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RESEARCH ARTICLE

Educational differences and changing reproductive trajectories across three family generations of women in Peru

Robin Cavagnoud [1]

ABSTRACT This study examines how educational expansion shapes reproductive trajectories across three generations of Peruvian women. Using Peru's Demographic and Health Surveys (1986–2022) and biographical interviews with 66 women from 22 family triads, we integrate quantitative and qualitative approaches to reveal complex education-fertility relationships. Five key patterns emerge: educational expansion with fertility postponement, early fertility persisting despite educational gains, increased reproductive agency, evolving responses to reproductive vulnerability and changing life course sequences. While statistical analysis confirms the existence of educational gradients in fertility, biographical data show how structural constraints, cultural models and family dynamics mediate educational effects. The multigenerational *Ageven* matrix methodology visualises temporal dimensions that are invisible in aggregate statistics. The findings challenge assumptions about education-fertility relationships by showing how demographic transitions operate through family lineages in which educational gains coexist with persistent early childbearing patterns shaped by violence, economic precarity and constrained choices.

KEYWORDS Reproductive trajectories • Educational expansion • Intergenerational analysis • Biographical methods • Fertility transition • Peru

Introduction

Latin America's fertility transition has transformed reproductive patterns since the 1960s, with substantial declines in fertility rates (Casterline and Mendoza, 2009; Chackiel and Schkolnik, 1992; Guzmán, 1996). Peru exemplifies this transition, with total fertility rates in the country falling from approximately six children per woman in the 1960s to 2.2 by 2020 (Cavagnoud, 2024). While demographic research has extensively documented these aggregate trends, less attention has been paid to how reproductive trajectories – the timing, sequencing and pattern of reproductive events – have evolved across generations within families. Understanding these intergenerational patterns is crucial for explaining how macro-level demographic changes shape women's lived experiences. As Esteve et al. (2022) note, family structures in Latin America, which are characterised by strong kinship

✉ Robin Cavagnoud, rcavagnoud@pucp.pe
1 Pontificia Universidad Católica Del Perú, Lima, Peru

networks and early family formation, shape reproductive patterns differently there than in other regions.

Statistical analyses have identified education as a key driver of fertility decline across Latin America (Castro Martín and Juarez, 1995; Weinberger et al., 1989). However, the relationship between education and reproductive trajectories is more complex than is often assumed in quantitative studies. Despite educational expansion in countries like Peru, the expected linear relationship between increased education and delayed childbearing has not consistently materialised across generations in Peru, suggesting that there are generational differences in how education shapes reproductive behaviour (Esteve and Florez-Paredes, 2018). The impact of education has been uneven across social groups, with persistent inequalities limiting its transformative potential among the most vulnerable populations (Rodríguez Vignoli and Cavenaghi, 2014). This indicates that the relationship between educational trajectories and reproductive patterns is mediated by complex interrelationships – including between social inequality, cultural norms and structural constraints – that statistical analysis alone cannot fully capture.

Family generations provide a powerful lens for examining reproductive change. As each new generation experiences different educational opportunities, economic contexts and social norms, the reproductive trajectories of that generation reflect both continuities and transformations in relation to previous generations. The experiences of grandmothers, mothers and daughters within the same families reveal not just statistical changes in educational attainment and fertility rates, but transformations in women's reproductive lives, from the timing of first births to contraceptive practices, and from reproductive agency to responses to reproductive challenges.

Biographical approaches can be particularly valuable for investigating these generational contrasts in reproductive trajectories. This methodological integration connects macrosocial trends with microsocial dynamics at the family and individual levels, shedding light on how demographic changes materialise in women's lives. The biographical lens illuminates dimensions of reproductive change that are often invisible in aggregate statistics, including the meanings women attribute to reproductive events, the complex decision-making processes surrounding childbearing and the interconnections between reproduction and other life domains such as education and work.

Building on pioneering work in demographic research that combined statistical and qualitative approaches (Caldwell, 1982; Greenhalgh, 1995; Knodel, 1974), we employ multigenerational biographical data to examine how reproductive trajectories change across generations in relation to educational attainment. The *Ageven* matrix methodology, initially developed by Antoine et al. (1987) and Vivier (2006), and recently enriched by Cavagnoud et al. (2019), offers a powerful tool for visualising multiple temporal dimensions and the interrelationships between different life domains that shape reproductive trajectories.

This paper examines how reproductive trajectories have changed across three generations of Peruvian families in relation to educational attainment. We address several interrelated questions: What patterns characterise reproductive trajectories across three family generations? What mechanisms link educational to reproductive outcomes across generations? How do family contexts influence reproductive patterns among women from different generations? We begin with cohort analysis using Peru's Demographic and

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Health Surveys (1986–2022), which reveals persistent educational gradients in fertility levels and timing. We then analyse multigenerational biographical data from 22 family triads to illuminate aspects of reproductive change obscured in statistical analyses: the lived experiences of educational and reproductive decisions, the complex mechanisms by which education shapes reproduction and the intergenerational transmission and transformation of reproductive patterns.

Theoretical framework and literature review

Conceptualising reproductive trajectories

The concept of reproductive trajectories provides a dynamic framework for understanding how childbearing experiences unfold over the life course. Unlike point-in-time fertility measures, reproductive trajectories encompass timing (when births occur), spacing (intervals between births) and quantum (total number of children) (Johnson-Hanks, 2015). This multidimensional approach recognises that fertility is a process rather than merely an outcome.

From a life course perspective, reproductive trajectories represent sequences of transitions that interact with other life domains such as education, employment and partnership formation (Mayer, 2009). The intergenerational dimension adds further complexity, as parents transmit reproductive values through socialisation, while each generation reinterprets reproductive norms in light of changing social conditions (Bernardi, 2016; Bernardi and Klärner, 2014).

Educational expansion and reproductive change

Education has emerged as one of the most consistent predictors of fertility patterns worldwide, with educational expansion frequently accompanying fertility decline (Bongaarts, 2003; Cleland, 2002; Lutz, 2013). Bongaarts et al. (2017) demonstrated that education's role in delaying reproductive transitions has intensified in developing countries, with educational differentials in age at first birth becoming more pronounced over time. Several theoretical mechanisms explain this relationship. First, education affects the opportunity costs of childbearing by increasing potential earnings and career possibilities. Second, education exposes women to new knowledge, values and social networks that may alter their fertility preferences and increase their autonomy in reproductive decision-making (Caldwell, 1982; Jejeebhoy and Sathar, 2024). Third, extended educational participation structurally delays family formation by keeping young women in institutional settings incompatible with childbearing roles (Blossfeld and Huinink, 1991).

Comparative evidence reveals consistent but contextually variable patterns, with higher education correlating with later first births and longer birth intervals, although the magnitude of these effects varies by context (Mills et al., 2011; Timæus and Moultrie, 2020). The relationship between education and reproduction is bidirectional. While educational attainment influences subsequent fertility, unplanned pregnancies and early childbearing can

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interrupt educational trajectories (Stange, 2011). This recursive relationship creates the potential for intergenerational cycles, whereby the mother's curtailed education due to early childbearing affects her daughter's educational opportunities and reproductive patterns (Kahn and Anderson, 1992).

Reproductive change in Latin America

Latin America's fertility transition exhibits distinctive features, with fertility in the region declining rapidly starting in the 1960s, even though Latin America was less economically developed than Europe was during its fertility transition (Chackiel and Schkolnik, 2004). Educational differentials have been particularly pronounced in Latin American fertility patterns. In the early stages of the transition, women with secondary or higher education led the fertility decline, with differences of 3–4 children between the educational extremes (Castro Martín and Juarez, 1995). While these differentials have narrowed, education remains a powerful predictor of fertility outcomes throughout the region (Lima et al., 2018).

Despite educational expansion, the region has not experienced the marked postponement of first births observed in Europe and East Asia (Esteve and Florez-Paredes, 2018; Rosero-Bixby et al., 2009). Even among highly educated women, childbearing often begins in the early to mid-twenties in Latin America, rather than in the late twenties or thirties, as is the case in other regions with similar educational profiles (Fussell and Palloni, 2004). This "Latin American paradox" has prompted examination of how contextual factors mediate the relationship between education and reproductive timing (Castro Martín and Juarez, 1995).

