96 (40.3%)	68 (25.7%)	
Does not apply		117 (44.2%)	
Fear of going out to get treatment			<0.001
No	124 (52.3%)	93 (35.2%)	Ref
Yes	26 (11.0%)	51 (19.3%)	<0.001
Does not apply	87 (36.7%)	120 (45.5%)	0.002
Family member has chronic disease			0.566
No	91 (38.2%)	108 (40.9%)	
Yes	124 (52.1%)	137 (51.9%)	
Does not apply	23 (9.7%)	19 (7.2%)	
Worry that a family member gets COVID-19			**0.001**
No	62 (26.1%)	34 (12.9%)	Ref
Yes	118 (49.6%)	150 (56.8%)	**0.001**
Does not apply	58 (24.4%)	80 (30.3%)	**0.001**

Notes: *p*-values in bold refer to statistically significant results; ref: group of reference used to compare other groups within the same variable.

in the context of combined sanitary and economic crises, as it sheds light on the multiple and interrelated levels of inequality that shape vulnerability to infection and health-related outcomes. It is noteworthy that men were more likely to be exposed to COVID-19 and had more risk factors (e.g., occupational exposure, chronic diseases, smoking, and other factors) than women. They expressed less fear of COVID-19, less fear of poverty, and better overall mental health, suggesting greater psychological vulnerability among women despite lower morbidity and mortality related to COVID-19 (Broche-Perez *et al.*, 2020; Griffith *et al.*, 2020).

These results are not surprising, as previous findings have revealed that anxiety and depressive disorders are more frequent in women (Altemus *et al.*, 2014). Gender differences in psychiatric disorders were also reported during the COVID-19 pandemic. Indeed, studies showed that anxiety disorders were two- to three-fold higher in women than men during COVID-19 (Casagrande *et al.*, 2020; Ozdin & Bayrak Ozdin, 2020; Wang & Zhao, 2020) (Moghanibashi-Mansourieh, 2020). As for PTSS, research has identified that the female gender was the most potent predictor of PTSS after pandemics, with women being more prone than men to re-experiencing negative alterations in cognition or mood and hyperarousal, as measured by PCL-5 (Liu *et al.*, 2020). This outcome could be related to the higher reactivity of trauma-associated neural networks in women's brains when exhibiting higher levels of stress, anxiety, and helplessness compared to men (Felmingham *et al.*, 2010). However, in contrast to findings in the Italian population (Casagrande *et al.*, 2020), women in our sample did not report an increase in COVID-19-related sleep disturbances or deterioration in their overall well-being. A possible explanation could be the difference in the scales used to assess insomnia. It is also plausible that men and women in our sample were influenced by shared triggering factors, which might have been mitigated or obscured through statistical adjustments in the multivariable analysis.

As for our secondary objective, to the best of our knowledge, no previous studies have assessed the differences in health outcomes based on the different types of violence during the COVID-19 pandemic. The recorded percentages of violence, categorized as verbal, physical, sexual, or other, were quite surprising since men reported domestic brutality more than women (8.4% versus 3.8%). In addition, 2.7% of women chose "no answer" when asked about violence, despite the survey's anonymity, suggesting a hidden cultural stigma preventing women from disclosing abuse (Francis *et al.*, 2017). Other factors may explain this finding, such as information bias, where participants may have witnessed violence committed by other men or observed their female partners engaging in violent behavior toward children. It could also be that they are self-reporting their violent conduct related to some cultures where domestic violence is accepted by men, particularly in the case of female "misconduct" (Almosaed, 2004; Vandello & Cohen, 2008). A previous review highlighted

Table 4. Gender and violence effects on self-declared measures (bivariate analysis)

	Fear of Poverty	Fear of COVID-19	BDS-22 (Distress)	LAS-10 (Anxiety)	LIS-18 (Insomnia)	PCL-5 (PTSS)	WHO-5 (Mental well-being)	IFDFW (Financial)	APGAR Index (Family functions)
Males	6.53 (2.75)	10.58 (6.06)	13.42 (14.45)	14.40 (9.29)	43.77 (11.60)	13.57 (14.77)	15.61 (5.03)	41.38 (16.81)	7.76 (2.73)
Females	7.23 (2.52)	12.03 (5.92)	18.49 (15.83)	16.10 (8.32)	45.36 (10.87)	21.29 (18.04)	14.08 (4.74)	38.58 (17.71)	7.85 (2.72)
p-value	**0.003**	**0.007**	**<0.001**	**0.032**	0.114	**<0.001**	**<0.001**	0.071	0.726
No violence (0)	6.91 (2.64)	11.49 (6.05)	15.52 (15.27)	14.92 (8.69)	43.96 (10.91)	17.87 (16.97)	15.06 (4.90)	40.01 (17.18)	7.93 (2.60)
Any violence (1)	6.52 (2.97)	8.67 (5.64)	23.00 (16.12)	20.57 (9.47)	53.89 (12.84)	15.07 (17.65)	11.37 (4.52)	40.85 (19.73)	6.44 (3.75)
No answer (2)	7.64 (2.01)	12.74 (3.91)	22.12 (13.61)	16.82 (8.73)	47.07 (9.38)	14.51 (17.30)	13.17 (3.51)	32.08 (16.17)	6.13 (3.32)
p-value	0.502	0.036	**0.017**	**0.003**	**<0.001**	0.577	**<0.001**	0.347	0.069
p-value (1) versus (0)	1.000	**0.040**	**0.030**	**0.002**	**<0.001**	1.000	**<0.001**	1.000	0.150
p-value (2) versus (0)	1.000	1.000	0.540	0.732	1.000	1.000	0.678	0.465	0.061

