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Bridging Education and Fertility: Unraveling the Role of Gender Attitudes

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Abstract

In 2023, Jordan's fertility rate has decreased to 2.6 children per woman. This decline is linked to women achieving higher levels of education, which contributes to their empowerment. This study analyzes the number of births by estimating several linear regressions and mediation models to examine how married women's gender role attitudes influence the relationship between education and fertility. The data used comes from the Jordanian Labor Market Panel Surveys (JLMPS) conducted in 2010 and 2016. Women's gender role attitudes were assessed using a 10-statement continuous scale reflecting their agreement with gender role statements. The findings indicate a strong connection between education and fertility rates. Specifically, an increase in years of education is significantly linked to lower fertility rates. Women who demonstrate intrinsic agency and hold egalitarian beliefs about gender typically have fewer children than those who adhere to unequal gender norms. Additionally, married women with higher levels of education are more likely to possess egalitarian attitudes and beliefs regarding gender roles compared to those with lower educational attainment. However, married women's attitudes toward gender roles do not mediate the relationship between education and fertility. To further promote women's empowerment, programs should focus on enhancing educational opportunities for women and encouraging more egalitarian views on gender roles.

Keywords: fertility, socio-demographic characteristics, Jordan, women's agency, women's empowerment, women's education, mediation, egalitarian gender attitudes
JEL Classifications: I14, J13, J16

ملخص

في عام 2023، انخفض معدل الخصوبة في الأردن إلى 2.6 طفل لكل امرأة. ويرتبط هذا التراجع بحصول المرأة على مستويات أعلى من التعليم، مما يساهم في تمكينها. تحلل هذه الدراسة عدد الولادات من خلال تقدير العديد من الانحدارات الخطية ونماذج الوساطة لدراسة كيفية تأثير مواقف دور الجنسين لدى المرأة المتزوجة على العلاقة بين التعليم والخصوبة. وتأتي البيانات المستخدمة من مسوحات سوق العمل الأردنية (JLMPS) التي أجريت في عامي 2010 و2016. تم تقييم مواقف المرأة تجاه الأدوار الجنسانية باستخدام مقياس مستمر مكون من 10 عبارات يعكس اتفاقها مع بيانات الأدوار الجنسانية. وتشير النتائج إلى وجود علاقة قوية بين التعليم ومعدلات الخصوبة. وعلى وجه التحديد، ترتبط الزيادة في سنوات التعليم بشكل كبير بانخفاض معدلات الخصوبة. النساء اللاتي يظهرن قوة جوهرية ويحملن معتقدات المساواة حول النوع الاجتماعي عادة ما يكون لديهن عدد أقل من الأطفال مقارنة بأولئك الذين يلتزمون بمعايير غير متساوية بين الجنسين. بالإضافة إلى ذلك، من المرجح أن تمتلك النساء المتزوجات ذوات المستويات التعليمية الأعلى مواقف ومعتقدات قائمة على المساواة فيما يتعلق بأدوار الجنسين مقارنة بأولئك ذوي التحصيل العلمي المنخفض. ومع ذلك، فإن مواقف المرأة المتزوجة تجاه الأدوار الجنسانية لا تؤثر على العلاقة بين التعليم والخصوبة. ولمواصلة تعزيز تمكين المرأة، ينبغي للبرامج أن تركز على تعزيز الفرص التعليمية للمرأة وتشجيع وجهات نظر أكثر مساواة بشأن أدوار الجنسين.

1. Introduction

World population projections suggest that fertility rates will converge towards replacement level. Jordan has seen a significant decrease in fertility rates over time, with the total fertility rate (TFR) falling from about 4.4 to 3.7 between 1997 and 2002 Nsour et al., (2008). Between the latest Population and Family Health Surveys, Jordan's Total Fertility Rate (TFR) fell from 3.5 to 2.7 over 5.5 years[1]. This decline stems from greater female education, access to contraception, urbanization, economic challenges, and changing social norms Krafft, Kula, & Sieverding (2021), along with fewer unwanted pregnancies and a rise in infecund women of reproductive age Bietsch et al., (2020).

Measuring women's agency involves looking at their fertility choices, as women primarily shoulder the responsibilities of childbearing. As women's agencies grow, fertility rates tend to decline. This is influenced by factors such as education, economic participation, and decision-making power, which empower women to decide when and how many children to have S. Chowdhury, M. M. Rahman, & M. A. Haque (2023).

A woman's agency and her beliefs regarding gender roles are shaped by cultural norms, education, and available resources, which in turn impact her reproductive health decisions Shanjida Chowdhury, Mohammad Meshbahur Rahman, & Md Aminul Haque (2023). Research indicates that individuals with more egalitarian views on gender roles tend to have lower fertility intentions, meaning they are less likely to desire children compared to those with traditional views Kato (2018); Liu et al., (2021).

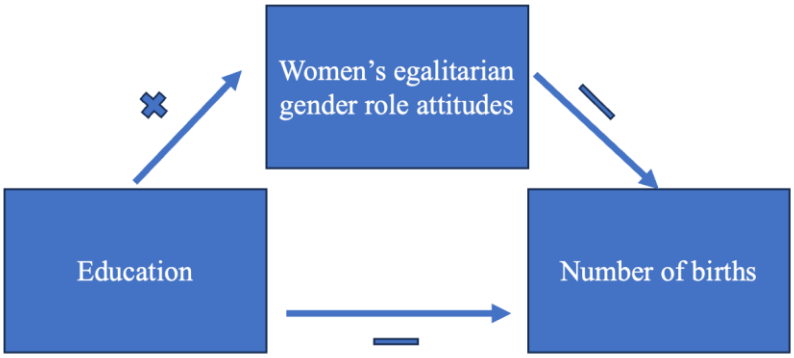
Education is a vital resource and an indicator of women's status, fostering agency and improving personal and social achievements Eger, Miller, & Scarles (2018). Education empowers women by allowing them to make informed decisions about their reproductive choices, including the size of their families and the use of contraception Castro Martín (1995). There is a negative correlation between women's education and total fertility rates (TFR). Women with higher education tend to have fewer children, while those with lower education are more likely to become mothers Kim (2023).

The interplay of education, gender-role attitudes, and fertility remains insufficiently explored in the Middle Eastern context, emphasizing the need for additional empirical research work. This paper makes three contributions. First, it documents how women's gender-role attitudes and fertility vary across education groups and two survey waves via a series of descriptive figures. Second, it estimates the schooling–fertility association using OLS regressions that incorporate a

[1] Estimates from the Jordan Labor Market Panel Survey (JLMPS) 2016 indicate a TFR of 3.3, while the Jordan Population and Family Health Survey (JPFHS) 2017 estimates it at 2.6. Civil Status and Passports Department (CSPD) statistics suggest a TFR similar to JLMPS Krafft, Kula, & Sieverding (2021).

continuous 10-item gender-attitudes index. Third, it formally tests mediation by examining whether more egalitarian beliefs lie on the pathway between schooling and fertility using a bootstrapped Sobel–Goodman framework. This research endeavor aims to deepen our understanding of the relationship between education and fertility. Figure 1 outlines the hypotheses discussed in this paper.