Peru's fertility transition reflects these regional patterns while exhibiting distinctive national features. The transition began in the 1970s, accelerated in the 1980s and 1990s and has continued at a slower pace in recent decades (Cavagnoud, 2024). Recent work by Batyra (2020) has documented increasing educational disparities in the timing of motherhood in the Andean region, finding that educational gradients in fertility timing have actually widened in recent cohorts, despite an overall fertility decline. However, in Peru specifically, educational differentials in both the quantum and timing of births have been substantial, though there are signs that these differences have narrowed in recent cohorts (Cavagnoud and Castro Martín, 2025).

Intergenerational approaches to reproductive change

Intergenerational perspectives are particularly valuable for understanding reproductive change, illuminating how demographic transitions unfold through family lineages, rather than merely across cohorts. These approaches recognise that reproductive attitudes and behaviours develop within family contexts, with parents serving as critical socialising agents (Axinn et al., 1994; Bernardi, 2016).

Previous research has identified correlations between mothers' and daughters' fertility across diverse contexts (Murphy and Wang, 2001; Pullum and Wolf, 1991). This

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intergenerational transmission operates through multiple pathways: genetic influences, socialisation processes, role modelling and shared socioeconomic conditions (Bernardi and Klärner, 2014). Studies have also identified intergenerational patterns in reproductive timing, with the mother's age at first birth predicting the daughter's timing (Barber, 2001; Steenhof and Liefbroer, 2008).

Despite these contributions, significant gaps remain. Most research has focused on parent-child dyads, rather than examining multiple generations (Anderton et al., 1987). Additionally, quantitative studies often reduce reproduction to simple outcomes, rather than considering reproductive trajectories as complex processes (Fasang and Raab, 2014). Three-generation studies are particularly promising for addressing these gaps, as they can examine gradual evolutions and dramatic transformations across extended family lineages (Bengtson, 2001; Mare, 2011).

Biographical approaches in demographic research

While statistical analyses have advanced our understanding of fertility patterns, their ability to explain reproductive change is limited. Aggregate measures capture broad trends, but obscure the diverse pathways through which women navigate reproductive decisions (Johnson-Hanks, 2015). Statistical approaches also struggle to access the meanings individuals attribute to reproductive events and the complex interplay between reproduction and other life domains (Randall and Koppenhaver, 2004).

Biographical methods address these limitations by examining reproduction as experienced and interpreted by individuals within specific life contexts. These approaches capture the processual nature of reproduction, disclose interconnections between life domains and access subjective meanings that influence reproductive behaviour (Johnson-Hanks, 2007). The *Ageven* matrix technique represents a particularly powerful biographical tool for studying reproductive trajectories. This approach creates visual representations of individual life courses, plotting key events across multiple domains against both chronological time and age (Antoine et al., 1987; Vivier, 2006). The resulting matrices facilitate the identification of coinciding transitions, turning points and patterns across different life spheres (Cavagnoud et al., 2019).

The methodological innovation of three-generation biographical analysis extends these contributions by capturing reproductive change across extended time periods, revealing both intergenerational continuities and contrasts, and illuminating how changing structural conditions interact with family contexts to reshape reproductive possibilities across generations.

Educational differences in Peru's fertility transition: Quantitative evidence

Peru has experienced a remarkable fertility transition over the past seven decades, with the total fertility rate (TFR) declining from approximately seven children per woman in

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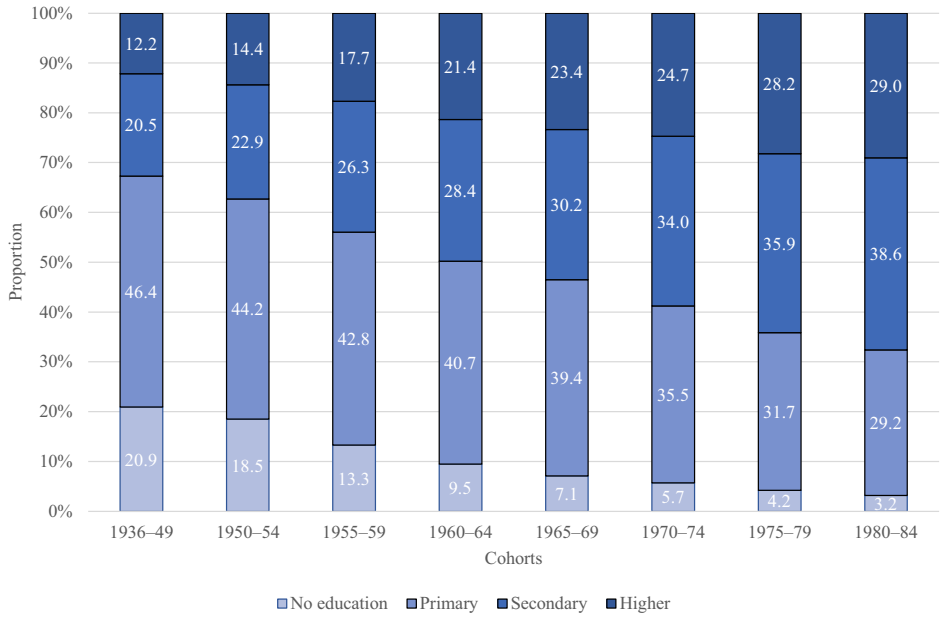
Figure 1 Educational levels in the cohorts of Peruvian women born between 1936–49 and 1980–84 (n = 116,298)



Source: Demographic and Family Health Surveys (ENDES), Peru, 1986 to 2022

the 1950s to 2.3 in recent years (Cavagnoud, 2024). Educational expansion stands out as a particularly influential factor in reshaping women's reproductive patterns. Our cohort analysis shows dramatic changes in women's educational attainment across successive birth cohorts (Figure 1). Among women born in 1936–1949, nearly half (46.4%) had only primary education and 20.9% had no formal education, while just 12.2% had achieved higher education. For women born in 1980–1984, this profile transformed dramatically: only 3.2% had no education, 29.0% had completed higher education and the proportion with secondary education more than doubled from 20.5% to 38.6%.

Despite this expansion, educational opportunities have remained unequally distributed. Significant urban-rural disparities persist, with rural and indigenous populations experiencing slower educational gains. Socioeconomic status continues to strongly influence educational trajectories, with women from lower-income families facing greater barriers to educational advancement (Benavides, 2007). Language barriers have also shaped educational inequalities, with Spanish-speaking populations achieving higher educational levels than those with indigenous language backgrounds (Ames, 2012). Even among the youngest cohorts (1980–1984), educational attainment remains heterogeneous, demonstrating that generational change does not lead to uniform educational profiles. This diversity in educational outcomes within cohorts is crucial for understanding the varied reproductive trajectories within each generation.

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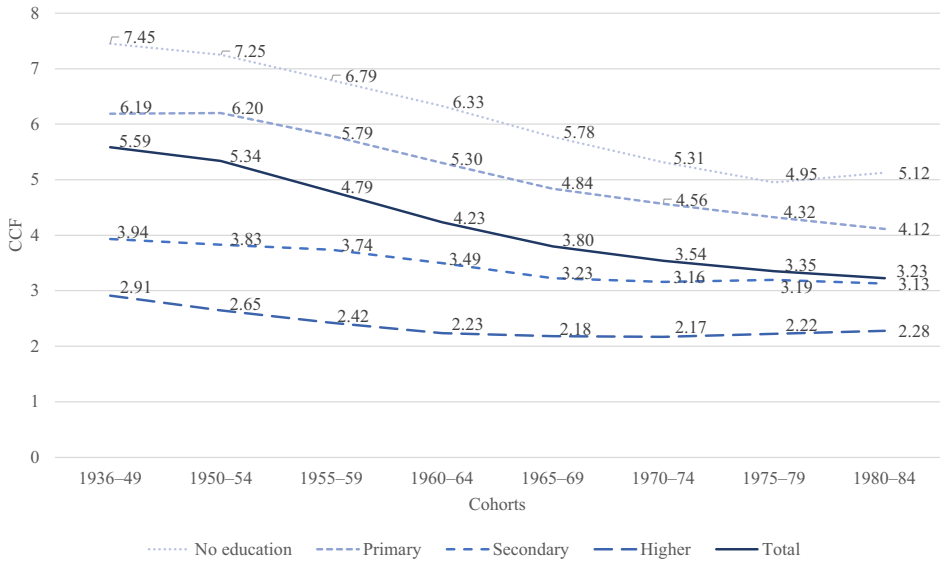
Figure 2 Completed cohort fertility (CCF) of Peruvian women born between 1936–49 and 1980–84 according to educational level (n = 116,298)



Source: Demographic and Family Health Surveys (ENDES), Peru, 1986 to 2022

Our data confirm that there are persistent educational gradients in fertility levels despite the overall fertility decline (Figure 2). Women with higher education have lower fertility than women with primary or no education across all cohorts. In the earliest cohorts (1936–1949), women with no education had on average 3–4 more children than those with higher education. This gap has narrowed somewhat for recent cohorts, but remains substantial at approximately two children. Women with higher education in the earliest cohorts already had relatively low fertility (approximately 2–3 children), while their less educated contemporaries had significantly higher fertility (5–7 children).