Note: *p*-values in bold refer to statistically significant results.
Abbreviations: APGAR: Adaptation, Partnership, Growth, Affection, and Resolve; BDS-22: Beirut Distress Scale-22; COVID-19: Coronavirus disease; IFDFW: InCharge Financial Distress/Financial Well-Being Scale; LAS-10: Lebanese Anxiety Scale-10; LIS-18: Lebanese Insomnia Scale; PCL-5: Post-traumatic Stress Disorder Checklist for DSM-5; PTSS: Post-Traumatic Stress Symptoms; WHO-5: World Health Organization Well-Being Index.

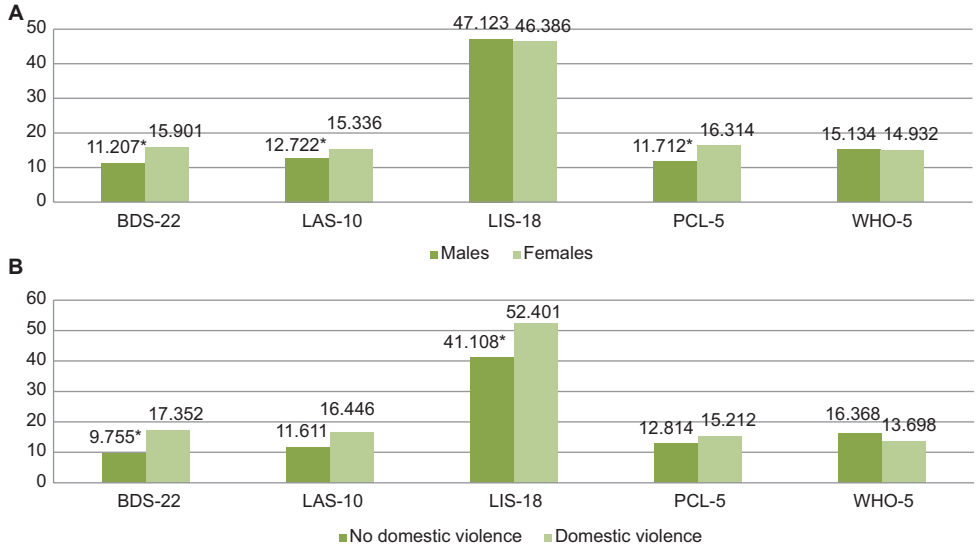

Figure 1. Mental health measure: estimated marginal means per gender (A) and according to domestic violence (B). *$p < 0.05$. (A) *p*-values for BDS-22 = 0.005; LAS-10 = 0.033; LIS-18 = 0.645; PCL-5 = 0.025 and WHO-5 = 0.754. Adjustment over age, marital status, university education, health coverage, chronic disease, family member with chronic disease, worrying for a family member with chronic disease, fear of not having access to chronic disease treatment, domestic violence, professional status, socioeconomic status, APGAR family index, financial wellness, and fear of COVID-19. Covariates appearing in the model are evaluated at the following values: APGAR index = 8.0140, age = 47.4720, financial wellness = 40.3318, fear of COVID-19 = 10.7243. (B) *p*-values for BDS-22 = 0.041; LAS-10 = 0.078; LIS-18 = 0.002; PLC-5 = 0.601 and WHO-5 = 0.065. Adjustment over gender, age, marital status, university education, health coverage, chronic disease, family member with a chronic disease, worrying for a family member with a chronic disease, fear of not having access to chronic disease treatment, professional status, socioeconomic status, APGAR family scale, financial wellness, and fear of COVID-19. Covariates appearing in the model are evaluated at the following values: APGAR scale = 8.0140, age = 47.4720, IFD wellness scale = 40.3318, fear of COVID-19 scale = 10.7243.
Abbreviations: BDS-22: Beirut Distress Scale-22; LAS-10: Lebanese Anxiety Scale-10; LIS-18: Lebanese Insomnia Scale; PCL-5: Post-Traumatic Stress Disorder Checklist for DSM-5; WHO-5: World Health Organization Well-Being Index. Additional details related to the MANCOVA are presented in Appendix.

the complexity of reporting differences between males and females, with males being more likely to report violence when they considered it of minor importance (Chan, 2011). Although many factors related to social desirability, culture, and religion have been suggested to explain the asymmetry in reporting between males and females, further studies are necessary to elucidate this finding.