Figure 1. Mediation model illustrating the relationship between education, intrinsic agency, and fertility.



(a) Higher education is associated with lower fertility rates in women.
(b) Higher education is positively associated with more egalitarian gender role attitudes.
(c) More egalitarian attitudes toward gender roles are negatively associated with fertility.

The paper is organized as follows: Section 2 reviews existing research and theoretical frameworks on women's fertility, gender role attitudes, and education, with a particular focus on the MENA region and Jordan. Section 3 outlines the methods, Section 4 details the data, Section 5 discusses the results, and Section 6 concludes by addressing limitations and providing suggestions for future research.

2. Background

2.1. Theoretical background

Two primary theories underpin most empirical research on fertility. The first is the New Home Economics, a microeconomic perspective introduced by Gary Becker Becker (1981), Becker (1960), who improved insights into family economics and fertility choices as a cost-benefit trade-off. Becker's fertility theory suggested that as income rises, families would choose to have more children like consumer goods. However, his research revealed a decline in fertility rates among higher-income groups Heckman (2015); Leibenstein (1974). The theory suggests that as income

rises, families prioritize quality over quantity by investing more in fewer children, leading to better education and opportunities Willis (1974).

The "quantity-quality trade-off theory" suggests that a family's number of children inversely affects resource investment in each child regarding education, healthcare, and quality of life. Thus, families with more children may spread their resources, which could negatively impact the well-being of each child development Becker & Lewis (1973); Willis (1973). Certain studies indicate that the trade-off may not consistently manifest, particularly within families of elevated socioeconomic status, where resources are likely more accessible Guo, Yi, & Zhang, (2022); Li, Zhang, & Zhu (2008).

The other theory is the second demographic transition theory, which connects changes in fertility behavior to broader shifts related to post-modernism. It emphasizes arguments such as the rise of female education and economic autonomy Lesthaeghe (1995), Lesthaeghe (2014). As child-rearing costs rise and the economic benefits of having children diminish, families are opting for fewer children. As a result, the demand for the use of birth control has increased. Cultural values emphasizing extended families can hinder fertility shifts, while slow economic growth can delay it further.

Esping-Andersen and Billari (2015) propose a U-shaped evolution of fertility levels linked to the spread of gender-symmetric norms. The theory suggests that fertility rates initially decline as societies move away from the traditional male breadwinner and female homemaker model. The initial decline in fertility is associated with uncertainty and confusion regarding new gender expectations during this transitional phase. However, these rates can increase again once more gender-equal norms are firmly established and supported by societal structures Esping-Andersen & Billari (2015). The theory indicates that adopting new gender norms is crucial for fertility recovery, as fertility rises in gender-equal societies. These societies lower costs and enhance compatibility for women managing careers and family, increasing the likelihood of women opting to have more children Hudde (2018).

The U-curve shape varies by each country's social and cultural context Hudde (2018). Some studies found that the MENA region may not display a clear U-shaped pattern in fertility trends, with certain countries exhibiting more complex or variable patterns Buyukkececi & Engelhardt (2021). Low female labor participation in MENA may influence fertility choices, causing deviation from the U-shaped pattern Verme (2015).

Modernization Theory posits that as economic development occurs and education expands, traditional gender roles begin to loosen. This shift enables women to engage more actively in the workforce and public life, resulting in enhanced opportunities for empowerment Alexander & Welzel (2007). Bargaining models indicate that education boosts a woman's bargaining power and

enhances her instrumental and intrinsic agency McElroy (1990) Kantor (2003). Education empowers women, providing skills for informed choices, delaying early marriage and motherhood, and promoting leadership Elsayed & Shirshikova (2023).

Fertility intentions theory examines how beliefs, emotions, and economic factors influence decisions about having children, typically assessed with a yes/no evaluation question Barker & Buber-Ennser (2024); Qiao et al., (2024). This theory examines the attitudes towards the costs and benefits of parenting, societal approval of parental choices, perceived control over childbirth, the influence of social groups, and how jobs and income affect these decisions intentions[2] Mencarini, Vignoli, & Gottard (2015).

2.2. Gender role attitudes and fertility

The Total Fertility Rate (TFR) indicates the average number of children a woman anticipates having based on current age-specific fertility rates throughout her reproductive years. The link between gender role attitudes and fertility differs based on social contexts, such as cultural norms, availability of childcare, and government policies that promote family well-being Arpino, Esping-Andersen, & Pessin (2015). Although both men and women with egalitarian views tend to have lower fertility intentions, this effect is often more significant in women Shang & Yin (2020).

"Intrinsic agency" reflects a woman's sense of self-worth, beliefs, and confidence, embodying the "power within" that drives her ambitions. While both intrinsic and instrumental agencies are essential for women's empowerment, they function on different levels Jones et al., (2020). Research shows that empowering women decreases fertility in low-income and wealthy countries alike Chakrabarti (2018); Behrman & Gonalons-Pons (2020).

Empowered women have better reproductive control, education, economic independence, and healthcare access, leading to healthier families and societies. They are also more likely to use family planning, achieve better birth spacing, and utilize contraception than those without the agency Do & Kurimoto (2012); Samari (2019). Yet, some Research shows that women with greater agency may still choose to have more children based on personal values, financial resources, and social circumstances Samari (2019).

Studies show that egalitarian relationships may negatively impact fertility, resulting in fewer children than traditional gender roles. This trend is linked to women's increased career

[2] A "short-term fertility intention" is a person's plan to have a child soon, strongly predicting future actions regarding the benefits and drawbacks of having a child at that time; it indicates a decision to conceive shortly Barker & Buber-Ennser (2024) .

opportunities and independence, leading them to prioritize careers over raising children Golmakani et al., (2015); Lappegård, Neyer, & Vignoli (2021); Li et al., (2021).

Yet sometimes egalitarian relationships may boost fertility by reducing women's childcare burden. Studies indicate that couples sharing childcare are more likely to have children Suero (2023). Support from partners and collaborative decision-making can significantly strengthen a woman's intrinsic agency and fertility choices Upadhyay et al., (2014). Fathers' involvement in childcare alleviates mothers' work-family trade-off, enabling them to work and have more children Fanelli & Profeta (2021).