These educational differentials appear across both urban and rural contexts, indicating that education influences reproductive outcomes even when controlling for other socio-demographic factors. The persistence of educational gradients despite the fertility decline across all groups suggests that education creates durable differences in reproductive preferences, opportunities and constraints that transcend broader societal changes (Aramburú, 2014).

Our analysis also reveals educational differentials in the timing of demographic events (Figure 3). Women with higher education experience sexual initiation, union formation and childbearing later than those with less education. The average age at first birth among women with higher education is approximately 5–7 years later than that among women with no education across all cohorts. While women with no education born in 1936–1949 had their first child at an average age of 20.9 years, their counterparts with higher education postponed this event until approximately 28 years of age.

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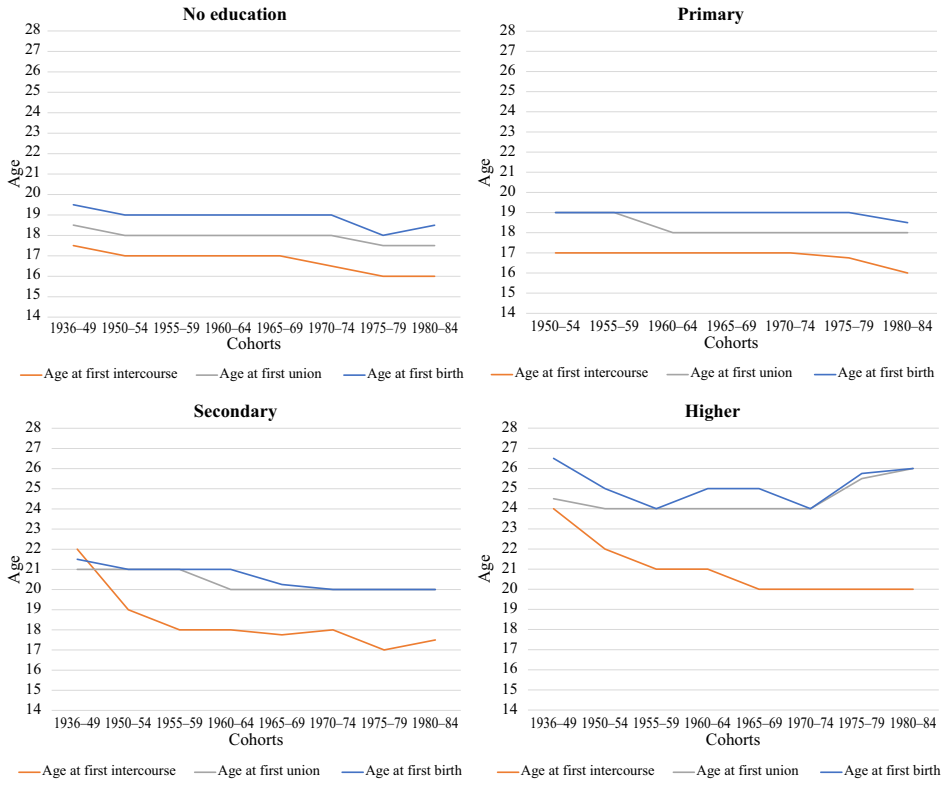
Figure 3 Median ages at first sexual intercourse, first union and birth of the first child in the cohorts of Peruvian women born between 1936–49 and 1980–84 by educational level (n = 116,298)



Source: Demographic and Family Health Surveys (ENDES), Peru, 1986 to 2022

Moderate educational differences are observed for age at first intercourse, with women with higher education initiating sexual activity 2–3 years later than women with no education. Educational differences in age at first union are more pronounced, with highly educated women entering marriage or cohabitation approximately 4–6 years later than women with no education. Our cohort data demonstrate that educational expansion has been accompanied by changing patterns in the timing of key demographic events, creating distinctly different reproductive calendars for women with different educational trajectories.

While our cohort analysis establishes clear educational differences in fertility levels and timing, key questions emerge that quantitative data alone cannot fully answer. Why do educational differentials persist despite expanded contraceptive access? Why has educational expansion not always resulted in delayed childbearing? And, what explains variations within educational categories? While statistical data document these patterns, they cannot access the meanings, motivations and decision-making processes underlying them. Understanding how education influences fertility requires an examination of how educational

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trajectories interact with other life domains at the individual level, and of how these patterns differ across generations.

Data and methods

This study employs a biographical approach to illuminate the mechanisms underlying educational differences in fertility across three generations of Peruvian women. Biographical methods are applied to show how childbearing decisions are embedded within webs of circumstances, constraints and opportunities that statistical analyses alone cannot capture. By examining women's narratives, we access the meanings they attribute to reproductive events and their decision-making processes surrounding fertility, as well as how reproductive events interact with other life domains (Bernardi et al., 2019; Johnson-Hanks, 2015). This approach helps us to understand not just what reproductive patterns have changed across generations, but why and how these changes have occurred.

Biographical methods are uniquely well-suited to capture intergenerational patterns in reproductive behaviour. By collecting life histories from multiple generations within the same families, we can observe both continuities and transformations in reproductive trajectories, identifying how patterns are transmitted, adapted or rejected across generations (Bernardi, 2016). This intergenerational lens reveals how changing educational contexts create different possibilities for each generation, reshaping reproductive options and constraints.

The Ageven matrix methodology

At the core of our methodological approach is the *Ageven* matrix technique, initially developed by Antoine et al. (1987) and subsequently refined by Vivier (2006). As demonstrated by Courgeau and Lelièvre (1993), biographical approaches allow researchers to address different temporal scales simultaneously, including the historical time of major social changes, the family time of generations and the individual time of personal biographies. This multi-temporal perspective is particularly valuable for understanding how reproductive trajectories emerge within specific conjunctures of personal biography, family dynamics and societal change.

The *Ageven* methodology operationalises this multi-temporal approach by creating visual representations of individual life courses, simultaneously capturing chronological time (years) and biographical time (age) to map key life events across multiple domains. For this study, we implemented a methodological innovation built on Cavagnoud et al. (2019) by integrating three individual matrices with family and contextual levels into a multigenerational *Ageven* matrix (Figure 4). This tool organises life events across domains – education, employment, residence, partnership, reproduction – in a temporal grid, allowing for the identification of patterns and coinciding transitions.