In this study, domestic violence was found to be associated with higher levels of distress and insomnia, with borderline results for anxiety and mental well-being. However, the recorded rates were lower than those reported in the previous studies conducted in Lebanon (Rahme *et al.*, 2020; Usta *et al.*, 2007). This difference is likely due to the fact that most participants had a university level of education. While prior research has explored the relationship between interpersonal violence and these factors, the present study adds a novel dimension by examining these associations in the specific context of the COVID-19 pandemic (Gallegos *et al.*, 2019; Ophuis *et al.*, 2018). This result is expected in times of crisis and lockdown as it represents a direct consequence of being forcibly confined with a violent partner. In poor-resource settings, confinement enhances psychological stress, increases unfavorable coping mechanisms (such as alcohol or smoking), and reduces the ability to access usual support (Anurudran *et al.*, 2020; Bradbury-Jones & Isham, 2020; Chandan *et al.*, 2020; Neil, 2020; van Gelder *et al.*, 2020; WHO, 2020). A national survey in the United Kingdom prioritized mental health issues during the COVID-19 pandemic, reporting several concerns, including mental illness, financial difficulties, family breakdown, and increased domestic violence. Interestingly, respondents were relatively less worried about becoming physically ill, consistent with our results (Holmes *et al.*, 2020).

Furthermore, our results showed no association between domestic violence and PTSS, a stressor-related psychiatric disorder occurring after experiencing or witnessing events involving physical injury, death, or other threats to physical integrity (American Psychiatric Association DSM-5 Task Force, 2013). As PTSD is one of the most common long-term psychiatric disorders, the absence of correlation could be related to insufficient time for the effects to appear. Even when the lockdown is over, the consequences would still be detected months or even years after the COVID-19 pandemic ends (Brooks *et al.*, 2020). Moreover, as the economic situation deteriorates, abusers would be more likely to exert their power and aggression in the aftermath of a crisis and significant financial setbacks (Chbaro, 2020), further relating to mental health outcomes, especially PTSS.

4.1. Public health recommendations

Implementing adequate early surveillance programs is warranted to capture the burden of gender differences and domestic violence on mental health during this pandemic (Galea *et al.*, 2020). Enhanced surveillance would provide targeted support and help develop intervention strategies for the most vulnerable groups. This study holds particular importance as it is the first attempt to describe and analyze mental health-associated factors, specifically focusing on gender differences and domestic violence, in the absence of surveillance and evaluation of effective interventions to support people at risk during this pandemic (Chandan *et al.*, 2020). The lack of such evaluations underscores the urgency of our findings.

Moreover, this contextual human rights analysis took into account gender and violence as social and economic determinants of health. Acknowledging and addressing these factors could inform future studies and the development of interventions aimed at effectively managing mental health problems.

4.2. Limitations and strengths

Our study has some limitations. First, it relies on a single cross-sectional analysis of a small non-random sample, making it difficult to draw any conclusions about the combined effect of COVID-19 and the economic crisis without a baseline assessment of the situation before the pandemic. The response rate could not be calculated due to the snowball technique used to collect the data. Moreover, this sampling method resulted in a selection bias since most participants were university graduates (while the percentage of university graduates among Lebanese adults is around 19% (Central Administration of Statistics [CAS], 2021), with adequate computer literacy and internet access. The sample distribution might have resulted in an underestimation of the prevalence of economic hardship and domestic violence (Ackerson *et al.*, 2008). Hence, it might not be representative of the whole population. Nevertheless, appropriate adjustments were made in the multivariate analysis, taking into consideration several sociodemographic, economic, and COVID-19-related factors that can be potential confounders, including education level. Furthermore, the sample size had adequate power to assess correlations and potential confounding, although residual confounding might still be possible.

Finally, the information related to domestic violence was self-reported and might not be accurate or credible, especially among women who might fear to report any category of violence. The complexity of defining domestic violence and the diverse perceptions of what constitutes

violence among individuals is also acknowledged; thus, some victims may not consider abusive language or coercive sexual behavior as domestic violence. Furthermore, data about victims of violence or whether couples were included in the study are lacking. Another critical point that needs to be addressed is that people experiencing interpersonal violence might have monitored/restricted access to their communication devices and are thus less likely to report violence due to the fear of retribution. Other relevant data were also missing, such as smoking and alcohol consumption before or after COVID-19 and economic crises (duration and time since the first consumption, changes in habits, regularity, and quantities), and, therefore, were not included in the final multivariable analyses to avoid interpretation bias affecting violence. This study can be considered a pilot one and should be followed by other research that would elucidate violence in the Lebanese population using validated scales/measures.