Some partners may hold traditional views on gender roles, leading to conflict when a woman has a demanding career Hu et al., (2021). In some cultures, traditional gender roles frequently emphasize motherhood, causing women with less agency to experience societal pressure to bear more children Friedrich (2024). In the Middle East, a son's birth increases the mother's respect and empowerment for fulfilling her duty, especially in rural, low-income communities Zimmermann (2018) Tanvir & Arif)2022). When an older son is around, fathers tend to give mothers more authority in household decisions Das Gupta et al., (2003); Zimmermann (2012).

In certain instances, women may increase their fertility to conceive a son, potentially leading to greater control over household budgeting and decision-making Bose & Das (2024). Research indicates that mothers of sons might hold more traditional views on gender roles Sun & Lai (2017). Other studies propose that a belief in gender equality does not rely on the child's gender Sun & Lai (2017).

2.3. Education and fertility

Education and fertility are interconnected from a life course perspective, highlighting how women's choices regarding childbearing, their attained education, and different aspects of life influence each other Elder Jr, (1998). The increase in marriage age, enhanced parenting skills, better access to healthcare, and evolving views on family size are contributing to the decline in fertility rates in the MENA region. This trend is anticipated to persist, as expanded educational and economic opportunities foster healthier pregnancies and offspring Bellés-Obrero et al., (2023); Samari (2019).

Educated women tend to have fewer children because of better economic opportunities. As societies evolve, they prioritize careers over large families for personal fulfillment Kim (2023). Women with higher education generally earn more, allowing for greater investment in their children's welfare and potentially leading to the decision to have fewer children (McCrary & Royer (2011). As educated women rely less on children for economic support, the perceived value of having them declines, leading to a decrease in their preferred number of children Chen, (2022).

Educated employed women are less likely to fulfill fertility intentions than unemployed women Shreffler & Johnson (2013).

Pursuing higher education typically requires extended study periods and rigorous careers, which may restrict the time available for starting a family Kim (2023). Educated women marry and have children later. The median age of first birth in Jordan is 20 for those with low education and 25 for those with higher education Sieverding, Krafft, & Berri (2018). Research shows that each additional year of schooling reduced total fertility by 0.3 to 0.4 births in Jordan Zhang & Assaad (2024).

Unexpectedly, Jordanian educated women now desire, on average, one additional child compared to their uneducated counterparts, indicating an increase in the desired fertility rate in Jordan De Bel-Air (2017). Women with advanced education were opting to have more children than previously observed Krafft, Kula, & Sieverding (2021).

Awareness of contraception is growing in the Middle East, leading to more women utilizing contraceptives De Bel-Air (2017). Educational attainment can enhance understanding of and access to contraceptives, thereby decreasing fertility Martin (1995). In 2009, 59% of married women in Jordan utilized contraception, an increase from 40% in 1990. The Ministry of Health oversees the family planning program, ensuring access to contraception in both public and private sectors Bietsch et al., (2021).

2.4. Education and gender role attitudes

Overall, people with more education often embrace more egalitarian views on gender roles. This is because higher education introduces individuals to egalitarian concepts through engagement with peers and the workforce Yücetas & Carol (2024). Equal education for girls and boys transforms societal norms, leading to acceptance of delayed childbearing. It also encourages men to engage in family planning and parenting Sahin (2013).

Educated women recognize rights, build confidence, and inspire change. Education empowers them with financial access, encourages self-expression, and enhances mobility. This redefines gender roles, promotes advocacy, and enables careers in male-dominated fields while changing healthcare perceptions Amir-ud-Din, Naz, & Ali (2024).

The influence of higher education on gender role attitudes varies by gender and context. For example, women with advanced degrees may adopt more progressive views about gender roles in their careers, yet their perspectives on marriage might be less progressive. Additionally, structural barriers, such as unequal pay and overwhelming responsibilities for spouses, can prevent women from fully achieving their egalitarian ideals Yücetas & Carol (2024) Zhang & Zhu (2024).

Higher education attainment and mean years of education have increased across all populations in Jordan Alkasasbeh (2024). Recent efforts have focused on boosting women's economic involvement, raising awareness about gender-based violence, and enhancing access to education and leadership roles in Jordan Weforum (2023). Jordan has updated its education curriculum to reshape social norms that have historically discriminated against women UNWomen (2017).

Although most Jordanians acknowledge the advantages of gender equality, only a few are actively engaged in promoting it Elfar (2024). Family pressure and societal expectations prioritize women's domestic roles over careers, creating a gap between educational achievement and women's economic involvement despite progress in equal access to education. Challenges such as male guardianship, traditional family roles, workforce underrepresentation, and restricted legal rights persist in obstructing women's equality and hinder women's progress and opportunities for advancement (USAID); IRCKHF (2019).

3. Methodology

3.1. Data analysis

The analysis consists of two components. The first part is descriptive, detailing the characteristics of married women aged 15 to 49 years in both waves. Graphical representations will be employed to illustrate the relationships between the mean of gender role attitudes, average number of births (fertility), and levels of educational attainment. Second, several bivariate and multivariate ordinary least squares models examine the relationship between education, gender role attitudes, and fertility while accounting for known control variables that influence women's fertility. In the multivariate analyses, years of education completed are included, followed by the addition of the mean of gender role attitudes to estimate the impacts of intrinsic agency and education on fertility.

The default Sobel-Goodman tests for mediation analysis have low statistical power. Bootstrapping standard errors, p-values, and confidence intervals is a common solution, as it doesn't assume normality and improves reliability with smaller samples or non-normal data Preacher & Hayes (2004); Preacher & Hayes (2008); Zhao, Lynch Jr, & Chen (2010). Stata's bootstrap command provides bias-corrected confidence intervals, clarifying the plausible values around the estimated mediated effect, accounting for control variables. Using 1,000 or more bootstrapped samples is often recommended Preacher & Hayes (2008).

The total effect is calculated as the sum of direct effect (the independent variable's impact on the dependent variable) and the indirect effect (the impact through the mediator). The Sobel test statistic is represented in Equation 1:

$$z = \frac{a \times b}{\sqrt{b^2 \times s_a^2 + a^2 \times s_b^2}} \qquad (1)$$

where:

- a is the coefficient for the effect of the independent variable on the mediator,
- b is the coefficient for the effect of the mediator on the outcome (controlling for the independent variable),
- s_{a} is the standard error of a,
- s_b is the standard error of b.

Stata version 18 is used for all the analysis StataCorp. (2023). To account for potential sample biases, all analyses were conducted using panel weights.

3.2. Measures

3.2.1. Primary dependent variable: fertility

Fertility is a continuous variable that reflects the number of live births recorded in a woman's birth history for the years 2010 and 2016. This definition applies to married women who have had at least one live birth.