Our multigenerational adaptation extends this approach by integrating matrices for three generations of women within the same family. This innovation allows for the visualisation

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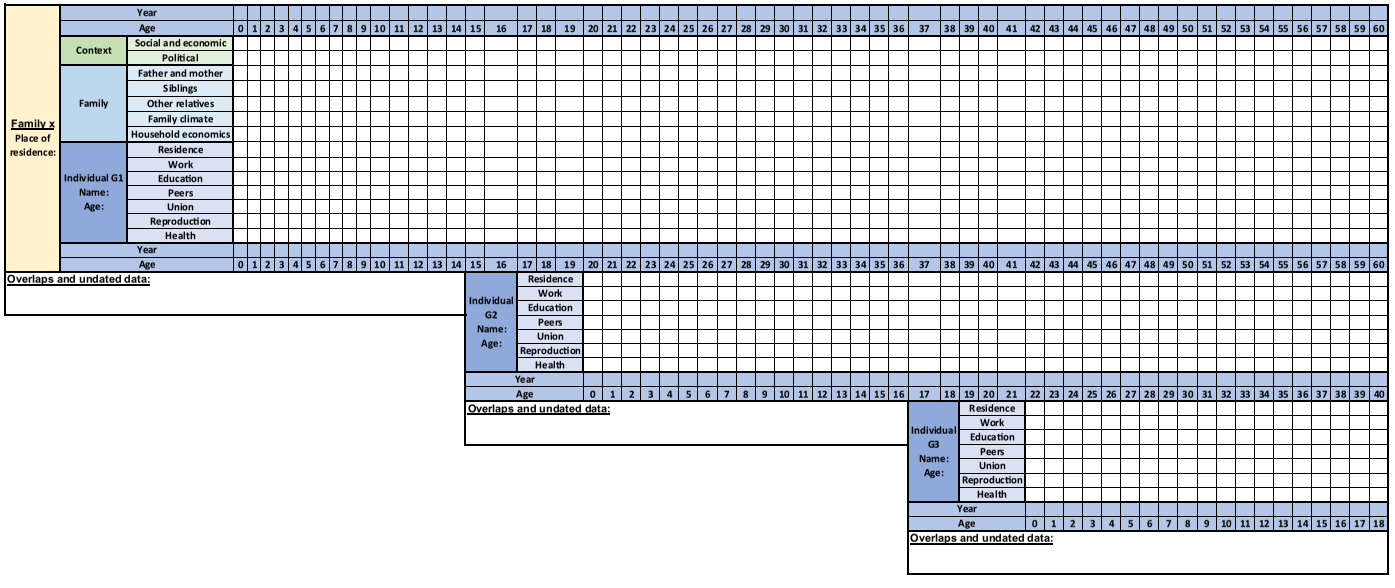
Figure 4 Multigenerational Ageven matrix: Synchronising life trajectories across three generations of women



Source: Author's elaboration based on Ageven biographical matrices, 2022

of how reproductive and educational patterns change across generations while maintaining synchronised historical time, which enables us to identify both family-specific patterns and responses to broader social changes affecting all families. The integrated matrix includes three individual-level sections (one for each generation), a family-level section capturing events affecting multiple family members and a contextual section recording historical events relevant to understanding reproductive trajectories.

This methodological approach offers several advantages for analysing reproductive trajectories across generations. First, it provides a visual tool for identifying timing patterns and sequences across different life domains, revealing how educational participation shapes the timing of reproductive events. Second, it facilitates the comparison of reproductive trajectories across generations within the same family, highlighting both continuities and transformations. Third, it situates individual reproductive decisions within both family contexts and broader historical circumstances, connecting micro and macro levels of analysis.

Data collection

Our data collection involved in-depth biographical interviews with women from 22 family triads (66 women in total) conducted between June and October 2022. These semi-structured interviews followed a comprehensive guide covering multiple life domains, with particular attention being paid to educational trajectories, employment histories, partnership formations and reproductive experiences. For each domain, we collected detailed chronological information about key events, transitions and turning points, while also exploring subjective dimensions, including motivations, constraints and meanings attributed to different life events.

Each interview began with open-ended questions inviting the participant to narrate her life story, followed by more structured questions to ensure comprehensive coverage of all life domains. Special attention was given to reproductive histories, including the timing of sexual initiation, contraceptive use, pregnancies (including those not carried to term), births and reproductive health challenges. We also explored how the women's reproductive decisions were related to their educational experiences, asking them to reflect on how their schooling influenced their childbearing decisions and vice versa.

Participant identification and selection occurred through personal networks and professional contacts in the three study regions. We identified cases of families with three female generations available for interviews, ensuring that all participants were above 18 years of age and willing to discuss their reproductive histories. A formal consent protocol was applied for each interview that explained the research objectives, data use procedures and participant rights, including confidentiality rights and the option to withdraw. Given the sensitive nature of reproductive histories, interviewers were trained to respond appropriately to emotional reactions and to respect participants' boundaries regarding topics they preferred not to discuss in detail.

The interviews were recorded, transcribed and complemented with field notes. The interviewers completed a template after each interview, recording key dates and events to ensure chronological accuracy before constructing the *Ageven* matrices.

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Table 1. Distribution of women by birth cohort across generations

Birth cohort	G1 (Oldest)	G2 (Middle)	G3 (Youngest)	Total
< 1935	3	0	0	3
1935–1939	5	0	0	5
1940–1944	4	0	0	4
1945–1949	5	0	0	5
1950–1954	3	3	0	6
1955–1959	2	4	0	6
1960–1964	0	2	0	2
1965–1969	0	10	0	10
1970–1974	0	3	0	3
1975–1979	0	0	4	4
1980–1984	0	0	2	2
1985–1989	0	0	3	3
1990–1994	0	0	4	4
1995–1999	0	0	8	8
> 2000	0	0	1	1
Total	22	22	22	66

Source: Author's calculations from multigenerational Ageven matrix data, 2022

Sample description

Our sample consists of 22 family triads (66 women in total) from three regions of Peru: Lima (metropolitan capital, 12 families), San Martín (northern jungle, six families) and Puno (southern highlands, four families). This geographical distribution provides diversity in terms of socioeconomic and cultural contexts, though we recognise that our sample size limits generalisable claims about regional differences.

These family triads include three generations: the oldest generation (G1, born 1933–1961, aged 62–89 at interview), the middle generation (G2, born 1954–1979, aged 43–67), and the youngest generation (G3, born 1979–2002, aged 19–43). The distribution of women by birth cohorts across generations is presented in Table 1, and shows how our biographical sample spans the fertility transition in Peru.

This generational span captures women's reproductive experiences across Peru's fertility transition, from the beginning of this process (G1) through the mid-point of the transition (G2) to the contemporary low-fertility context (G3). Importantly, these women share kinship ties: G1 women are the mothers of G2 and the grandmothers of G3; G2 women are the daughters of G1 and the mothers of G3; and G3 women are the granddaughters of G1 and the daughters of G2.

Table 2 provides the characteristics of our sample by generation, indicating both the dramatic educational expansion and the heterogeneity within each generation that shape reproductive trajectories.

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Table 2. Sample characteristics by generation

Characteristic	G1 (n = 22)	G2 (n = 22)	G3 (n = 22)
Age at interview			
Mean (range)	77.5 (62–89)	53 (39–67)	25.9 (19–42)
Educational level			
Primary incomplete	12 (54.5%)	0 (0%)	0 (0%)
Primary complete	3 (13.6%)	0 (0%)	0 (0%)
Secondary incomplete	3 (13.6%)	1 (4.5%)	0 (0%)
Secondary complete	2 (9.1%)	1 (4.5%)	0 (0%)
Technical education	1 (4.5%)	11 (50%)	3 (13.6%)
University (complete/incomplete)	1 (4.5%)	9 (40.9%)	19 (86.4%)
University complete			
Reproductive characteristics			
Women with children	22 (100%)	22 (100%)	4 (18.2%)
Mean number of children (range)	4.7 (3–10)	2.3 (0–5)	0.3 (0–3)
Mean age at first intercourse	19.1	20.9	17.8[a]
Mean age at first union	19.3	22	19.3[b]
Mean age at first birth (range)	21.1 (16–30)	24.2 (16–37)	24.5[c] (21–30)

[a]Among women who have had a first intercourse (n = 19)
[b]Among women who have formed unions (n = 11)
[c]Among women who have had children (n = 4)
Source: Author's calculations from multigenerational Ageven matrix data, 2022

Reproductive patterns also show substantial generational differences. G1 women had between 2–10 children (average 4.5), with the first birth occurring between ages 16–23. G2 women had between 1–5 children (average 2.3), with the first birth occurring between ages 22–30. Most G3 women (18 out of 22) had not yet had children at the time of interview, with only four having 1–3 children. An important limitation is that most G3 women were under age 30 at interview, and thus their reproductive trajectories were still unfolding. Consequently, our analysis of G3 women focuses on their stated intentions, their early patterns and the minority who had started having children, rather than on their completed fertility. This limits our ability to draw definitive conclusions about the ultimate reproductive patterns and life course sequencing of G3 women.

Analytical strategy

Our analytical strategy focuses on identifying patterns of change and continuity in reproductive trajectories across generations within families. We examine how educational trajectories differ between G1, G2 and G3 women, and how these differences relate to contrasting patterns in reproductive timing, spacing and quantum. This approach allows

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us to observe how educational expansion has manifested in changing reproductive patterns at the family level, and how individual women's reproductive trajectories have been shaped by both family contexts and broader social transformations.