Despite these limitations, our study remains one of the few that assessed the effects of COVID-19 and economy-related variables on the mental health of Lebanese adults, focusing on gender differences and domestic violence after adjusting over potential confounders. Additional studies, taking into account all the weaknesses, are suggested to confirm the current results.

5. Conclusion

Our pilot study found that mental health outcomes are not equally felt by women or those subject to domestic violence in the context of combined health and economic crises. Women exhibit higher levels of distress, anxiety, and PTSS than men, while violent homes harbor more distress and insomnia. However, our results should be interpreted cautiously and in light of the study limitations since our sample was not randomly selected or representative of the general population. Further robust studies using more representative larger samples would help better understand the long-term impact of the sanitary and economic crises, especially on PTSS and mental well-being. Public health strategies are warranted to address, prevent, and manage transient and persisting psychiatric disorders, with focused measures to support and protect the most vulnerable populations, including women and those at high risk of domestic violence.

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Conflict of interest

The authors have no conflicts of interest to declare.

Author contributions

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Ethics approval and consent to participate

The Institutional Review Board of the American University of Science and Technology approved this study protocol (AUST-IRB-20200527-01), as this work has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The topic was explained to all participants in the introductory section of the survey and consent to participate was implicit. The anonymity of participants was guaranteed throughout the process of data collection and analysis.

Consent for publication

The participants gave consent to publish their data.

Availability of data

The datasets used and/or analyzed during the present study are available from the Figshare repository: https://figshare.com/s/939d0fc0032c7af0b8c9

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Appendix

General Linear Model: MANCOVA details

Estimated Marginal Means

1. Domestic violence

Estimates					
Dependent variable	Domestic violence; no answer are counted yes	Mean	Std. Error	95% Confidence interval	
				Lower bound	Upper bound
BDS-22 scale	0.00	9.755[a]	2.508	4.808	14.702
	1.00	17.352[a]	4.377	8.719	25.985
LAS scale	0.00	11.611[a]	1.847	7.968	15.255
	1.00	16.446[a]	3.224	10.088	22.804
LIS scale	0.00	41.108[a]	2.433	36.308	45.907
	1.00	52.401[a]	4.246	44.026	60.776
PTSD scale	0.00	12.814[a]	3.104	6.691	18.937
	1.00	15.212[a]	5.417	4.528	25.896
WHO5 scale	0.00	16.368[a]	0.977	14.442	18.295
	1.00	13.698[a]	1.704	10.336	17.059

Notes: [a]Covariates appearing in the model are evaluated at the following values: APGAR scale=8.0140, Age=47.4720, IFD wellness scale=40.3318, Fear of COVID scale=10.7243.

Pairwise comparisons							
Dependent variable	(I) Domestic violence; No answer are counted yes	(J) Domestic violence; No answer are counted yes	Mean difference (I-J)	Std. Error	Sig.[b]	z% confidence interval for difference[b]	
						Lower bound	Upper bound
BDS-22 scale	0.00	1.00	−7.597*	3.702	0.041	−14.898	−0.297
	1.000	0.00	7.597*	3.702	0.041	0.297	14.898
LAS scale	0.00	1.00	−4.835	2.726	0.078	−10.212	0.542
	1.00	0.00	4.835	2.726	0.078	−0.542	10.212
LIS scale	0.00	1.00	−11.293*	3.591	0.002	−18.376	−4.210
	1.00	0.00	11.293*	3.591	0.002	4.210	18.376
PTSD scale	0.00	1.00	−2.398	4.581	0.601	−11.434	6.637
	1.00	0.00	2.398	4.581	0.601	−6.637	11.434
WHO5 scale	0.00	1.00	2.670	1.441	0.065	−0.172	5.513
	1.00	0.00	−2.670	1.441	0.065	−5.513	0.172

Notes: Based on estimated marginal means; *The mean difference is significant at the 0.05 level; [b]Adjustment for multiple comparisons: least significant difference (equivalent to no adjustments).

2. Sex

Estimates					
Dependent variable	Sex	Mean	Std. error	95% confidence interval	
				Lower bound	Upper bound
BDS22 scale	1	11.207[a]	3.049	5.193	17.220
	2	15.901[a]	3.266	9.460	22.341
LAS scale	1	12.722[a]	2.246	8.293	17.150
	2	15.336[a]	2.405	10.593	20.079
LIS scale	1	47.123[a]	2.958	41.289	52.957
	2	46.386[a]	3.168	40.138	52.634
PTSD scale	1	11.712[a]	3.773	4.270	19.154
	2	16.314[a]	4.041	8.344	24.285
WHO5 scale	1	15.134[a]	1.187	12.792	17.475
	2	14.932[a]	1.272	12.425	17.440

Notes: [a]Covariates appearing in the model are evaluated at the following values: APGAR scale=8.0140, Age=47.4720, IFD wellness scale=40.3318, Fear of COVID scale=10.7243.

