

Research Article

Assessing the Global Impact of Education and Employment on Life Expectancy: A Gender Based Analysis

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Abstract

This study investigates the differential impact of education and employment on life expectancy across genders using a global dataset, comprising 177 countries. Grounded in the Social Determinants of Health framework and Gender Intersectionality theory, we employ a multivariable regression model to analyze data from the Human Development Index and the World Bank (2022), using life expectancy at birth as the dependent variable and mean years of schooling (a proxy for education) and the unemployment rate (a proxy for employment) as independent variables. Our findings reveal that education significantly influences life expectancy for both men and women, with a stronger effect observed in men. Conversely, the impact of unemployment is statistically significant only for men. Although women exhibit higher overall life expectancy than men, their health quality remains compromised due to systemic marginalization. Interaction effects suggest that men derive greater longevity benefits from both employment and schooling, highlighting gendered disparities in the socioeconomic returns to health. These results underscore the importance of gender-sensitive health, employment and education policies that address unequal access and outcomes. By integrating a gender perspective into cross-country health outcome evaluations, this study contributes to the global health economics literature and provides actionable insights for international development and public health policy aimed at reducing gender-based health inequalities.

Keywords

Education, Employment, Gender, Life Expectancy

1. Introduction

Life expectancy at birth is one of the most fundamental indicators used to assess a population's overall health and wellbeing. Life expectancy refers to the average number of years a person is expected to live from birth, based on current mortality rates. It serves as a comprehensive indicator of overall health and well-being, particularly when used in relation to environmental and social factors [1]. Among these, income and education have consistently emerged as influential factors. Research shows that increased employment rates

often increase income, facilitates better access to healthcare services and improved living conditions, resulting in longer and healthier lives [2]. Similarly, higher educational attainment is strongly linked to better health outcomes, both directly and indirectly. This link is explained through improved economic conditions, stronger social-psychological resources, and healthier lifestyles among the well-educated [3].

Despite this general trend, the effects of employment and education on health are not uniform across genders. Women,

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although experiencing longer life expectancy on average, are disproportionately affected by socioeconomic inequalities. They are more likely to suffer from chronic illness, disability, unemployment, and mental health challenges such as depression and loneliness [4]. Similarly, the gender gap in life expectancy (GGLE), favouring women by about 5 years, is influenced more by behavioural and psychosocial factors than by economic ones. Male longevity is more sensitive to national conditions like GDP, inequality, tobacco use, and life satisfaction, while female longevity responds mainly to GDP and alcohol consumption [5].

The relationship between education and health has been widely studied across various contexts. For instance, Albert and Davia [6], confirmed a strong positive relationship between education and self-reported health across 11 EU countries using eight waves of panel data from 1994–2001. Both secondary and especially tertiary education significantly improve health, though effects vary by country. Additionally, findings supported by Watson and Nilam [7], shows that individuals with lower levels of education tend to have poorer oral health. Gumà and Arpino [8] expanded this discourse by showing how education interacts with other social determinants, such as household arrangements, to shape health outcomes in different European settings.

In addition, Nutbeam [9] highlights health literacy as a key outcome of effective health education, encompassing not only basic skills but also empowerment and critical engagement. He critiques earlier models for overlooking the broader social determinants that limit the impact of health education. To address these gaps, he proposes a health outcome model that emphasizes communication strategies grounded in social, political, and community-based contexts. This approach shifts the focus from individual behaviour change to structural factors influencing health. By promoting critical health literacy, Nutbeam argues for more equitable health outcomes through strategies that empower individuals and communities to better navigate health systems.

Further, one of the most influential social determinants of health is unemployment, as financial independence is strongly linked to improved health outcomes and longer life expectancy. Rogot and Johnson [10] found that disparities in life expectancy were most pronounced across employment categories. For instance, white men aged 25 and included in the labour force lived, on average, 12 years longer than their non-labour force counterparts, while white women in the labour force lived 9 years longer than those outside it. This disparity was even more severe among individuals unable to work: white men in this category had a life expectancy nearly 20 years shorter than those in the labour force, and for white women, the gap widened further to almost 29 years.