We integrate quantitative and biographical data through several complementary analytical steps. First, we use the statistical patterns identified in the previous section to establish the broader context of educational differences in fertility. Second, we analyse the *Ageven* matrices to identify typical patterns of educational and reproductive trajectories within each generation. Third, we examine the qualitative interview data to understand the meanings, motivations and constraints that women associate with their educational and reproductive experiences. Finally, we compare patterns across generations within families to identify both common themes and key contrasts.

This integrated approach allows us to move beyond documenting educational differences in fertility to explain how and why these differences emerge in women's lived experiences. By analysing the interrelationships between educational trajectories and reproductive patterns across generations, we provide insights into the mechanisms that quantitative cohort analysis alone cannot reveal.

Educational trajectories and their evolution across generations

Overall patterns of educational change

The biographical matrices disclose dramatic transformations in educational trajectories across three generations. G1 women (born 1933–1961) predominantly experienced limited educational opportunities, with most receiving only primary education or incomplete secondary schooling. However, heterogeneity exists within this generation: while 54.5% of these women had only primary education or less, 27.3% had secondary education and 9.1% accessed technical or university training. This variation within G1 challenges any assumption of homogeneous educational profiles, and highlights the existence of early pioneers of educational advancement whose trajectories differed markedly from those of their generational peers. However, the educational trajectories of most of these women were brief, often terminating by age 12–14, and rarely including post-secondary training. For instance, Laurentina (born 1934, Family 3) abandoned education at age 12 while in the fifth grade of primary school following the deaths of her grandmother and brother, who had been her caregivers. Despite valuing education, Laurentina's family circumstances and structural barriers made it impossible for her to continue.

G2 women (born 1954–1979) experienced expanded educational opportunities compared to their mothers. Many completed secondary education and continued to technical or university training, though their educational trajectories often included interruptions and delays. For example, Cecilia (born 1963, Family 17) reported that she completed university education at age 26 despite facing economic challenges, emphasising that she sees education as "a fundamental pillar" for advancement.

G3 women (born 1979–2002) had the most extensive educational trajectories, characterised by greater continuity, standardisation and extended duration, continuing into their

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mid-twenties. Clara (born 1987, Family 17) pursued university education without the interruptions common in previous generations, completing her law degree and additional specialised diplomas.

Educational aspirations and expectations have evolved dramatically across generations. While G1 women rarely articulated specific educational goals beyond achieving basic literacy, G2 women frequently expressed clear educational aspirations for both themselves and their daughters. By G3, educational ambitions have expanded significantly, with many young women envisioning having not only an undergraduate degree, but also postgraduate education and professional specialisation. As shown in Table 2, these patterns of educational change reveal both clear generational progression and important within-generation variation that shapes reproductive trajectories in complex ways.

Educational discontinuities and disruptions

Despite the overall trend towards educational expansion, educational discontinuities and disruptions remain important features across generations, though their patterns, causes and consequences have evolved. For G1 women, school abandonment was extremely common and permanent. The primary reasons included economic necessity, family demands for domestic labour and geographic barriers to educational access. Yolanda (G1, Family 10) left school at age eight due to economic necessity, later migrating to Lima at 19 to work as a live-in domestic worker, while Magdalena (G1, Family 15) left education at age 15 to assume domestic responsibilities.

G2 women experienced educational disruptions with different patterns and motivations. While some faced economic constraints similar to those reported by their mothers, many encountered disruptions related to their own reproductive lives. Several G2 women temporarily suspended their education during pregnancy or early motherhood, though some eventually returned to complete their studies. These educational pauses created sequences of interwoven educational and reproductive events.

For G3 women, educational disruptions have become less common and less directly linked to reproduction. When they occur, they involve temporary pauses stemming from financial constraints, health issues or career reconsiderations, rather than from family formation.

The relationship between educational disruptions and reproductive outcomes shows generational variation. For G1 women, educational abandonment preceded early union formation and childbearing. For G2 women, the relationship became more bidirectional: early pregnancy sometimes caused educational disruption, but educational interruptions could also increase vulnerability to unplanned pregnancy. By G3, this relationship has weakened considerably, as there are no cases in which reproductive events have caused the women of this generation to leave education.

Educational expansion and life course opportunities

The expansion of educational trajectories across generations has transformed women's life course opportunities, creating conditions for reproductive change. Extended educational

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participation directly postpones family formation through both institutional constraints and shifting aspirations. As educational trajectories have lengthened from G1 to G3, they have increasingly competed with early reproduction for women's time and resources.

This competition appears clearly in the contrasting life sequences across generations. G1 women followed compressed sequences in which a brief period of education was quickly followed by union formation and childbearing, with the first birth often occurring by age 18–20. G2 women more often separated educational completion from family formation, with their expanded educational trajectories creating temporal gaps before childbearing. G3 women plan for an even more extended separation, with their educational pathways often continuing into their late twenties.

The linkages between educational advancement and reproductive decision-making have strengthened across generations. For G1 women, their limited education restricted their access to reproductive information, services and decision-making power. By G2, women's increased education had expanded their reproductive knowledge and options, though many still negotiated constraints. For G3, having advanced education not only provides them with comprehensive reproductive information, but also fosters the decision-making skills, planning capabilities and future orientation that reshape reproductive approaches. The reproductive narratives of highly educated G3 women reveal strategic planning regarding reproductive timing, with education functioning as both the precondition and the means for achieving reproductive autonomy.

Reproductive trajectories: Patterns of generational contrast

The *Ageven* matrices expose striking patterns of continuity and change in women's reproductive trajectories across three generations in Peru. We identify five interrelated patterns that characterise generational contrasts in reproductive experiences. Table 3 shows the distribution of women across these patterns, recognising that some women's trajectories reflect multiple patterns. As noted in the Methods section, G3 trajectories remain largely incomplete, limiting interpretation of the completed patterns of these women.

Table 3. Distribution of women across identified patterns

Pattern	G1 ($n = 22$)	G2 ($n = 22$)	G3 ($n = 22$)	Total
Pattern 1: Educational expansion and fertility postponement	5	14	18	37
Pattern 2: Persistent early fertility despite educational gains	12	6	2	20
Pattern 3: Increased reproductive agency	8	18	20	46
Pattern 4: Evolving responses to reproductive vulnerability	15	12	8	35
Pattern 5: Changing normative life course sequences	10	16	19	45

Note: Women may be classified as following multiple patterns, as these are not mutually exclusive categories, but rather different dimensions of reproductive change
Source: Author's calculations from multigenerational Ageven matrix data, 2022

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Table 4. Educational expansion and fertility postponement across three generations

Generation	Predominant educational level	Median age at first birth	Average completed family size	Representative family example
G1 (1933–1961)	Primary or incomplete secondary	20	4–8 children	Family 2 (Lima): Juana – incomplete primary, first birth at 23, 4 children
G2 (1954–1979)	Complete secondary, many with technical or university	24	1–3 children	Family 2 (Lima): Rufina – university complete, first birth at 28, 2 children
G3 (1987–2002)	Nearly all pursuing or completed university	Many still childless at 25+	Too early to determine	Family 2 (Lima): Ingrid – university complete, age 25, childless, using contraceptives since age 19

Source: Author's synthesis from multigenerational Ageven matrix data, 2022

Pattern 1: Educational expansion and fertility postponement

Educational expansion from G1 to G3 is associated with fertility postponement. Table 4 illustrates this pattern across the three generations. G1 women (born 1933–1961) typically completed only primary education, initiating childbearing between ages 16–22 (median 20). G2 women (born 1954–1979) achieved higher educational levels, and generally had their first birth 3–5 years later (median 24), with a smaller completed family size (1–3 children versus 4–8 children). Nearly all G3 women (born 1987–2002) have pursued university education, with most remaining childless into their mid-twenties and beyond.

Three mechanisms link educational advancement to fertility postponement. First, extended education creates structural incompatibility between the student and mother roles. G3 women's matrices indicate that for them, education is a primary life focus, with employment and relationship formation following sequentially, and childbearing being postponed or absent. Second, academic credentials provide access to formal employment with higher opportunity costs for childbearing. Third, educational attainment reshapes life aspirations. Thus, G3 women express ambivalence about motherhood. Camila (G3, born 1999, Family 11) articulates this transformed reproductive consciousness as follows: "Until a year ago I was saying no, I didn't want to have children . . . it's not something I desperately want . . . I'm a little afraid, not so much of bringing them into the world, but rather of the world I would be bringing them into". Her university education in dance (2016–2022) and professional establishment as a teacher have reframed reproduction as contingent rather than inevitable.