Pairwise comparisons							
Dependent variable	(I) Sex	(J) Sex	Mean difference (I-J)	Std. error	Sig.[b]	95% confidence interval for difference[b]	
						Lower bound	Upper bound
BDS-22 scale	1	2	−4.694*	1.649	0.005	−7.946	−1.442
	2	1	4.694*	1.649	0.005	1.442	7.946
LAS scale	1	2	−2.614*	1.214	0.033	−5.009	−0.219
	2	1	2.614*	1.214	0.033	0.219	5.009
LIS scale	1	2	0.737	1.600	0.645	−2.418	3.892
	2	1	−0.737	1.600	0.645	−3.892	2.418
PTSD scale	1	2	−4.602*	2.041	0.025	−8.627	−0.578
	2	1	4.602*	2.041	0.025	0.578	8.627
WHO5 scale	1	2	0.202	0.642	0.754	−1.065	1.468
	2	1	−0.202	0.642	0.754	−1.468	1.065

Notes: Based on estimated marginal means; *The mean difference is significant at the 0.05 level; [b]Adjustment for multiple comparisons: least significant difference (equivalent to no adjustments).

ACCSCIENCE PUBLISHING

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COMMENTARY

COVID-19 and the precarious low-skilled workforce in the European Union: Time to call the shots?

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Abstract

This commentary highlights the critical role of low-skilled workers who are often considered unwanted populations within the European Union (EU) migration system that privileges high-skilled migrants, while neglecting the existence of low-skilled migrants, creating unfavorable job conditions for low-skilled migrants despite their considerable contributions to EU economies. Unfortunately, this wrenching problem became evident during the pandemic. While the COVID-19 pandemic has affected all segments of the population to varying degrees in the EU, the migrant populations were adversely affected in many aspects. Specifically, low-skilled migrants are the most vulnerable to the pandemic's secondary effects, due to multiple forms of vulnerability, risk, exploitation, and precarity shaped by their intersectional identities and membership in other marginalized groups. It has been argued that the roles of low-skilled migrants should be considered when appraising their impact and developing labor migration policies. This commentary concludes by proffering some recommendations for the EU governing entities in formulating schemes to ensure the inclusion of low-skilled migrant workforce into the public policy and labor migration system.

Keywords: COVID-19; Low-skilled workforce; Migration policy

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1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has tremendous, negative repercussion on the global scale, including loss of life (6,985,278 deaths and 772,052,752 confirmed cases as of November 30, 2023) (WHO, 2023), disruption of the global production chain supply, curtailed mobility, and a deepening economic crisis (Dotsey, 2023; Jones *et al.*, 2021). The adverse effect of the pandemic has also been extended to the global labor force, which has hardly recovered since the 2008 global economic downturn, and an ongoing pandemic coupled with a global economic crisis has significantly added to the challenges facing the current labor force. Workers in precarious employment, both in formal and informal positions, are among those most impacted by the pandemic's secondary effects (Matilla-Santander *et al.*, 2021). Within this framework, migrant workers are often the hardest hit during economic downturns, as they are likely the first to lose their jobs and are mostly excluded from social welfare systems (Jones *et al.*, 2021; WFP-IOM, 2020). Of course, some citizens or non-migrants may also be

bonded to precarious employment; however, migrants are disproportionately attached to low-paid, insecure jobs (Dotsey *et al.*, 2023; Moehring *et al.*, 2021). With an estimated 169 million migrant workers worldwide in 2019, constituting 4.9% of the global labor force in the receiving countries, international migrant workers remains an increasingly significant workforce in the global economy (ILO, 2021). Migrant workers fill essential labor shortages in several countries, committing difficult, precarious, and dangerous jobs. Their job nature, in general, makes the migrant populations more susceptible to injury and fatality than the native labor force, with the pandemic further increasing the risks. Many migrant workers are employed in key sectors, frequently in positions that make it difficult for them to work from home, and have a higher risk of contracting COVID-19 (MDP, 2022; OECD, 2022). The pandemic increased the work activity of the migrant workers without compensating them with appropriate remuneration, despite their already precarious, low-paid, low-quality, insecure, and irregular employment, which is not equipped with social welfare and labor protection (Jones *et al.*, 2021; Van Hooren, 2020). Thus, the COVID-19 pandemic has made migrants' already precarious conditions worse worldwide, particularly in regions where their labor rights are poorly established or non-existent (Jones *et al.*, 2021).