Similarly, Laditka [11] observed that African American and white men and women facing high unemployment had significantly lower life expectancy compared to those with lower unemployment rates. Moreover, individuals in high-unemployment groups spent a greater proportion of their

later life with disability. Notably, the study found no significant racial differences between African Americans and whites in how unemployment affected life expectancy and the duration of disability. Supporting this link between employment and health, Tafran and Osman [2] highlighted that rising female labour force participation, increased household income, and poverty reduction were major contributors to Malaysia's increasing life expectancy over recent decades. His study emphasized that to further improve health outcomes, policies must aim at eradicating poverty and minimizing unemployment to sustainable economic levels.

Gender-specific health disparities are further compounded by intersecting variables such as race, ethnicity, and socioeconomic status. Benoit et al. [12] examined the importance of integrating sex and gender within a broader intersectional analysis of health inequities in Canada. It emphasizes that socioeconomic status, race, immigrant status, and geography all influence the health of Canadians—especially girls and women—amid structural changes and a weakening social safety net. Additionally, findings from Rochellea et al. [5] indicate that alcohol consumption and life satisfaction play significant roles in shaping the Gender Gap in Life Expectancy (GGLE), with men disproportionately affected by harmful alcohol use and benefiting more from increased life satisfaction.

Moreover, Alam [4] reports that despite increased life expectancy, older women in Bangladesh experience greater suffering due to chronic illness, economic insecurity, anxiety, and depression. This highlights the need to consider sex and gender differences in health-related policymaking. Achieving gender equity in health requires targeted government and policy interventions—particularly those aimed at enhancing women's quality of life, challenging gender stereotypes, and promoting community engagement. Similarly, Assari [13] demonstrates that the health benefits of employment in the United States are unequally distributed, with women, Black individuals, and those with lower education levels gaining fewer health advantages compared to their more privileged counterparts.

This underlines the critical importance of integrating gender-sensitive perspectives into the formulation of health policies and the design of public health interventions. Recognizing that men and women experience health risks and benefits differently due to both biological and sociocultural factors, it becomes essential to tailor policies that specifically address these disparities. Promoting health equity involves not only challenging deeply rooted gender stereotypes but also creating supportive environments that empower marginalized groups—particularly women and gender minorities—to actively participate in shaping health decisions. Such inclusive, community-driven approaches are vital for ensuring that health systems are responsive, just, and effective for all segments of the population.

Based on the above, this study aims to evaluate how education and employment impact life expectancy for men and women globally. By using recent global datasets and applying

a gender-disaggregated analysis, it contributes to the existing literature by offering evidence-based insights to inform more equitable and targeted public health policies. Based on this objective, the study tests the following hypotheses:

- 1) Education affects the life expectancy of both genders.
- 2) The effect of education on life expectancy is more pronounced for males than females.
- 3) Unemployment rate impacts the life expectancy of both genders.
- 4) The negative effect of unemployment is stronger for males than for females.

2. Methods and Materials

2.1. Conceptual Framework

This study is grounded in the Social Determinants of Health (SDH) framework and Gender Intersectionality theory to examine the impact of education and employment on life

expectancy across genders. The SDH framework posits that non-medical factors-such as socioeconomic status, education, and living conditions-significantly shape health outcomes [14]. To enrich this analysis, Gender Intersectionality theory [15] is employed to recognize that health outcomes are not only shaped by socioeconomic factors in isolation, but also by their interaction with gender. This perspective allows for an exploration of how structural inequalities and gendered access to resources affect the relationship between education, income, and life expectancy.

The conceptual framework assumes, as shown in Figure 1, that:

- 1) Education and employment positively influence life expectancy by improving knowledge, access to healthcare, and living standards.
- 2) These influences are mediated by gender, whereby the strength and nature of these effects may differ for men and women due to their different social status.