3.2.2. Primary independent variable: education

In the context of Ordinary Least Squares (OLS) and mediation analysis, the variable "completed years of schooling" serves as a continuous measure of the total years of education a woman has received. For clarity in visual representation, I categorized women's educational attainment into three distinct levels: (1) lower education (illiterate, can read and write, or basic education), (2) intermediate education (secondary education), and (3) higher education (university and beyond).

3.2.3. Mediator: women's intrinsic agency (gender beliefs and attitudes)

Gender beliefs and attitudes toward gender norms serve as indicators of intrinsic agency. This was assessed using a 10-item continuous scale derived from the JLMPS questions. Participants were asked about their beliefs and attitudes regarding various issues, including their opinions on women's right to work, the financial empowerment that work provides to women, and the importance of girls attending school to prepare for their careers. They also expressed their views on whether women should hold leadership positions in society and whether boys and girls have equal educational opportunities. Additionally, participants were asked if husbands should support their working wives with childcare and household responsibilities, whether working women can be effective mothers, and if they believe that women's jobs hinder their marital relationships.

Married women assessed their agreement with a statement using a scale from 1 to 5, where 1 means strongly agree (egalitarian) and 5 indicates strongly disagree (inegalitarian). Questions 5 and 7 were recoded for consistency, with 1 indicating the most egalitarian and 5 the least. Table 1 shows the gender role attitudes questions and responses from the JLMPS survey.

Table 1. Questions on gender role attitudes and response options, source: 2010 and 2016 Jordanian labor market panel surveys

Intrinsic agency-gender role attitudes	Response Agree/Disagree:
Questions	
1-Women allowed to work	1 strongly agree
2-Help working wife with children	2 agree
3-Help working wife with chores	3 indifferent
4-Girls go to school to prepare for jobs	4 disagree
5-Women who work cannot be good mother	5 strongly disagree
6-For financial autonomy, women must work	
7-Women's work interferes with relationship with husband	
8-Women should have leadership positions in society	
9-Boys and girls should get same schooling	
10-Boys and girls should be treated equally	

3.2.4. Controls

The models considered various factors that influence women's fertility in Jordan. These factors include age, employment history (whether women have been employed), geographic region (categorized as northern, including Irbid, Mafraq, Ajloun, and Jerash; central, including Amman, Zarqa, Balqa, and Madaba; and southern, including Karak, Aqaba, Tafileh, and Ma'an), urban status (urban/ rural), and household wealth score. Parental resources are assessed based on the mother's education level, categorized as follows: (1) lower education (illiterate or basic literacy), (2) intermediate education (secondary), and (3) higher education (university or higher). Additionally, other factors affecting married women's fertility include whether the husband is a blood relative, the woman's age at first marriage, and the sex of the first child.

4. Data

The analytical sample centers on married women of childbearing age, specifically those aged 15 to 49 years. I utilized both waves of the Jordan Labor Market Panel Surveys, conducted in 2010 and 2016 by the Economic Research Forum. These surveys provide comprehensive insights into women's social backgrounds, levels of agency, fertility, and education. All surveys and microdata are publicly accessible through the ERF data portal[3].

5. Results

5.1. Descriptive statistics

Table 2 presents the demographic characteristics of married women in Jordan, aged 15 to 49, in the years 2010 and 2016. It reports the number of observations and the percentage contribution in the corresponding sample in parentheses. For continuous variables, means and standard deviations are reported. In the first wave, there were 3,571 observations of women, while the later wave had 4,741 observations. The average age of women in both waves was approximately 33 years.

[3] www.erfdataportal.com

More than half of the women in both waves had a lower level of education, with an average of around 11 years of completed schooling. The majority of the women in the sample lived in urban areas in both waves. Approximately 74% of women in the first wave and 84% in the later wave had never worked. Most of the women had spouses who were not related by blood, with percentages of 63% in the first wave and 72% in the later wave. Around 90% of women in both survey waves had mothers with low education levels. The age at first marriage has increased from 20.5 years in the first wave to 21.7 years in the later wave. Fertility rates declined from an average of 4.036 in the first wave to 3.535 in the later wave. Furthermore, the mean of gender role attitudes is approximately 2 in both waves, reflecting strong egalitarian responses in both waves.

Table 2. Sample characteristics (% or mean [SD]) of married women aged 15–49 years, 2010 and 2016 Jordanian labor market panel survey

	Summary	
Years	**2010**	**2016**
Number of Observations	3,571	4,741
Education Level		
Low	1,880 (52.6%)	2,654 (56.1%)
Intermediate	691 (19.4%)	693 (14.6%)
High	1,000 (28.0%)	1,386 (29.3%)
Urban		
Rural	959 (26.9%)	1,213 (25.6%)
Urban	2,612 (73.1%)	3,528 (74.4%)
Region		
Central	1,863 (52.2%)	2,201 (46.4%)
North	1,183 (33.1%)	1,814 (38.3%)
South	525 (14.7%)	726 (15.3%)
Ever Worked		
No	2,633 (73.7%)	3,991 (84.3%)
Yes	938 (26.3%)	743 (15.7%)
Husband Related by Blood		
Unrelated	2,233 (62.5%)	3,384 (71.5%)
Related	1,338 (37.5%)	1,350 (28.5%)
Sex of First Child		
Boy	1,694 (51.7%)	2,165 (51.9%)
Girl	1,581 (48.3%)	2,004 (48.1%)
Mother's Education		
Low	3,256 (91.2%)	4,244 (90.1%)
Intermediate	198 (5.5%)	305 (6.5%)
High	117 (3.3%)	163 (3.5%)
Age	33.893 (7.976)	33.295 (8.475)
Age of First Marriage	20.528 (4.433)	21.707 (4.661)
Wealth	0.039 (0.853)	-0.054 (1.027)
Fertility	4.036 (2.246)	3.535 (2.044)
Years of Completed Schooling	10.982 (3.869)	10.630 (4.408)
Mean of Gender Attitude	1.972 (0.471)	2.028 (0.518)

Figure 2 illustrates the average responses of gender role attitudes for married women aged 15 to 49 across both survey waves. On average, women reported strongly agreeing to agreeing with the statements, with a mean score of 1.972 (SD = 0.471) in 2010 and a mean score of 2.028 (SD = 0.518) in the subsequent survey. For instance, the mean responses for women to the statements that boys and girls should be treated equally were 1.35 and 1.62 in 2010 and 2016, respectively. This indicates that the overall sample holds a strong degree of egalitarian gender role attitudes and beliefs (intrinsic agency). The highest average response in 2010 and 2016 was 2.66 and 2.47,

respectively, indicating responses between agreeing and being indifferent about these statements overall.