In the European Union (EU) labor market for 2022, 9.93 million non-EU citizens were employed, making up 5.1% of the total workforce aged 20 – 64 years in the EU regardless of migration status. Compared to EU citizens, non-EU citizens were over-represented in some specific economic sectors, particularly low-skilled sectors, including accommodation and food service activities, administrative and support service activities, domestic work, and constructions. Thus, many non-EU citizens can be deemed as *essential workers* (EC, n.d.). The significance of the non-EU workers to the economy became more evident during the COVID-19 pandemic, which accentuated the significant role played by migrant workers of all skill levels (Fernández-Reino *et al.*, 2020). Yet, research shows that workers in the low-skilled migrant workforce are among the worst-hit by the pandemic's secondary effects (see, *e.g.*, Moehring *et al.*, 2021; Ullah *et al.*, 2021). This commentary explores the secondary effects of COVID-19 on the low-skilled migrant workforce within the context of state-constructed precarity and vulnerability. Low-skilled migrant workers make up a significant portion of the frontline workforce and are essential to keeping many EU economies afloat. While the pandemic has affected the living conditions of all segments of the population, migrant populations are hit especially hard due to the multiple forms of vulnerability, risk, exploitation, and precarity shaped by their intersectional identities and membership in other marginalized groups (*i.e.*, migratory status, gender, and ethnicity) (Bonizzoni & Dotsey, 2021; Dotsey *et al.*, 2023). Without labor protections or regulations, and given the restricted access to public space and services, low-skilled migrants experienced further marginalization and exploitation.

This commentary proceeds as follows: Section 2 briefly analyses the international migration and (low-skilled) migrant labor force dynamics in Europe, while Section 3 explores the impacts of COVID-19 pandemic on the low-skilled migrant labor force. The commentary is concluded in Section 4, calling for the need to craft schemes to ensure the inclusion of low-skilled workforce into the public policy and labor migration system.

2. International migration and the (low-skilled) migrant labor force in the EU

Europe's labor market faces several challenges, which are driven by many interrelated factors, including an aging society, rapid technological change, increased demand for specific job categories, and uncertainty about the future growth of European economies across a range of sectors and occupations (EMN, 2019). These problems were aggravated by the COVID-19 pandemic.

Low-skilled and semi-skilled migrants constitute most of the total immigrant population, but a recent shift in Europe's labor migration policy has focused primarily on attracting more highly skilled migrants from outside the EU to augment competitiveness by increasing the talent pool (Dotsey, 2023; Platonova & Urso, 2012). The employment of foreign workers is mainly dependent on the employer-driven temporary or seasonal labor migration channels, if any. Where employment lists are used, restrictions are often applied to low-skilled occupations to prioritize the employment of the native population. In many EU countries, low-skilled immigrant workers primarily fill most short-term positions (Beirens *et al.*, 2019; Platonova & Urso, 2012). Low-skilled migrant workers have been an integral part of the EU and the U.S. economies, with recently emerging demands for low-skilled workers from the Middle East and East Asia. Southern Europe, in particular, draws more from low-skilled and unskilled migrant workers than high-skilled workers (Bertozzi, 2010; Platonova & Urso, 2012). Unlike high-skilled migration, low-skilled migration is often the subject of intense policy debates, with much of the public expressing resistance to these migrants and disregarding their positive contributions to society. The pandemic has, however, drawn attention to their important roles in essential sectors as frontline workers, including workers

in agriculture, clerks, delivery workers, and particularly healthcare workers (Dotsey *et al.*, 2023; Fernández-Reino *et al.*, 2020; Isaac & Elrick, 2021; Ruhs, 2020; van Hooren, 2020).

Presently, there are no universally accepted definitions for low-, semi-, and high-skilled migrants. Moreover, there are no sharp distinctions between these groups. Thus, classification reference is generally obtained from the International Standard Classification of Education and the International Standard Classification of Occupations (ISCO) (Beirens *et al.*, 2019). For occupations, low qualification refers to ISCO group 9 (elementary occupations), medium qualification includes ISCO groups 4 – 8, and high qualification includes ISCO groups 1 – 3 (ILOSTAT, 2023). Hierarchical immigrant sorting highlights the differences between wanted and unwanted migrants. For instance, those who are financially stable and skilled are considered good migrants, whereas unskilled or humanitarian migrants are portrayed as less so (Anderson, 2014). This feeds a system in which different categories of people are entitled with unequitable rights. A lack of equal rights makes migrants more likely to face exploitation and less likely to work with authorities in times of need. It is of utmost importance that the dichotomy between low- and high-skilled migration must be handled cautiously. In general, a migrant classification system based on their talents or skills has not been agreed upon among the EU Member States since their discussions are often replete with differing ideas as to what constitutes a skill. Focusing on formal qualifications often conceals the reality that skills and experience gained through on-the-job training are necessary for lower-skilled jobs; third-country nationals frequently possess skills that are difficult to evaluate through a certification process or are difficult for employers to acknowledge (Beirens *et al.*, 2019). In addition, labeling migrants taking part in seasonal programs, for instance, as low- or semi-skilled fails to recognize the possibility that many are actually highly educated and have solid work experience but are incorrectly categorized in the labor market. Within the current framework, high or low skills in migrant workers are often interpreted solely through the perspective of a country's labor-market demands (Dotsey *et al.*, 2023; Platonova & Urso, 2012).