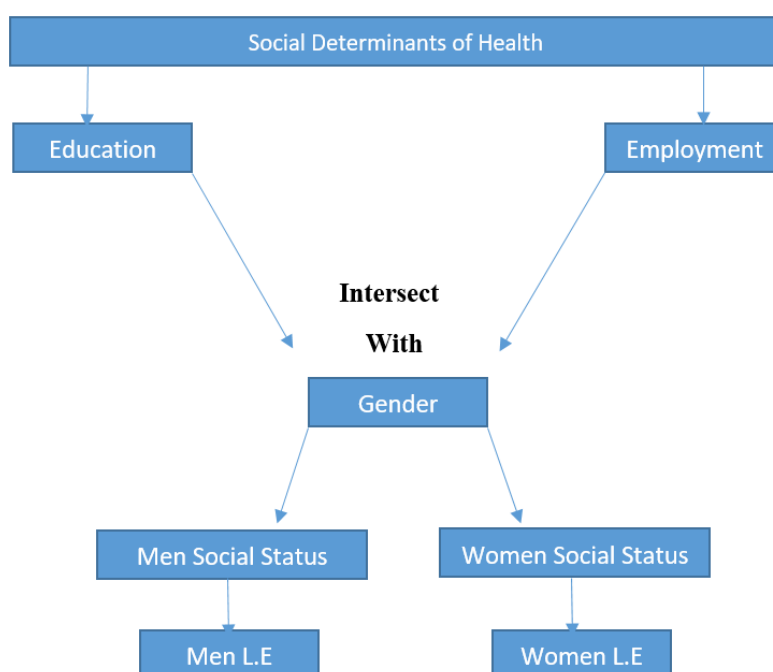


Figure 1. Conceptual Framework.

2.2. Sampling and Data Source

This study utilizes secondary data from the 2022 Human Development Reports (HDR) and the World Bank Open Data. Three gender-disaggregated indicators were selected for analysis: Life Expectancy at Birth, Mean Years of Schooling, and the Unemployment Rate. Due to missing values in some datasets, the final sample comprises 177 countries. These indicators were chosen based on their relevance to SDG targets and their widespread use in global development research.

2.3. Variables

1) Dependent Variable

Life expectancy at birth, measured in years, is used in this study as the dependent variable and serves as a proxy for population health. It represents the average number of years a new-born is expected to live under prevailing mortality conditions [16]. As a comprehensive health indicator, it reflects the cumulative effect of various social determinants such as income, education, access to healthcare, nutrition, and living

conditions [1]. Its use allows for assessing how broader socioeconomic factors influence overall health outcomes across populations, making it a widely accepted and robust variable in development and health-related research.

2) Independent Variables

Mean years of schooling, a proxy for education, defined as the average number of completed education years among adults aged 25 and older, serves as an important indicator of human capital and educational attainment [17]. It influences various socioeconomic and health outcomes by enhancing knowledge, skills, and health awareness [3]. Conversely, the unemployment rate, a proxy for employment, measuring the percentage of the labour force actively seeking but unable to find work [18]-reflects economic conditions that can adversely affect household income, mental health, and access to resources. Together, these variables are used in this study as independent

factors to examine their effects on dependent variables such as life expectancy, highlighting how education and labour market conditions shape overall population well-being.

3) Dummy Variables

The gender variable in this study is coded as a binary dummy variable, where Men is assigned a value of 0 and Women is assigned a value of 1. This coding facilitates quantitative analysis by allowing the model to distinguish between the two groups and examine gender-based differences in the dependent variables.

2.4. Statistical Model

To evaluate the relationships between employment, education, and life expectancy by gender, the study uses multivariable linear regression analysis.

$$\text{Life Expectancy}_i = \beta_0 + \beta_1(\text{Education}_i \times \text{Men}_i) + \beta_2(\text{Unemployment}_i \times \text{Men}_i) + \beta_3 \text{Women}_i + \beta_4(\text{Education}_i \times \text{Women}_i) + \beta_5(\text{Unemployment}_i \times \text{Women}_i) + \epsilon_i$$

Where:

Life expectancy at birth reflects the average number of years a new-born is expected to live, indicating overall health and living conditions. Education is measured by mean years of schooling, representing the average number of completed years of education by adults aged 25 and older. Unemployment rate captures the proportion of the labour force without jobs, while gender-specific dummy variables for men and women help analyse disparities in employment outcomes

across sexes.