Educational expansion has depended on intergenerational support arrangements. Several matrices reveal how G1 and G2 women have enabled G3's educational achievements through economic support and childcare arrangements, creating opportunities their (grand)daughters that were unavailable to previous generations. The resulting educational advancement corresponds with fertility postponement, as illustrated by Family 2 (Lima). G1 (Juana, born 1940) had incomplete primary education, married at age 17 and had four children beginning at age 23. Her G2 daughter (Rufina, born 1968) achieved a university

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education despite experiencing political persecution during her studies, delayed childbearing until age 28 and limited her family to two children through contraceptive use. Rufina's G3 daughter (Ingrid, born 1996) completed university and remains childless at age 25. Ingrid has used contraceptives since age 19, and links her reproductive postponement to professional development. This three-generation sequence demonstrates how educational advancement translates into progressive fertility postponement, with childbearing becoming contingent upon prior educational and career achievement.

The matrices show a powerful association between women's increasing educational attainment and reproductive postponement across generations. While G1 women rarely portrayed education and childbearing as competing priorities, G2 women's biographies document emerging tensions between these life domains. By G3, a clear sequencing norm emerges: education first, then employment establishment, followed by partnership formation, with reproduction being considered only after these prior stages have been completed.

Pattern 2: Persistent early fertility despite educational gains

While Pattern 1 indicates a general trend of educational expansion and fertility postponement, biographical data also reveal a counter pattern: persistent early fertility despite educational advancement. Table 5 provides examples. Across all three generations, some women had their first child at a young age (16–22), despite achieving higher levels of education than their mothers. This pattern is particularly evident in several G2 women who, despite completing secondary or technical education, reproduced at ages similar to those of their less educated G1 mothers.

Among the 20 women exhibiting this pattern (12 G1, six G2, two G3), three overlapping mechanisms operate across educational levels. Gendered violence affected eight women, economic precarity influenced 14 women and early union formation (before age 20) characterised 16 women of all educational levels. These factors reinforced each other: six women experienced both violence and economic precarity and 12 faced economic problems combined with early union pressure, demonstrating that education provides limited protection against these intersecting constraints.

The role of violence in derailing educational aspirations appears vividly in individual testimonies. Isidora (G1, Family 1) migrated to Lima at age 13 to pursue education but encountered a relationship that disrupted her plans: "I came with the intention of studying, becoming a professional", she explains, "but destiny crossed my path with the father of my children". Her first birth at age 18 was followed by additional pregnancies resulting from sexual violence: "Sometimes I didn't want to be with him, he would come and hit me . . . he would tear my clothes to be with me and in those circumstances, I got pregnant with my son, my third child". This pattern persists across generations. Elyzabeth (G2, Family 8), despite achieving technical education, experienced "non-consensual sexual relations" at age 19, with her matrix documenting reproductive coercion coinciding with her first birth at age 21.

Economic precarity operates alongside violence to shape reproductive decisions. Family 13 exemplifies this pattern: despite achieving technical education and possessing contraceptive knowledge, economic instability combined with reliance on natural family

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Table 5. Persistent early fertility despite educational gains across generations

Family	Generation	Educational level	Age at first birth	Number of children	Primary constraining factors
Family 1	G1: Isidora	Incomplete primary	18	4	Sexual violence, forced union
	G2: Teodora	Complete secondary	24	4	Domestic responsibilities, economic precarity
Family 8	G1: Jenara	Incomplete secondary	20	8	Arranged marriage, limited contraceptive knowledge
	G2: Elyzabeth	Complete technical	21	3	Non-consensual sexual relations, early union
Family 18	G1: Protasia	Incomplete secondary	16	4	Arranged marriage, limited agency
	G2: Delia	Complete secondary	20	3	Economic problems, sexual coercion

Source: Author's synthesis from multigenerational Ageven matrix data, 2022

planning methods rather than modern contraceptives led Liliana (G2) to have her first child early. This example illustrates how financial constraints and limited contraceptive access intersect to drive early family formation even among educated women. Similarly, early unions formation persists across educational levels and generations. While "arranged marriage" appears in G1 biographies, this evolves into "early cohabitation" in G2 and G3 generations, with many educated women still entering unions before age 20.

These intersecting factors create tensions between educational aspirations and reproductive outcomes that many women navigate simultaneously. Despite educational gains, persistent patterns of early fertility across generations highlight how structural constraints – gendered violence, economic necessity and early union formation – continue to shape women's reproductive trajectories in ways that education alone cannot overcome.

Pattern 3: Increased reproductive agency across generations

Reproductive agency evolved markedly from G1 to G3, primarily through changing contraceptive knowledge, access and decision-making power. Table 6 illustrates this evolution across the three generations. G1 women (born 1933–1961) report minimal contraceptive use: of the 22 women interviewed, 15 report using no contraceptive methods at all even after having large families (4–10 children). Those who did use contraception predominantly relied on traditional methods like the "rhythm method". This limited contraceptive use reflects both restricted knowledge and constrained decision-making power, with G1 women frequently describing reproduction as something that "happened to them", rather than as something they controlled.

G2 women (born 1954–1979) demonstrate increased contraceptive knowledge and use. Nearly all report using modern contraceptive methods, with pills, IUDs and injectable

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Table 6. Evolution of reproductive agency across three generations

Dimension of reproductive agency	G1 (1933–1961)	G2 (1954–1979)	G3 (1987–2002)
Contraceptive knowledge and use	• 15/22 report no contraceptive use • Primary methods: rhythm, withdrawal • Usually initiated after multiple births	• Nearly all use modern contraceptives • Common methods: pills, IUDs, injectables • Initiated earlier in reproductive trajectories	• Sophisticated knowledge of multiple methods • Proactive rather than reactive use • Method switching common
Timing between sexual initiation and first birth	• Typically 0–2 years • Sexual activity quickly followed by reproduction • Median: 1 year	• Typically 2–5 years • Some intentional delay • Median: 3 years	• Often 5+ years or remains unbridged • Deliberate separation • Many sexually active but childless at 25+
Reproductive decision-making language	• "It was my destiny" • "That's how life was back then" • No distinction between planned/unplanned	• "I decided to use contraception" • Some pregnancies described as planned • Increased reference to choice	• "I'm making a conscious decision" • Explicit discussion of reproductive planning • Strong distinction between planned/unplanned

Source: Author's synthesis from multigenerational Ageven matrix data, 2022

contraceptives frequently being mentioned. Women of this generation engaged in greater reproductive planning, with many linking contraceptive use to educational and professional goals. Rufina (Family 2) exemplifies this shift: having obtained university education, she delayed childbearing until age 28 and used oral contraceptives to limit her family to two children – in stark contrast to her mother, who had four children beginning at age 23 with no contraceptive use.

By G3 (born 1987–2002), contraceptive knowledge and use have transformed dramatically. These young women report being aware of multiple contraceptive options and often describe using different methods at different life stages. Maeva (Family 5) began using oral contraceptives at 17, well before considering childbearing, reflecting a proactive rather than reactive approach to fertility management. Her testimony reveals both purposeful contraceptive use and the capacity to make nuanced decisions: "I've used hormonal contraceptive pills in the 21-day format . . . I used them intermittently from 17 until 21 or 22, about four or five years".

Beyond contraceptive use, reproductive agency manifests in how women articulate reproductive decision-making. G1 women rarely describe children as "planned" or "unplanned", instead using language of acceptance and destiny. By contrast, G3 women differentiate between planned and unplanned pregnancies and discuss reproduction in terms of personal choice.

The increasing separation between sexuality and reproduction represents a crucial dimension of this expanding agency. While G1 women's biographies show that they started childbearing almost immediately following their sexual initiation (within 1–2 years), G3 women are maintaining active sexual lives for years or decades before considering reproduction. This decoupling represents enhanced agency – the ability to engage in sexuality without automatic reproductive consequences.