Figure 2. Mean responses of gender role attitudes by question for married women aged 15-49, 2010 and 2016

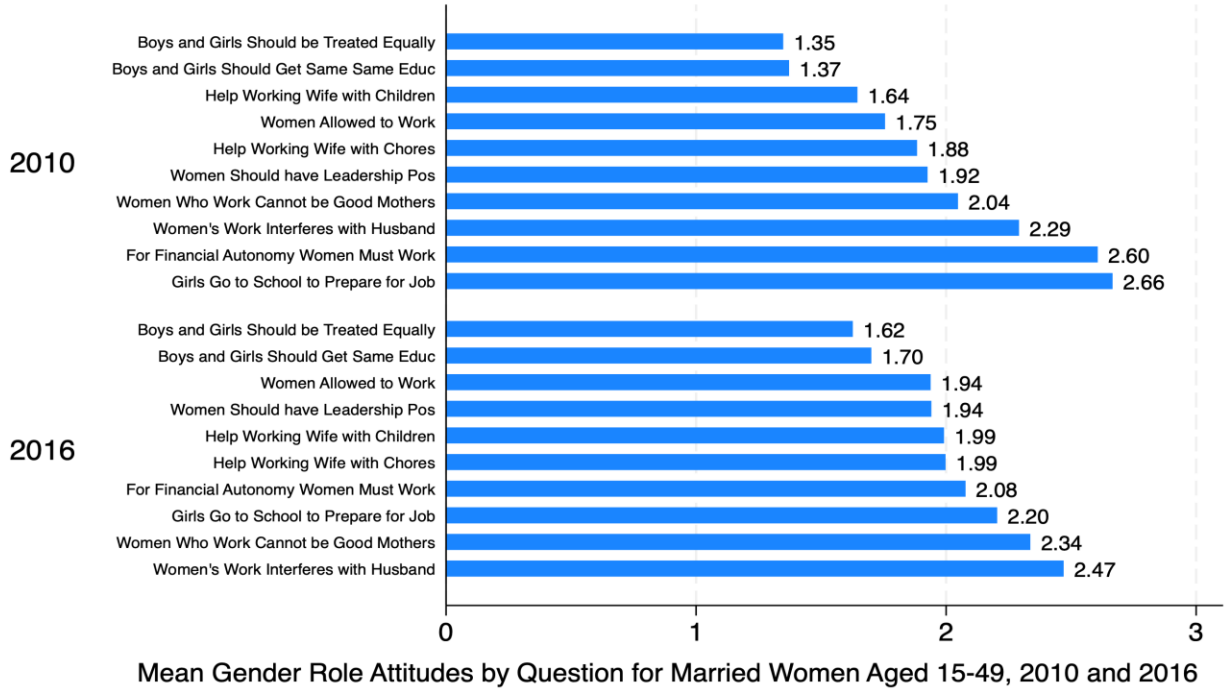


Figure 3 illustrates the average number of births based on education level for both survey waves. It is evident that women with higher educational attainment tend to have lower fertility rates in comparison to those with lower educational levels for the years 2010 and 2016. For instance, women with high education had an average of 3.3 births in 2010 and 2.98 births in 2016, whereas women with lower education had averages of 4.57 births in 2010 and 4.23 births in 2016.

Figure 4 illustrates the average responses regarding gender attitudes based on women's education level across both survey waves. It is evident that women with higher educational attainment tend to have more egalitarian views on gender roles compared to those with lower educational attainment. For instance, in both 2010 and 2016, women with higher education achieved mean scores of 1.83 and 1.89 for gender attitudes, respectively, while women with lower educational attainment had mean scores of 2.01 and 2.09 in the same years, respectively.

Figure 3. Average number of births by education level in 2010 and 2016

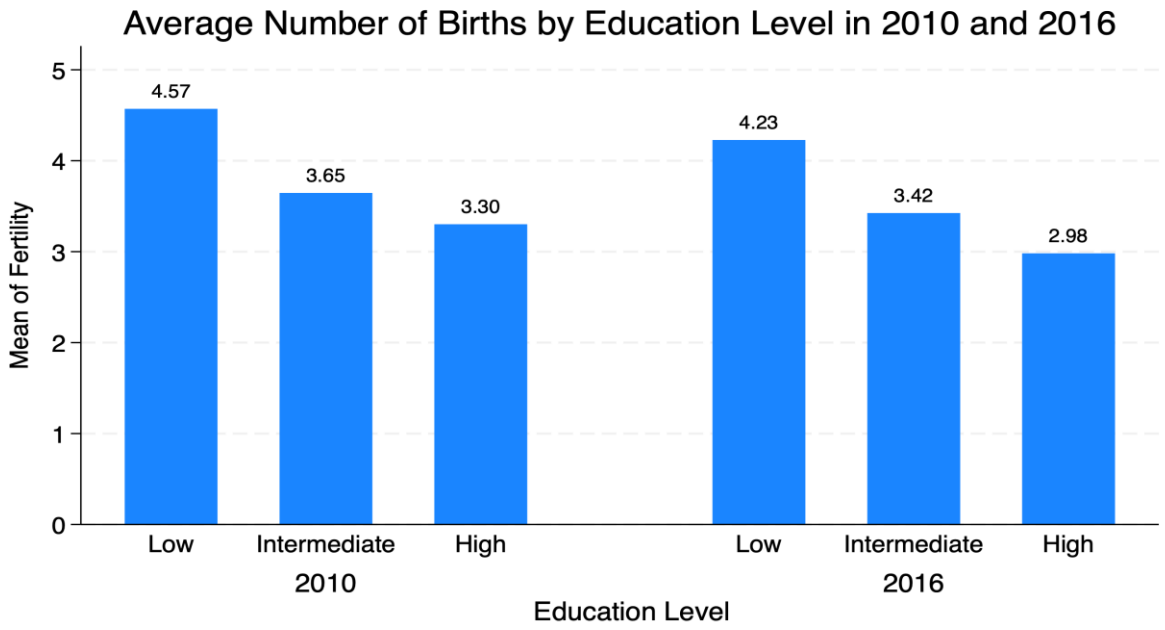


Figure 4. Mean responses of gender role attitudes by education level in 2010 and 2016