Model performance was assessed using adjusted R^2 to account for the number of predictors and provide a robust measure of explanatory power. All independent variables were tested for multicollinearity using the Variance Inflation Factor (VIF), and results indicated acceptable levels ($VIF < 5$ for all variables). Heteroscedasticity was examined using the Breusch-Pagan test, and robust standard errors (HC3) were used where necessary to ensure valid inference.

3. Results

3.1. OLS Results

Table 1. OLS Results.

Variable	Coefficient	Robust Std. Error	t-Ratio	p-Value	Significance
Constant	54.2693	1.29245	41.99	<0.001	***
Men Mean Years of Schooling	1.83105	0.117418	15.59	<0.001	***
Men Unemployment Rate %	-0.295592	0.0781060	-3.784	0.0004	***
Women	6.57203	1.72819	3.803	<0.001	***
Women Mean Years of Schooling	1.68456	0.0940233	17.92	<0.001	***
Women Unemployment Rate %	-0.107309	0.0716864	-1.497	0.1353	

Model F test statistics: 153.9257

The regression results in Table 1, provide support for several of the proposed hypotheses regarding the relationship between education, unemployment, and life expectancy across genders. The constant term is statistically significant,

indicating a strong baseline level of life expectancy in the absence of the other variables.

Education shows a statistically significant and positive effect on life expectancy for both men and women, supporting

the first hypothesis. Specifically, an additional year of schooling for men increases life expectancy by approximately 1.83 years, while for women, it increases life expectancy by about 1.685 years. Both coefficients are highly significant with p-values less than 0.001. This confirms that education contributes positively to life expectancy for both genders.

When comparing the magnitude of the coefficients for men and women education, the effect of education on life expectancy appears slightly more pronounced for men than for women (1.83 vs. 1.65). This difference suggests that additional years of schooling may yield a somewhat stronger impact on men's life expectancy. Although the difference is not substantial, it lends partial support to the second hypothesis, which posits that the effect of education on life expectancy is more pronounced for men than for women.

The unemployment rate also exhibits a negative effect on life expectancy, partially confirming the third hypothesis, though with gender-specific differences. For men, the unemployment coefficient is approximately -0.3 and statistically significant ($p = 0.0004$), indicating that a 1% increase in men unemployment is associated with a 0.30-year reduction in male life expectancy. In contrast, the women unemployment coefficient is approximately -0.11 and statistically insignificant ($p = 0.1353$), suggesting that the effect of unemployment on women life expectancy is weaker and not statistically distinguishable from zero in this model.

These results support the fourth hypothesis, showing that the negative effect of unemployment on life expectancy is stronger and more robust for men than for women. The insignificance of the women unemployment rate further highlights the gender disparity in how unemployment affects health outcomes, potentially reflecting differences in labour market roles or social resilience mechanisms between men and women.

In addition to the four hypotheses, the dummy variable women used in the model also turns out to be significant and with a positive coefficient (coefficient = 6.57, $p = 0.0002$). It means that considering education and employment, the average life expectancy of women is about 6.6 years longer than men. This result can also be matched with other current trends and literature used in the world as it demonstrates that a female is likely to live a longer life due to both biology and behaviour.

Overall, the model aligns well with the theoretical expectations, with education consistently enhancing life expectancy across genders and unemployment demonstrating a harmful but gender-differentiated impact.

3.2. Multicollinearity

Variance Inflation Factor (VIF) was used to measure multicollinearity between the independent variables, where each predictor was measured. VIF is the measure of the extent to which the variability of a regression coefficient is exaggerated by collinearity with other regressors. Multicollinearity is

generally assessed by the VIF value, where VIF greater than 10 is quite possibly high. Nonetheless, some authors go further and consider $M = 5$ as a setting of high multicollinearity.

Table 2. Variance Inflation Factor (VIF) for Independent Variables.