These generational shifts in reproductive agency intersect with but transcend educational differences. While education served as a gateway to contraceptive knowledge, with educated G1 women being twice as likely to use any contraception as their less educated counterparts, by G3, reproductive agency has become more democratised. Nearly all G3 women, regardless of their educational level, demonstrate contraceptive knowledge and intentional fertility management. However, education still shapes how this agency is exercised: university-educated G3 women typically employ hormonal methods and articulate reproduction as a strategic life decision, while those with less education, though equally knowledgeable about contraception, may face greater constraints in actualising their reproductive preferences. This evolution suggests that while contraceptive knowledge has diffused across educational strata, the ability to fully exercise reproductive agency remains mediated by educational and economic resources.

Pattern 4: Evolving responses to reproductive vulnerability

Reproductive vulnerability has evolved rather than simply declining across generations. Table 7 illustrates this transformation. G1 women faced infant mortality and maternal health crises with minimal institutional support, G2 women accessed healthcare primarily for crisis

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Table 7. Evolving responses to reproductive vulnerability across generations

Dimension of reproductive vulnerability	G1 (1933–1961)	G2 (1954–1979)	G3 (1987–2002)
Reproductive health challenges	• High maternal mortality risk • Frequent infant losses • Complications of high parity	• Documented miscarriages • Reproductive health surgeries • Complications of birth control	• Diagnosed reproductive health conditions • Mental health impacts • Earlier intervention
Healthcare engagement	• Minimal contact with medical system • Home births predominant • Late-stage intervention only	• Increased medical engagement • Hospital births common • Some preventive care	• Regular reproductive healthcare • Preventive gynaecological care • Early diagnostic procedures
Support systems	• Almost exclusively family-based • Minimal institutional resources • Women as primary caregivers	• Mixed family and institutional • Emerging healthcare networks • Extended family involvement	• Predominantly institutional • Specialised medical services • Peer support important

Source: Author's synthesis from multigenerational Ageven matrix data, 2022

intervention purposes, while G3 women have received preventive care leading to early diagnosis of health conditions, including mental health impacts that were previously unrecognised or unrecorded. The increased documentation of depression and anxiety in G3 likely reflects greater awareness and diagnostic capacity, rather than increased prevalence.

The absence of institutional support extended to pregnancy loss. Isidora (Family 1) experienced a spontaneous abortion at age 17 resulting from physical violence, yet sought no medical care. Her testimony reveals the physical trauma and social isolation characterising reproductive loss in this generation: "I lost my baby because of the blows . . . the father of my children would hit me a lot, mistreated me a lot. From the beatings I lost my baby". She managed this crisis entirely alone without medical intervention despite the traumatic circumstances: "I had no support from anyone, just myself".

G2 women (born 1954–1979) document increased engagement with healthcare institutions, although reproductive vulnerability persists among these women. Their biographies frequently note hospital births, medical interventions for reproductive health problems and formal diagnoses. Delia (Family 18) exemplifies this transitional generation: her matrix records multiple reproductive health challenges in the 1990s, including "ectopic pregnancy" and "hysterectomy", all with corresponding medical interventions. Unlike in her mother's generation, her reproductive vulnerabilities were addressed through institutional healthcare, although the care she received was often reactive rather than preventive.

G3 women (born 1987–2002) document a distinctive pattern of reproductive vulnerability and response. Their matrices show earlier diagnosis of reproductive health conditions, with many reporting conditions like "endometriosis" or "polycystic ovary syndrome" in their early twenties. Clara (Family 17) exemplifies this pattern, with her matrix noting "insulin resistance and polycystic ovaries" diagnosed during routine gynaecological care, long before any pregnancy attempt.

Perhaps most striking is the emergence of mental health as a dimension of reproductive vulnerability in G2 and especially G3 matrices. While G1 women rarely mention psychological aspects of reproductive experiences, G3 women frequently document "depression", "anxiety" and "trauma" in connection with reproductive events. Norma (Family 18) explicitly links her abortion experiences to psychological distress, as her diagnosis of "depression after abortion" highlights an expanded conception of reproductive health that includes mental well-being.

Pattern 5: Changing normative life course sequences

Life course sequencing across generations shows education-stratified patterns evolving across generations. Table 8 illustrates these sequences for each generation. G1 women (born 1933–1961) with limited education followed compressed sequences (early school leaving → marriage → childbearing), likely reflecting constrained choices. G2 women demonstrate increased diversity, with their educational levels strongly influencing their sequence patterns. G3 women with higher education articulate strong preferences for standardised sequencing (education → employment → union → childbearing). While G1 women's education rarely overlapped with family formation due to early school leaving,

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Table 8. Evolution of life course sequencing across generations

Life course domain	G1 (1933–1961)	G2 (1954–1979)	G3 (1987–2002)
Educational timing	• Often interrupted • Frequently incomplete • No clear endpoint	• More continuous • Clearer completion points • Some return to education	• Continuous through completion • Extended duration • Sequential progression
Work-family relationship	• Work begins in childhood • Continues through childbearing • No clear separation	• Work often pauses for childbearing • Clearer role separation • Return to work after children	• Work established before family formation • Sequential rather than simultaneous • Career identity before mother identity
Union-childbearing timing	• Often nearly simultaneous • Union followed quickly by birth • Median gap: < 1 year	• Greater separation • Some deliberate delay • Median gap: 1–2 years	• Extended period between union and birth • Deliberate delay or childlessness • Many years or indefinite

Source: Author's synthesis from multigenerational Ageven matrix data, 2022

their work and childbearing trajectories frequently coincided, with 15 of 22 G1 women continuing informal or domestic labour while raising children, in contrast to the sequential ideals articulated by educated G3 women.

G2 women (born 1954–1979) exhibit more standardised life course sequences, with clearer separations between life domains. Their biographies show completed education before family formation, though their work and family responsibilities often overlap. Angélica (Family 7) demonstrates this emerging standardisation: her matrix shows completed technical education, followed by work establishment, then marriage and finally childbearing at age 32.

G3 women (born 1987–2002) display increasingly sequential life course patterns, albeit with some variation by educational level. The life course patterns of the minority of G3 women with only secondary education more closely resemble those of similarly educated women in previous generations. However, the biographies of the university-educated majority document a normative sequence: extended education → work entry and establishment → stable union formation → (potential) childbearing. Clara (Family 17) exemplifies this pattern among educated G3 women, with her life course proceeding through university education, career establishment and relationship formation, with childbearing being planned for after she achieves professional stabilisation.

This standardisation of life course sequences has profound implications for reproductive experiences. G1 women experienced reproduction as integrated with other life domains, not as a separate stage requiring prior completion of education and career establishment. By contrast, G3 women conceptualise reproduction as contingent on a proper sequence of prior achievements. Romy (Family 12, G3) embodies this sequential logic: at 25, having completed university education, she works at the Municipality of Callao while postponing childbearing despite being in a stable relationship since age 20. Her contraceptive use since age 17 and stated intention to establish professional and economic stability before considering having children reflect a different understanding of reproduction than that of her grandmother, who married at age 16 and had eight children while working informally.

This evolution towards increasingly standardised life course sequences represents a profound dimension of reproductive change across generations – one that shapes not just when women have children, but also how they conceptualise the relationship between reproduction and other life domains.

Educational heterogeneity and reproductive patterns within generations

To address heterogeneity within generations, we examined reproductive patterns among women with similar educational levels across G1, G2 and G3. However, the educational homogeneity of G3 women (19 of 22 are attending or have completed university) prevents systematic comparison across educational levels within this generation. Among women with secondary education as their highest completed level, the mean age at first birth was 22.3 for G1 (n = 5) and 23.8 for G2 (n = 9), suggesting modest generational shifts in reproductive timing even when controlling for education. These differences are smaller

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than those observed when comparing across educational levels within the same generation. Only one G3 woman with secondary education has begun childbearing (Gladis, Family 22, Puno, first birth at age 21), precluding a generational comparison at this educational level.

An examination of women with university education across generations (one in G1, five in G2 and 19 in G3) indicates that G1's sole university-educated woman had her first child at 23, while the average age at first birth was 28.2 for university-educated women in G2 and was 26.5 for the few university-educated mothers in G3. These patterns suggest that both educational and generational effects operate simultaneously, though our small sample sizes within education-generation cells limit definitive conclusions. Despite these limitations, the available evidence challenges narratives of generational transformation and highlights the importance of considering educational heterogeneity within each generation. Where comparable data exist, educational level exerts a stronger influence on reproductive timing than generational membership alone, though the concentration of higher education in G3 itself reflects the educational expansion that characterises generational change.