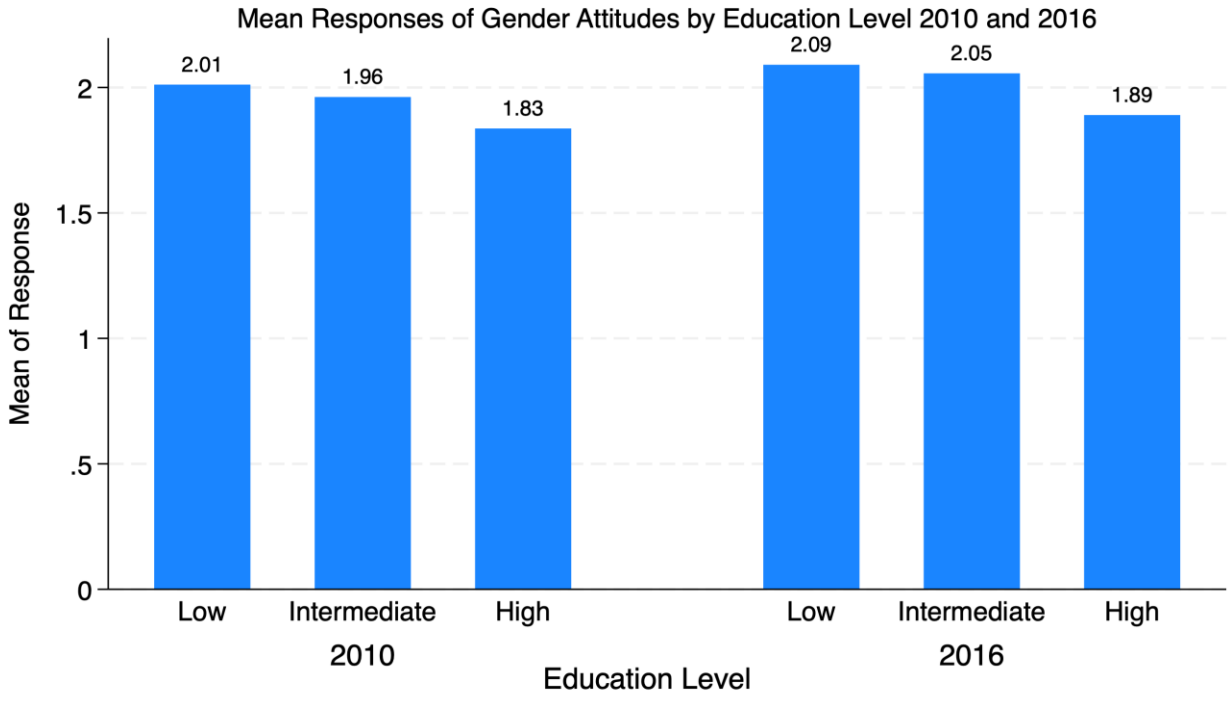
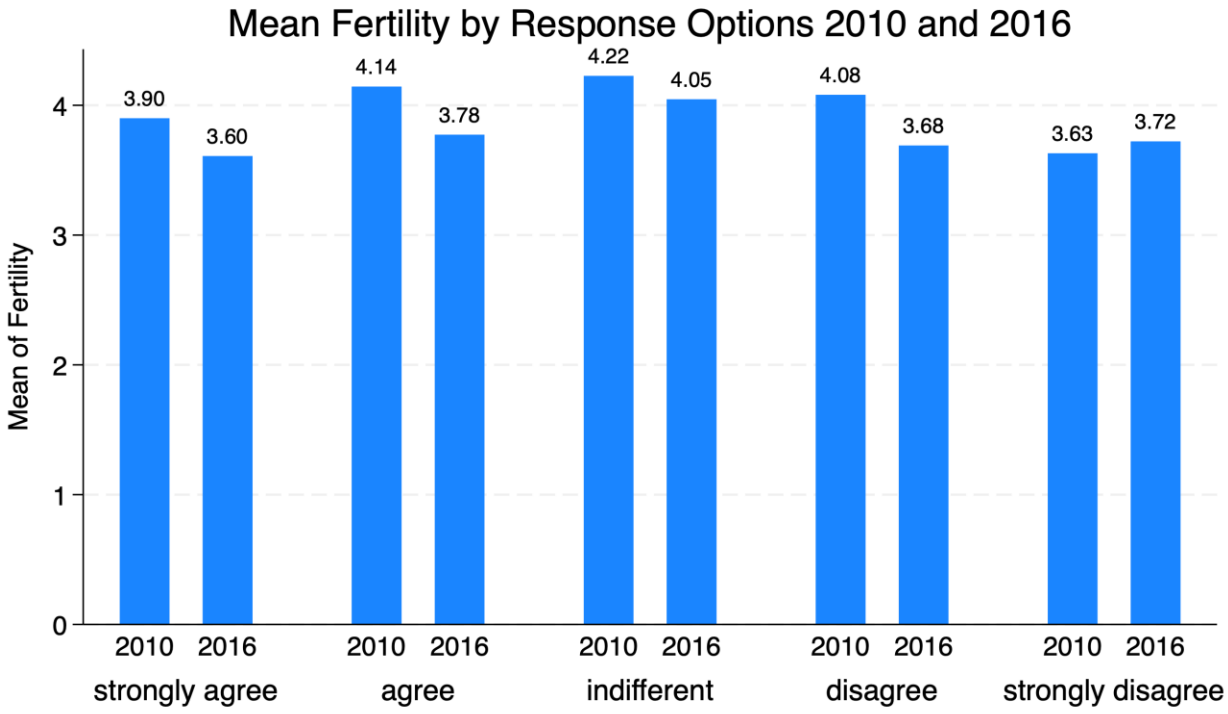


Figure 5 shows the average number of births based on response options. As we move from "strongly agree" to "strongly disagree," there is a general trend of increasing fertility. This indicates that women with more egalitarian responses tend to have slightly lower birth rates. For example, in 2016, women who mostly embraced egalitarian views had an average of 3.6 children. In comparison, those who indicated agreement, indifference, disagreement, and strong disagreement showed average birth rates of 3.78, 4.05, 3.68, and 3.72, respectively, revealing a trend of rising births.

Figure 5. Mean fertility by response options 2010 and 2016



5.3. Ordinary Least Squares (OLS) regression models

Table 3 presents the results of the bivariate ordinary least squares (OLS) regression models of years of education, mean of gender role attitudes, and fertility (Models 1 and 2), as well as the multivariate OLS models that consider education, mean gender role attitudes, and fertility, controlling for other variables for the year 2010 (Models 3 and 4).

Model 1 reveals a statistically significant negative relationship between education and fertility, indicating that for each additional year of schooling, the number of births decreases by 0.212 ($P < 0.001$). The bivariate model analyzing intrinsic agency and fertility (Model 2) demonstrates a significant positive relationship with mean of gender role attitudes ($P < 0.05$). This indicates that for each increase on the scale—reflecting more inegalitarian responses—the number of live births increases by 0.198 ($P < 0.05$).