Variable	R ² R ²	VIF
Men Mean Years of Schooling	0.673	3.058
Men Unemployment Rate	0.3664	1.578
Women Mean Years of Schooling	0.630164	2.704
Women Unemployment Rate	0.34028	1.516

Table 2 shows that all the VIF values are significantly lower than the standard cut-off point of 10 (see the table), it can be indicated that multicollinearity is not a serious issue in this model. The greatest VIF was of the men mean years of schooling (VIF = 3.058), then came the women mean years of schooling (VIF = 2.704). Although on a relatively higher level compared to the others, these values still manifest a moderate degree of multicollinearity that should not be addressed through corrective practices like the removal and transformation of variables.

In this way, it is possible to conclude that the multicollinearity between independent variables included in the model is not problematic, and the regression outcomes may be discussed with a relative certainty of its stability (regarding the values of the estimated coefficients).

3.3. Heteroscedasticity

In order to test the existence of heteroskedasticity in the regression system, the Breusch-Pagan test was taken using 354 observations. In auxiliary regression, the scale of the squared residuals (dependent variable) was regressed by men mean years of schooling, men unemployment Rate, women dummy, women mean years of schooling, and women unemployment Rate as a set of explanatory variables. Table 3 shows that the Lagrange Multiplier (LM) statistic of the test was 11.82 with a p-value of 0.0373 implying that the heteroskedasticity was significant at a level of 5%.

Women unemployment rate was important among the explanatory variables ($p = 0.0026$), which shows that it is the factor that adds to the variation in the residuals. Other factors that included men mean years of schooling, men unemployment rate, women dummy, and women mean years of schooling were not statistically significant.

Seeing that heteroskedasticity existed, regression was corrected with the help of heteroskedasticity-consistent standard errors (HC3) to be certain that the inferences would be robust. The HC3 correction gives more accurate standard errors in the case of heteroskedasticity, especially sample of modest sizes.

Table 3. Breusch-Pagan Test for Heteroskedasticity.

Variable	Coefficient	Std. Error	p-value
Constant	1.0374	0.3822	0.0070 ***
Men Mean Years of Schooling	0.0017	0.0362	0.9628
Men Unemployment Rate	0.0010	0.0203	0.9612
Women	-0.2520	0.4992	0.6141
Women Mean Years of Schooling	-0.0261	0.0301	0.3874
Women Unemployment Rate	0.0451	0.0149	0.0026 ***

P Value: 0.0373

Test Statistics LM: 11.82

3.4. Model Specification

In order to test the validity of the functional form of the regression model, the Ramsey RESET test was used. To check whether any non-linear relationships which might have been ignored, a squared form of the fitted values was incorporated as a regressor using the auxiliary regression. The auxiliary regression results in Table 4 indicated that coefficient on y squared was not statistically significant ($p = 0.4519$)

which gave no evidence of model misspecification caused by omitting non-linear terms. The general F statistic of the RESET analysis was 0.5671 with the related p-value of 0.452, which is significantly higher than the standard levels of significance. Such outcomes defend the conclusion that the current form of the model based on the linear specification is properly specified.

Table 4. Ramsey RESET Test Auxiliary Regression.

Variable	Coefficient	Std. Error	p-value
Constant	38.5554	20.9137	0.0661 *
Men Mean Years of Schooling	0.4106	1.8909	0.8282
Men Unemployment Rate	-0.0709	0.3076	0.8179
Women	1.9219	6.4416	0.7656
Women Mean Years of Schooling	0.2881	1.8577	0.8769
Women Unemployment Rate	-0.0165	0.1324	0.9011
$\hat{Y}^2$ ($y\text{hat}^2$)	0.0057	0.0075	0.4519

F Test: 0.5671

P Value: 0.452

3.5. Normality of Residuals

To test the assumption that the residuals follow the normal distribution, histogram of the residuals was drawn including the curve of normal distribution. Figure 2 shows that the residual portrays a rather normal shape, though to some extent, there is a discrepancy in terms of normality, which is evident by the skewed tendency to the right. The formal Chi-square

test for normality with having a test statistic as 9.345 with a p-value of 0.0093 is statistically significant at a 1% level. This finding indicates that residuals are not normally distributed, and the classical linear regression model is not accurate in accordance with the underlying assumptions about the normality of residuals. Although the violation occurs, it is important to remember that robust standard errors (HC3) as have already been mentioned previously reduce the issues of inference validity that could be given by non-normal residuals.