3. Secondary effects of the COVID-19 pandemic on the low-skilled migrant workforce

The COVID-19 pandemic has taken a toll on many people's lives, with migrants being one of the marginal group's hardest-hit by the pandemic's secondary effects (for a general overview of this, see Ullah *et al.*, 2021). Fasani and Mazza (2020a; 2020b) divided key work categories into jobs either requiring low- or high-skilled qualifications following the COVID-19 outbreak; they found that non-EU workers most commonly served in the low-skilled category (Figure 1).

The proportion of migrant workers in high-skilled jobs was lower than that of native workers or the workforce from EU Member States. The non-EU workers were, and still are, assigned to more fragile job position, often given lower wages, and employed in jobs with fixed-term contracts and, above all, that are the least compatible with teleworking (Fasani & Mazza, 2020a). COVID-19-related border closures and travel restrictions had also exacerbated migrants' existing vulnerabilities. The pandemic compromised access to regular migratory routes to cross borders for work, with implications for larger networks of communities (Dotsey *et al.*, 2023; Jones *et al.*, 2021; van Hooren, F., 2020). Thus, the distribution of the pandemic's secondary effects was concentrated on groups with preexisting vulnerabilities who faced uncertain employment conditions and for whom pandemic restrictions had acute socio-economic consequences. While low-skilled migrants played a recognized role in keeping key sectors running during the pandemic, their placement in these sectors makes them unequally vulnerable to the adverse effects on their well-being and the job precarity, on top of the already low-paid and insecure work. The pandemic thus disproportionately hit low-skilled workers the hardest (Moehring *et al.*, 2021; OECD, 2022; Ullah *et al.*, 2021) and impacted those employed in more invisible forms of labor, particularly workers in agriculture, the informal sector, and the domestic sector (Dotsey *et al.*, 2023; UNODC, 2021). Compared to other sectors, these sectors were less regulated and rarely inspected before the pandemic, but the most recent global health crisis has exacerbated scanty regulations imposed in these areas.

The care sector in the EU largely depends on the intra-EU and non-EU labor force (Artero & Dotsey, 2020; Dotsey, 2021). Care workers have proven essential in containing the pandemic and are vital in caring for high-risk populations such as elderly, disabled, and sick individuals (Dotsey *et al.*, 2023). They were on the front lines during the pandemic, keeping themselves and their patients safe from COVID-19 infection. The lockdown and quarantine-related measures reduced contact with the outside world, limited mobility, and restricted access to socio-emotional support. There was a concurrent increase in the exploitation and abuse of, for example, domestic workers, who were likely to be trapped in their homes with their employers. Furthermore, the pandemic impacted the lives of care workers in institutions and homes in several ways, in both formal and

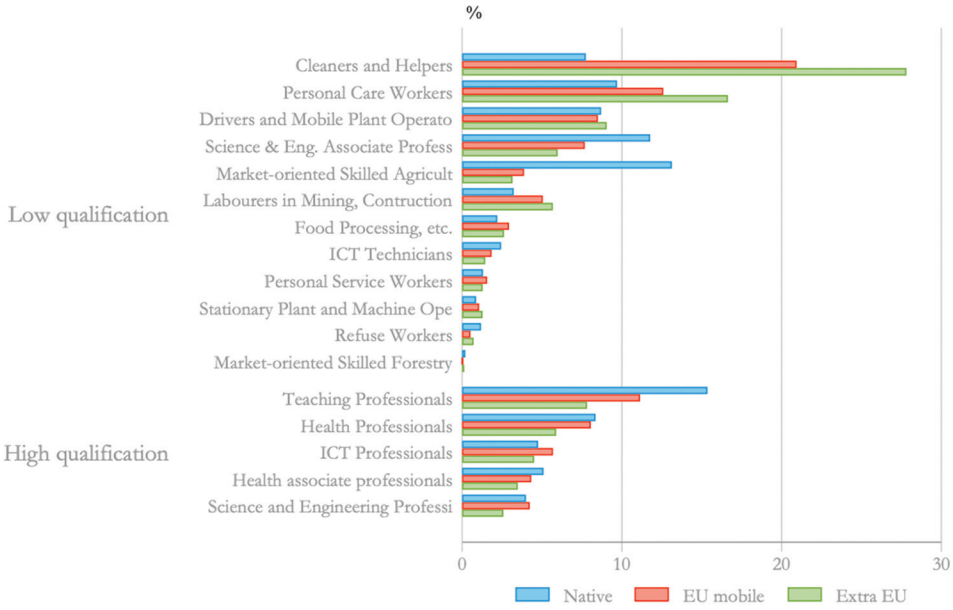

Figure 1. Proportions of natives, intra-EU mobile workers, and non-EU migrant workers in key occupations. Note: Occupations are defined following ISCO two-digit classification.
Source: Fasani & Mazza (2020a).