In Model 3, for each year of increased schooling, the number of births decreases by 0.029 ($P < 0.001$), holding all else constant. In Model 4, when the mean of gender beliefs and attitudes is included in the analysis, the effect of education on fertility decreases slightly to 0.027 ($P < 0.001$). Women with higher mean responses regarding gender role beliefs have more births than those with lower scores (more egalitarian responses) by 0.107 ($P < 0.05$), assuming all other factors are equal. This indicates that, on average, women with more egalitarian views tend to have fewer children than those with traditional perspectives, provided all other factors remain the same. For Model 4, the amount of variance explained by the model increases slightly from .63911 to .63958.

Table 4 presents both bivariate and multivariate ordinary least squares regression models that predict women's fertility in 2016 among married women aged 15–49 years. In Model 1, there is a statistically significant negative relationship between education and fertility. This finding indicates that for each additional year of schooling, the number of births decreases by 0.172 ($P < 0.001$). Model 2 examines the relationship between intrinsic agency and fertility. Each increase in the response scale, which indicates less egalitarian gender role attitudes and beliefs, is associated with an increase of 0.220 births ($P < 0.001$).

In Model 3, each additional year of schooling lowers births by 0.039 ($P < 0.001$) when other factors remain constant. Model 4 includes the mean of gender beliefs, reducing the education effect on fertility to 0.038 ($P < 0.001$). Compared to women with inequitable gender norms, those with higher intrinsic agency and egalitarian beliefs have 0.085 fewer births ($P < 0.05$) when other factors are equal. In Model 4, the explained variance slightly increases from 0.61 to 0.62.

Table 4 presents both bivariate and multivariate ordinary least squares regression models that predict fertility among married women aged 15–49 years in 2016. In Model 1, there is a statistically significant negative relationship between education and fertility. This finding indicates that with each additional year of schooling, the number of births decreases by 0.172 ($P < 0.001$). Model 2 examines the relationship between agency and fertility and reveals a statistically significant positive relationship with mean gender role attitudes. Specifically, a one-unit increase in egalitarian gender role attitudes is associated with an increase of 0.220 births ($P < 0.001$).

In Model 3, the analysis indicates that each additional year of schooling is associated with a decrease of 0.039 in the number of births ($P < 0.001$), with other factors controlled. In Model 4, which integrates mean gender beliefs and attitudes, this effect slightly decreases to 0.038 ($P < 0.001$). Furthermore, women exhibiting greater intrinsic agency and more egalitarian gender beliefs tend to have 0.085 lower births ($P < 0.05$) compared to those adhering to inequitable gender norms. Additionally, the explained variance of the model enhances marginally from 0.61 to 0.62.

Table 3. Bivariate and multivariate ordinary least squares regression models predicting women's fertility (number of births) for married women aged 15–49 years, JLMPS 2010

	Fertility 2010 (Number of Births)			
	Model 1	**Model 2**	**Model 3**	**model 4**
Years of Completed Schooling	-0.212***		-0.029***	-0.027***
	(-0.009)		(-0.008)	(-0.008)
Mean of Gender Attitude		0.198**		0.107**
		(-0.084)		(-0.052)
Urban (Ref = Rural)				
Urban			-0.150***	-0.158***
			(-0.056)	-0.056
Region (Ref = Central)				
North			0.257***	0.260***
			(-0.053)	(-0.053)
South			-0.025	-0.007
			(-0.072)	(-0.072)
Ever Worked (Ref = No)				
Yes			-0.121**	-0.110*
			(-0.06)	(-0.06)
Husband Related by Blood (Ref = Unrelated)				
Related			0.016	0.016
			(-0.05)	(-0.05)
Sex of First Child (Ref = Boy)				
Girl			0.134***	0.134***
			(-0.047)	(-0.047)
Mother's Education (Ref = Low)				
Intermediate			-0.149	-0.154
			(-0.113)	(-0.113)
High			-0.127	-0.12
			(-0.139)	(-0.139)
Age			0.210***	0.210***
			(-0.003)	(-0.003)
Age of First Marriage			-0.224***	-0.223***
			(-0.006)	(-0.006)
Wealth			-0.254***	-0.252***
			(-0.034)	(-0.034)
Intercept	6.348***	3.647***	1.682***	1.437***
	(-0.109)	(-0.17)	(-0.185)	(-0.22)
Number of observations	3290	3290	3288	3288
R-squared	0.13	0.0016	0.63	0.64

*Notes: *** p<.01, ** p<.05, * p<.1. Standard errors in parentheses.*

Table 4. Bivariate and multivariate ordinary least squares regression models predicting women's fertility (number of births) for married women aged 15–49 years, JLMPS 2016

	Fertility 2016 (Number of Births)			
	Model 1	**Model 2**	**Model 3**	**Model 4**
Years of Completed Schooling	-0.172***		-0.039***	-0.038***
	(-0.007)		(-0.006)	(-0.006)
Mean of Gender Attitude		0.220***		0.085***
		(-0.064)		(-0.042)
Urban (Ref = Rural)				
Urban			-0.226***	-0.225***
			(-0.051)	(-0.051)
Region (Ref = Central)				
North			0.252***	0.271***
			(-0.045)	(-0.046)
South			0.122**	0.143**
			(-0.061)	(-0.062)
Ever Worked (Ref = No)				
Yes			-0.161***	-0.155***
			(-0.06)	(-0.06)
Husband Related by Blood (Ref = Unrelated)				
Related			0.107**	0.110**
			(-0.046)	(-0.046)
Sex of First Child (Ref = Boy)				
Girl			0.239***	0.238***
			(-0.041)	(-0.041)
Mother's Education (Ref = Low)				
Intermediate			-0.111	-0.106
			(-0.091)	(-0.091)
High			-0.189	-0.187
			(-0.118)	(-0.118)
Age			0.168***	0.168***
			(-0.002)	(-0.002)
Age of First Marriage			-0.174***	-0.174***
			(-0.005)	(-0.005)
Wealth			-0.080***	-0.077***
			(-0.026)	(-0.026)
Intercept	5.566***	3.308***	1.945***	1.741***
	(-0.08)	(-0.134)	(-0.15)	(-0.181)
Number of observations	4559	4560	4530	4530
R-squared	0.12	0.0025	0.61	0.62

*Notes: *** p<.01, ** p<.05, * p<.1. Standard errors in parentheses.*

Table 5 presents bivariate ordinary least squares regression models predicting women's years of completed schooling. There is a significant negative relationship ($P < 0.001$) between the mean of gender attitudes and the years of completed schooling. This suggests that greater inequitable beliefs among women relate to fewer years of completed schooling in both waves.