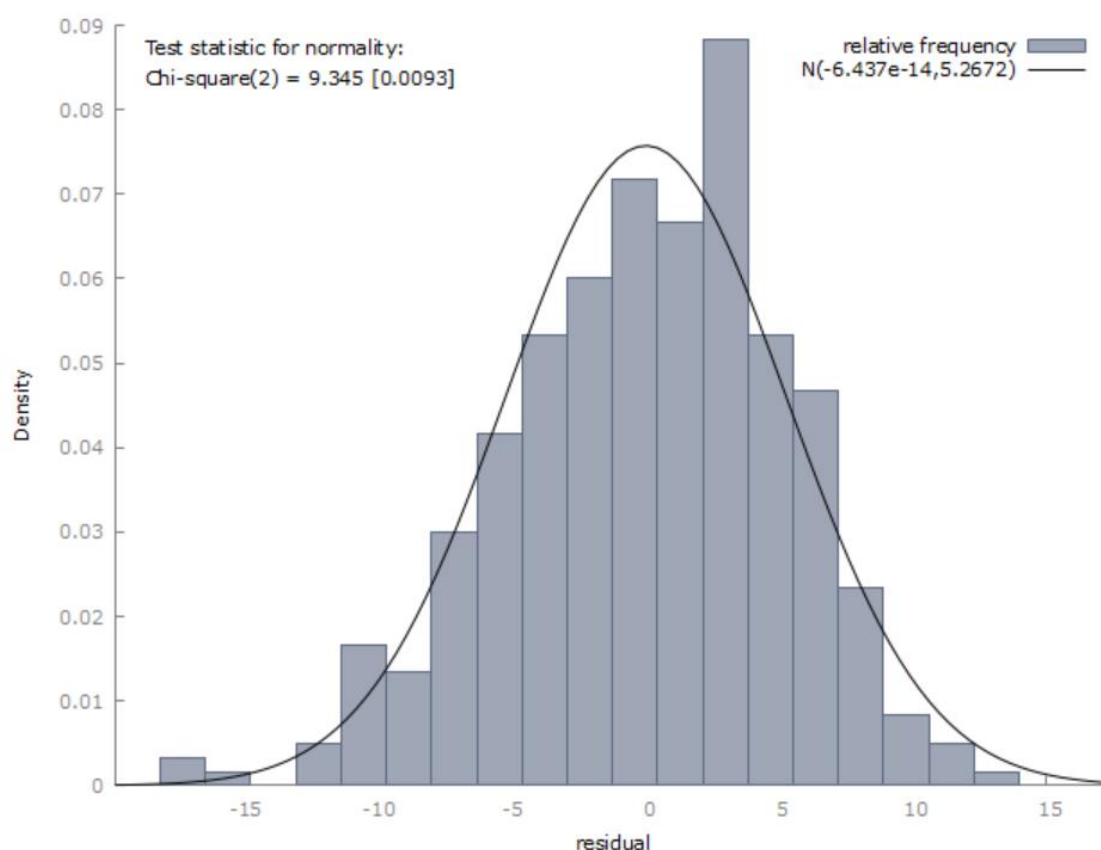


Figure 2. Histogram of Residuals with Normal Distribution Overlay.

4. Discussion

First, the positive and highly significant coefficients for both men and women mean years of schooling (1.83 and 1.65 respectively, $p < 0.001$ for both) confirm the first hypothesis, that education positively affects life expectancy for both genders. This finding aligns closely with the literature emphasizing the fundamental role of education in improving health outcomes. As discussed by Albert and Davia [6] and Nutbeam [9] education improves not only economic opportunities but also health literacy, self-care capabilities, and access to healthcare services. These effects are evident across different contexts and are reflected in the data here, where each additional year of schooling corresponds to a substantial gain in life expectancy for both men and women.

The second hypothesis, that the effect of education on life expectancy is more pronounced for men than women, receives a weak but clear support. Both sexes benefit under any educational improvement, the men education coefficient is slightly higher than that of the women (1.83 vs. 1.69), tipping the balance of facilitating such educational gains slightly towards the men. Men's life expectancy increase by 1.83 years as compared to 1.69 years for women. This clearly illustrates the intersectional effect of education on the genders, which results in different health outcomes for both [15].