Discussion: Understanding reproductive change through a biographical lens

Our multigenerational analysis yields five key insights about fertility decline and educational expansion in Peru that extend theoretical perspectives.

First, our findings confirm that education affects reproductive trajectories through multiple pathways, revealing a more complex relationship than that suggested by simple statistical correlations. The role incompatibility mechanism – whereby extended education delays childbearing by creating competing demands on women's time and resources – appears in G3 women's matrices, supporting Blossfeld and Huinink's (1991) theoretical proposition about the institutional incompatibility of student and mother roles. However, this pattern is less evident in earlier generations, among whom education and childbearing often overlapped, suggesting that institutional incompatibility intensifies as educational systems formalise and extend temporally. The opportunity cost considerations become increasingly prominent across generations, with G2 and G3 women describing how educational investments shaped their fertility decisions by enhancing their employment options. Our findings thus support economic theories of fertility, but demonstrate that these mechanisms operate differently across historical contexts and generations, even within the same families.

Our biographical data illuminate how education's influence operates through the multidimensional empowerment framework described by Jejeebhoy and Sathar (2024). The impact of education on reproductive decision-making is mediated through interconnected dimensions, including economic autonomy, social power and household decision-making authority. The variable development of these dimensions across our generations helps to explain why education alone does not produce uniform reproductive outcomes, with G1 women often lacking complementary dimensions of empowerment while G3 women benefit from more synergistic developments across multiple domains.

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Second, the biographical data illuminate how reproductive agency has expanded across generations in ways that extend Johnson-Hanks' (2002) concept of "vital conjunctures". While G1 women rarely describe reproduction as subject to deliberate control, G3 women consistently articulate reproductive decision-making that incorporates multiple considerations, including education, career goals, relationship quality and broader societal conditions. This expanding agency represents not merely increased choice sets, but fundamentally different constructions of reproduction as a domain of strategic action, rather than of inevitable life progression. G3 women's narratives reveal what Johnson-Hanks (2015) terms "structured contingency", with reproduction becoming increasingly contingent on achieving prior life milestones, while simultaneously being structured by institutional and normative frameworks. This transformation manifests in changed contraceptive practices, with a distinct shift occurring from reactive to proactive fertility control across generations that alters the relationship between sexuality and reproduction.

Third, our findings highlight the importance of family support across generations in enabling educational expansion and its effects on reproductive trajectories, supporting and extending Bernardi's (2016) work on intergenerational transmission. The matrices show how G1 and G2 women have often facilitated educational opportunities for subsequent generations through economic support, childcare provision and encouragement that they themselves lacked. This cross-generational investment creates conditions that allow younger women to pursue extended education without the reproductive interruptions common in previous generations. Our findings thus support Bernardi and Klärner's (2014) contention that intergenerational influences operate not merely through value transmission, but also through concrete support mechanisms that shape opportunity structures across generations. The biographical data expose how demographic change operates through family lineages, rather than merely across cohorts, supporting Mare's (2011) argument for the use of multigenerational approaches.

Fourth, the biographical approach shows how reproductive vulnerability persists despite educational advancement, though its forms evolve across generations. While G1 women faced reproductive vulnerability primarily through infant mortality and maternal health risks, G2 and G3 women have experienced different vulnerabilities, including reproductive health conditions, psychological distress related to reproduction and continued exposure to sexual violence despite their increased education. These patterns challenge modernisation narratives that presume that educational expansion automatically enhances reproductive well-being. Instead, our findings align with Elder's (1998) life course principle of "linked lives", whereby individual trajectories remain embedded in social relationships that may constrain their agency despite their expanded capabilities. In particular, our finding that women's reproductive vulnerability persists despite their educational advancement illuminates what Johnson-Hanks (2015) terms the "durable inequalities" that continue to shape women's reproductive experiences regardless of their educational credentials.

Fifth, our analysis suggests potential patterns of life course sequencing across generations, albeit with important limitations for G3. The intended sequencing expressed by G3 women – education first, then employment, then union formation and only then childbearing – represents their stated preferences and plans, rather than their completed

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trajectories. Among the four G3 women who have had children, three followed this sequence while one experienced an unplanned pregnancy during education. The remaining 18 G3 women articulate this sequential ideal, though whether they will realise these plans remains uncertain. Therefore, we cannot definitively conclude that educational expansion has produced increased standardisation in Peru; rather, we observe strong normative preferences for standardised sequences among educated young women whose actual trajectories are still unfolding.

These findings enhance our understanding of the education-fertility relationship in several ways. While statistical analyses treat education as a static attribute influencing subsequent fertility, the biographical approach considers education and reproduction as dynamic, interacting trajectories unfolding over time, consistent with the life course perspective advocated by Elder (1998). Educational differences in fertility emerge not simply from completed educational levels, but also from how educational and reproductive events are sequenced, timed and experienced within specific life contexts. Our findings particularly support Johnson-Hanks' (2007) critique of the demographic transition theory's deterministic assumptions, showing that similar educational credentials may produce different reproductive outcomes depending on family circumstances, economic conditions, partnership situations and institutional supports.

Our findings also add nuance to the understanding of fertility decline in Latin America by highlighting both change and continuity across generations, directly engaging with what Esteve and Florez-Paredes (2018) term the "Latin American paradox". This aligns with Nathan's (2024) recent analysis of educational expansion and age at first birth in the Southern Cone, which similarly finds complex, non-linear relationships between education and reproductive timing. While women's reproductive patterns have undergone marked transformations, particularly in terms of contraceptive use, birth timing and family size, certain continuities persist, including women's vulnerability to reproductive coercion, early union formation among some educated women and persistent tensions between women's educational aspirations and their reproductive realities. These continuities help to explain why educational expansion in Peru and other Latin American contexts has not always produced the fertility postponement observed in Europe and East Asia. The biographical approach reveals how cultural models of family formation, gender norms and economic insecurities create counterforces to educational effects on fertility, producing complex patterns that cannot be reduced to simple educational gradients, as Castro Martín and Juarez (1995) have suggested.

Our study has several limitations: the sample size limits generalisability; most G3 women's reproductive trajectories remain incomplete; and retrospective data introduce potential recall bias. Future research should include longitudinal follow-up of G3 women to assess whether their stated sequential preferences materialise into actual behaviours, expanded regional comparisons and larger samples permitting the systematic analysis of educational effects within generations.

Despite these limitations, our findings have implications for both demographic theory and policy. Theoretically, they demonstrate the value of using biographical approaches to better understand demographic change by shedding light on processes and meanings that quantitative analysis alone cannot capture. The multigenerational perspective in particular

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highlights how demographic transitions unfold through family lineages, with each generation both being constrained by and transforming the conditions they inherit. The policy implications include the need for educational policies sensitive to women's reproductive lives, reproductive health services responsive to women's educational aspirations and social supports that facilitate women's ability to pursue both educational advancement and their desired family formation.

Conclusions

This study demonstrates how integrating quantitative cohort analysis with multigenerational biographical data illuminates dimensions of Peru's fertility transition that are invisible in aggregate statistics. By examining three family generations, we have shown that the influence of educational expansion on reproductive trajectories operates through complex, context-dependent mechanisms, rather than through the linear relationships that are often assumed in demographic transition theories. The biographical lens has been particularly valuable in exposing how structural constraints, cultural models and family dynamics mediate education's effects, producing patterns that are more nuanced than statistical correlations alone would suggest.

A critical caveat merits emphasis: most G3 women's reproductive trajectories remain incomplete. What we observe are emerging patterns, stated intentions and early reproductive behaviours, rather than completed fertility histories. Whether the sequential life course ideals articulated by these educated young women will materialise into actual behaviours remains uncertain, and warrants longitudinal follow-up.

The multigenerational *Ageven* matrix methodology has proven particularly powerful for visualising how reproductive patterns both persist and transform across family lineages, revealing the temporal and relational dimensions that shape demographic change. As educational expansion continues globally, understanding how cultural, economic and familial contexts mediate educational influences on fertility remains essential for both theorical advancement and evidence-based policy development.

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ORCID iDs

Robin Cavagnoud https://orcid.org/0000-0002-0584-8620

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