informal conditions (Foley & Piper, 2020; Dotsey, 2021; Giammarinaro & Palumbo, 2020; Sanfelici, 2021). At the other end of the spectrum, caregivers also experienced reduced working hours and wages, lost income, or faced increased risk of unemployment due to decreased economic activities (Foley & Piper, 2020; Sanfelici, 2021). Some live-in domestic care workers were laid off, thereby losing a place to stay (ILO, 2020). In addition, individuals employed in institutional settings, even those on stable contracts, experienced reduced working hours, layoffs, or the constant fear of losing their jobs due to the closure of their wards following COVID-19 deaths and/or a minimal admission of new patients (Dotsey *et al.*, 2023). Therefore, the pandemic has highlighted the vulnerabilities, unstable environments, and severe socioeconomic repercussions faced by the frail and high-risk populations. The decrease in purchasing power has put the already vulnerable groups who are more likely to work in informal sectors, including women, refugees, low-skilled workers, and irregular migrants, at increased risks of being exploited and abused.

4. Low-skilled workers, COVID-19, and labor migration: Time to call the shots?

The pandemic has highlighted the role of migrants, including low-skilled migrants, as frontline workers in key sectors in the EU (Isaac & Elrick, 2021). Recent research and policy papers show that the public has recognized the crucial role of migrants during the pandemic in keeping essential service sectors functioning (Fernández-Reino *et al.*, 2020; van Hooren, 2020). Notwithstanding low-skilled migrants' significant contributions to EU economies, they are often overlooked in migration discussions and policy initiatives. Migration policies in many EU countries have focused primarily on closing or fortifying internal and external borders and pushing back unwanted immigrants while attracting high-skilled migrants.

Low-skilled migration is an intensely contentious topic. The distribution of low-skilled migrants in key sectors exposed them disproportionately to precarious and vulnerable conditions. The pandemic further restricted labor mobility and migration, constraining further labor choices with implications for vulnerability to exploitation. While low-skilled migration in the care sector, for example, is essential to EU economies, the group of migrants working in this sector has remained outside EU policy initiatives related to labor migration management over the years (Triandafyllidou & Marchetti, 2014). The pandemic has reaffirmed the essential role of low-skilled migrants in EU economies, showing that these migrant groups cannot be excluded from public policy and debates. It is thus a clarion call to all EU Member States to individually and collectively craft policies to improve the inclusion of marginalized populations, particularly low-skilled migrants, in their public and immigration policies to create situations wherein all parties could benefit.

This commentary offers some practical policy recommendations for the inclusion of the low-skilled migrant workforce in the public and migration policies. In

principle, there is a need for coherent individual Member States and EU policy targeting the low-skilled workforce. Developing appropriate policy responses to low-skilled migration to Europe is apt and necessary, given that many such workers end up in irregular and precarious conditions in destination countries despite their significant contributions to society, as evident during the COVID-19 pandemic. Furthermore, there is a need to improve legal avenues for the low-skilled migrant labor force to work in the EU. Undoubtedly, the EU requires a migrant workforce to meet its labor demands in sectors that require low-, medium-, and high-skilled workers. Some EU countries, particularly those in Southern Europe, require more unskilled migrant workers than highly skilled ones. Well-managed labor migration can be one of the most effective ways to respond to skills shortages, combat over-aging, and govern the low-skilled recruitment process. Opening more legal labor migration routes and constantly monitoring the market conditions of host countries can help fill labor shortages in the EU and somewhat prevent people from employing the relatively risky migration channels. More importantly, EU Member States and regions across the globe must adopt and enforce policies to protect low-skilled labor rights and ensure safe working conditions. Low-skilled migrants must be guaranteed their full labor rights, even during crises like the COVID-19 pandemic. This is particularly important in regions such as the Gulf states and Asian countries that largely depend on a low-skilled migrant workforce but have less established regulations concerning human and labor rights.

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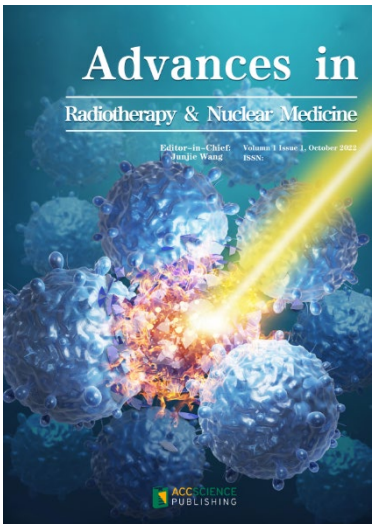

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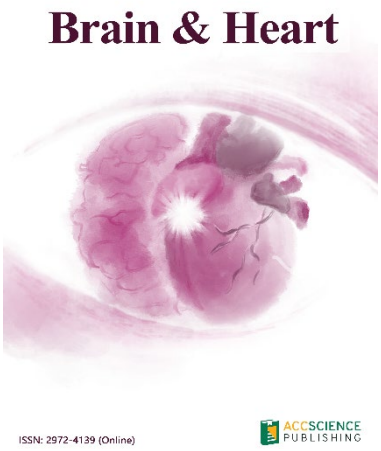

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