Support for the third hypothesis, that unemployment affects

life expectancy for both genders, is mixed and gender-dependent. The men unemployment rate shows a statistically significant negative effect on life expectancy (coefficient = -0.2956 , $p = 0.0002$), suggesting that each 1% increase in men unemployment reduces men life expectancy by about 0.30 years. This confirms past findings, such as those of Rogot and Johnson [10] and Laditka [11], who documented strong links between employment status and life expectancy, particularly among men. Employment provides not only income but also social structure, purpose, and access to healthcare-factors particularly salient in male health outcomes due to gendered social expectations around breadwinning roles.

In contrast, the women unemployment rate coefficient is negative but statistically insignificant (-0.1073 , $p = 0.1353$), indicating that while unemployment may negatively impact women life expectancy, this relationship is weaker and less certain in the current model. This finding is consistent with research by Assari [14], which emphasizes that women may not reap the same magnitude of health benefits from employment as men, often due to labour market segregation, lower earnings, and double burdens of work and unpaid care. Moreover, Rochellea et al. [5] and Alam [4] highlight that women's health is more heavily influenced by non-economic factors, such as chronic illness, social exclusion, and mental health issues, which may buffer or complicate the direct link between unemployment and longevity.

Finally, the fourth hypothesis, that the negative effect of unemployment is stronger for men than for women, is clearly supported by the data. The men unemployment effect is both larger in magnitude and statistically significant, whereas the women effect is smaller and insignificant. This reflects gendered pathways through which socioeconomic status influences health, a point stressed in multiple studies, including those by Tafran and Osman [2]. Male health appears to be more tightly linked to labour market conditions, possibly due to social role pressures and behavioural health risks associated with unemployment (e.g., stress, substance use), as suggested by Rochellea et al. [5].

In conclusion, the results validate the core proposition that education significantly improves life expectancy for both genders, while unemployment reduces life expectancy more strongly for men than women. These findings underscore the need for gender-sensitive health and labour policies. While promoting education remains universally beneficial, addressing male vulnerability to labour market shocks and women exposure to non-economic health stressors is essential to achieving equitable health outcomes across genders.

5. Conclusion

This study investigates the gendered impact of education and employment on life expectancy across countries, offering fresh insights grounded in global data. The results confirm that both education and employment are significant determinants of life expectancy, yet their effects vary notably by gender. Educational attainment is positively and significantly associated with life expectancy for both men and women, supporting the broad literature that links education to healthier lifestyles, greater health awareness, and improved socioeconomic conditions. Similarly, the slightly stronger effect observed for men suggests that men may benefit more from education in terms of longevity, likely due to different gender roles and expectations as predicted by Gender Intersectionality theory. In contrast, unemployment negatively affects men life expectancy significantly, while its impact on women life expectancy is statistically insignificant. This finding reflects traditional gender roles and socioeconomic structures where employment plays a more central role in shaping male identity and well-being. The consistently higher life expectancy for women, as captured by the significant female dummy variable, further reinforces the well-documented Gender Gap in Life Expectancy (GGLE), though this longevity advantage often masks underlying disparities in health quality, chronic illness, and socioeconomic vulnerability among aging women.

Overall, the study highlights the importance of adopting gender-sensitive approaches in health and development policy. Improving educational access and employment opportunities for all, while tailoring interventions to address gender-specific health risks and structural inequalities, is essential for achieving equitable and sustainable improvements in popula-

tion health. Future research should further explore the intersections of gender with other social determinants such as race, income inequality, and healthcare access to inform more inclusive public health strategies.

Abbreviations

GGLE	Gender Gap in Life Expectancy
VIF	Variance Inflation Factor
OLS	Ordinary Least Square
LM	Lagrange Multiplier

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the author used *ChatGPT*, a language model developed by OpenAI, in order to assist with language refinement, conceptual clarity, and structural organization of the manuscript. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Conflicts of Interest

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research was conducted independently and without any external financial support.

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