Table 5. Bivariate ordinary least squares regression models predicting women's years of completed schooling for married women aged 15–49 years, 2010 and 2016 JLMPS

	Years of Completed Schooling	
	2010	**2016**
Mean of Gender Role Attitudes	-1.299***	-1.577***
	(0.124)	(-0.118)
Intercept	13.629***	13.655***
	(0.249)	(-0.248)
Number of observations	4084	5171
R-squared	0.03	0.03

*Notes: *** p<.01, ** p<.05, * p<.1. Standard errors in parentheses.*

Table 6 presents the bivariate ordinary least squares regression models predicting married women's mean gender role attitudes in both waves. There is a significant negative association between completed years of schooling and the mean gender attitudes ($p < .01$), indicating that as years of schooling increase, women tend to have more egalitarian views. For instance, in 2016, a one-year increase in schooling caused the mean gender attitudes to decline by .021 (becoming more egalitarian). These results show that education can serve as a tool to challenge gender norms since exposure to diverse perspectives and critical thinking skills prompts individuals to question traditional beliefs about gender roles.

Table 6. Bivariate ordinary least squares regression models predicting women's mean of gender role attitudes for married women aged 15–49 years, 2010 and 2016 JLMPS

	Mean of Gender Role Attitudes	
	2010	**2016**
Years of Completed Schooling	-0.020***	-0.021***
	(0.002)	(0.002)
Intercept	2.178***	2.248***
	(0.023)	(0.018)
Number of observations	4084	5171
R-squared	0.03	0.03

*Notes: *** p<.01, ** p<.05, * p<.1. Standard errors in parentheses.*

5.4. Mediation calculations

Table 7 displays the mediation calculations derived from the ordinary least squares analysis, which investigates the link between fertility, women's education, and average gender role attitudes across both waves of data, while adjusting for control variables. The total effect is the sum of the direct effect (completed schooling's impact on live births) and the indirect effect (influence through gender role attitudes).

The results from the bootstrapping mediation analysis show that the total effect is significantly negative, with values of -0.0288 in 2010 and -0.039 in 2016. This indicates that the number of completed schooling years has a statistically significant negative impact on fertility levels when considering both direct and indirect effects through the mediator. In both waves, the direct effect

from the bootstrapping mediation analysis is significantly negative, suggesting that as years of completed education increase, fertility decreases, even when controlling for the mediating variable.

The negative coefficient for the indirect effect indicates that the mediator, gender role attitudes, is adversely influenced by the independent variable, years of completed schooling educational. This negative effect on the mediator subsequently leads to a reduction in the dependent variable, fertility, as determined by the number of live births. However, the statistical significance of this effect is not strong enough to reach definitive conclusions[4].

Table 7. Mediation calculations for ordinary least squares of fertility on women's education and mean gender role attitudes, 2010 (N= 3,288) and 2016 (N= 4,530) JLMPS

	2010					2016				
	coefficient	Bootstrap std. err.	P-value	[95% conf. interval]		coefficient	std. err.	P-value	[95% conf. interval]	
Indirect effect	-0.0014	0.0008	0.0770	-0.0031	0.0001	-0.0011	0.0006	0.0740	-0.0022	0.0001
Direct effect	-0.0273**	0.0089	0.001	-0.04411	-0.0106	-0.0381***	0.0066	0.000	-0.0510	-0.0251
Total effect	-0.02881**	0.0085	0.001	-0.0455	-0.0120	-0.0391***	0.0066	0.000	-0.0521	-0.0261

*Notes: *** p<.001, ** p<.01, * p<.05*

6. Conclusion

6.1. Conclusion and discussion

This innovative longitudinal study offers insights into Jordan's social landscape by examining how education influences fertility rates, specifically through the lens of women's attitudes toward gender roles. The research reveals several key findings: first, there is a clear association between higher education and lower fertility rates among women. Additionally, higher education enhances women's intrinsic sense of agency, which is negatively correlated with fertility rates. Women with higher educational attainment tend to hold more egalitarian gender role attitudes and beliefs compared to those with lower educational attainment. This is especially evident when examining women who may encounter societal pressure to prioritize family roles over academic goals because of the social norms. Interestingly, the study revealed that the mean of gender beliefs and attitudes, as an indicator of intrinsic agency, do not mediate the relationship between education and fertility in both survey waves.

The results emphasize education's transformative role in women's lives, enabling better control over personal and professional choices. It shapes reproductive decisions and enhances agency, highlighting the need for policies that promote women's educational opportunities. To improve

[4] The Sobel-Goodman mediation tests yielded similar results, along with bootstrapping using 2,000 repetitions.

policies' effectiveness, educational programs should align with broader community initiatives aimed at addressing social norms and fostering women's empowerment. Challenges like early marriage, poverty, and cultural expectations can hinder girls' access to education, making it essential to direct attention toward overcoming these obstacles. This empowers individuals and contributes to broader demographic shifts.

Promoting egalitarian gender norms and shared responsibilities fosters equitable relationships and contributes to the reduction of gender-based violence. Essential policies for advancing gender equality in Jordan include ensuring equitable access to education for all genders and providing comprehensive fertility support. Research plays a crucial role in recognizing challenges and assessing the effectiveness of interventions aimed at enhancing egalitarian gender norms.

6.2. Limitations and future research on women's agency, fertility, and education

The JLMPS has gathered extensive data on background circumstances, employment, marriage, and fertility history; however, it does not include women's contraceptive practices, fertility goals, or sexual behavior. Keeping track of this information over time will help us understand how education, personal choices, and birth rates are connected. The JLMPS offers two waves of data on women's empowerment, education, and fertility, improving upon many cross-sectional surveys but limiting robust longitudinal analyses.

Current evaluations of women's agency provide minimal insight into household dynamics. As men were not questioned about their beliefs on gender roles or fertility intentions, the responses solely reflect women's viewpoints, which complicates the understanding of the differences in men's and women's perspectives on household power dynamics and gender attitudes. The data does not accurately portray gender attitudes in critical areas such as women's autonomy over partner choice, education, careers, and expressing their opinions. These elements are essential indicators of gender equality, particularly in the Middle East, where societal pressures frequently limit women's freedoms. Moreover, the 10-item attitude index may overlook deeper cultural pressures—like extended-family expectations, tribal norms, or religious beliefs—that affect childbearing apart from individual survey responses.

Grasping the evolution of women's agency is vital for implementing effective social policies. It is important to tailor research methods to fit cultural contexts. Future research could investigate the pathways of instrumental agency that mediate the relationship between education and fertility, highlighting aspects such as freedom of movement, financial independence, and decision-making in Jordan. Understanding the connection between women's gender role attitudes, education, and reproductive experiences—like puberty, abortion, menopause, and stillbirths—is vital for comprehending women's agency in various contexts. It is also essential to examine how

perceptions of gender roles influence labor dynamics and mental health issues such as depression and anxiety at various stages of women's lives.

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