ACCSCIENCE PUBLISHING

ISSN: 2424-8150 (Print)
ISSN: 2424-8606 (Online)
Volume 9 · Issue 2
August 2023

INTERNATIONAL JOURNAL OF POPULATION STUDIES

International Journal of Population Studies

Print ISSN: 2424-8150

Online ISSN: 2424-8606

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Volume 9 • Issue 2 • August 2023
ISSN 2424-8150 (print) ISSN 2424-8606 (online)

INTERNATIONAL JOURNAL OF POPULATION STUDIES

ACCSCIENCE PUBLISHING
Access Science Without Barriers

International Journal of Population Studies

ISSN: 2424-8150 (print)

ISSN: 2424-8606 (online)

Editorial and Production Credits

Publisher: AccScience Publishing
Managing Editor: Alicia Tian
Production Editor: Sharmila Velapasamy
Special Issue Commissioning Editors: Alicia Tian, Eva Liu
Article Layout and Typeset: Sinjore Technologies (India)
Cover Design: ProPub (China)

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International Journal of Population Studies

RESEARCH ARTICLE

Explaining the gender gap in reproductive transition of Ethiopian youths: A decomposition analysis

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Abstract

The achievement of gender equality and ending all forms of disparity in the spheres of sexual and reproductive health are critical components of sustainable development goals. We endeavor to investigate the characteristics and/or structural sources of the gender gap in the reproductive transition among Ethiopian youths. The analysis was carried out using parts of data drawn from the 2011 and 2016 Ethiopian Demographic and Health Survey. The decomposition of the gender gap in the reproductive transition of youths into components was made using the Blinder-Oaxaca decomposition analysis for non-linear models. The results demonstrate that the delay in the age at first marriage among the youth was accompanied by an increase in the prevalence of premarital sex. Furthermore, the findings show that the gender gap in reproductive transition is triggered by both compositional and structural effects of covariates such as education, modern contraceptive use, and media exposure. Thus, in addition to reducing inequalities in education, media exposure, and deprivation between male and female youths, working on the structural components is recommended to close the gender gap in the reproductive transition of youths.

Keywords: Youths; Reproductive transition; Gender gap; Decomposition analysis; Ethiopia

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Citation: Dejene, T., & Gurmu, E. (2023). Explaining the gender gap in reproductive transition of Ethiopian youths: A decomposition analysis. *International Journal of Population Studies,* 9(2): 1-11. https://doi.org/10.36922/ijps.476

Received: March 3, 2023

Accepted: April 6, 2023

Published Online: April 17, 2023

1. Introduction

In many areas, including education, health, and economic empowerment, there is a significant gender disparity, particularly in developing nations (Jayachandran, 2015). Goal 5 of the Sustainable Development Goals (SDG) promises an end to all forms of gender disparity everywhere and to achieve gender equality by 2030. However, the United Nations admits that the world is falling behind in terms of progress toward gender equality (UNDESA, 2023). The inequality is caused by a complex set of factors, including economic and cultural norms, as well as the interaction of these factors (Jayachandran, 2015).

Ethiopia is one of Africa's demographic powerhouses (Hailemariam, 2017). Women and girls constitute half of Ethiopia's population (Ethiopian Statistics Service, 2020), and they are more vulnerable than men. In Ethiopia, a woman's worth is determined by her role as a wife and a mother, and compared to men, women face a wide range of barriers and have limited access to economic, social, and political empowerment (Dessalegn

et al., 2020; Dula, 2019). One of the most significant barriers is lack of access to education. Only 44.4% of Ethiopian women over the age of 15 are literate, compared to 59.2% of men in 2017 (UNESCO, 2023). This not only limits their ability to participate in the workforce but also perpetuates a cycle of poverty and discrimination. Further, women also lack of access to healthcare due to factors such as poverty and limited knowledge about the importance of healthcare including childbirth and contraceptive use. This leads to unplanned pregnancies and increased risk of maternal and child mortality (Jebena *et al*., 2022; Kitila *et al*., 2023; Tamirat *et al*., 2020).

In an attempt to alleviate the highly persistent gender inequality, Ethiopia made a shift in policy thinking and passed several legislations. One of the various initiatives Ethiopia has undertaken is the family law, which advocates equal rights in the administration of the family and sets the minimum age for marriage at 18 (Federal Democratic Republic of Ethiopia, 2000). Early sexual initiation, child marriage, and adolescent birth rates all significantly decreased when the law went into effect. The occurrence of the drop in both rural and urban places lends credence to the notion that strong legal frameworks for gender equality may operate as potent accelerators for cultural change (Rokicki, 2021).

Despite the improvements scored in areas of adolescent and youth reproductive health, gender inequality remained to be a significant challenge in Ethiopia. Early marriage is still prevalent, and adolescent girls often married off before they are physically and emotionally mature (CSA [Ethiopia] & ICF International, 2016). Child marriage robs young girls of an education and puts them at risk of exploitation and pregnancy-related complications (Abera *et al*., 2020). Thus, early marriage and parenthood serve to reinforce traditional gender roles and expectations, which perpetuates gender disparity. As a result of which, young girls' agency and autonomy may be restricted, and patriarchal beliefs and behaviors may be maintained.

The reproductive behavior of youths is changing over time, and youths' transition to family formation and parenthood generally shifted from the traditional pattern and followed a variety of patterns in Ethiopia. In a recent study, sex was noted as a significant element that led to the disparities in the reproductive trajectories of the youth in Ethiopia (Dejene & Gurmu, 2022). Even though there was a large body of literature that studied the issue of early marriage and parenthood among young females (Blum, 2007; Koski *et al*., 2017; Nguyen & Wodon, 2015; Wado *et al*., 2019), the driving forces of the gender gap were not well studied. To shrink and/or eliminate the gender gap in the timing of the reproductive transition of youths, a thorough understanding of the underlying causes is essential. As such, we base our work on the premise that gender inequality in the timing of the reproductive transition is spanned by structural effects of covariates as well as differences in characteristics between male and female youths.

1.1. Theoretical grounding of the research

The life-course theory, which places developments in people's lives in both personal characteristics and larger social contexts, served as the study's overarching theoretical framework. The theory posits that prior and current life stages influence the trajectory of life experiences of individuals and families. Thus, in view of the life-course theory, the interplay between socioeconomic, environmental, and behavioral factors are considered the underlying drivers of trajectories over lifespan (Chen & Lin, 2011; Piccarreta & Studer, 2019). Such consideration of the interdependence between different stages of life enables the comparative study of the life-course experiences.

Reproductive transition disparity in developing nations can be related to a number of variables, including lack of access to education and healthcare and poverty. The previous reports indicated that educational attainment, household wealth, exposure to media, and economic reasons were the major factors that influenced the timing of reproductive transitions of African young females (Usman *et al*., 2018; Wado *et al*., 2019). Socio-economic deprivation exacerbates reproductive transition inequality by restricting access to essential resources and increasing the likelihood of early marriage and childbearing among adolescents. Similarly, due to a lack of education, there may be a lack of awareness about family planning and reproductive health, resulting in an unmet need for contraception and unplanned childbirth (Munakampe *et al*., 2021).

With a better access to a healthcare, contraceptive use becomes more widespread, leading to delayed childbearing and a longer interval between children. As a result, women would have a better chance of maintaining their health and avoiding complications that can arise from too many pregnancies close together. Moreover, by delaying the first birth, young women have a higher chance to complete their education and gain employment, leading to greater opportunities in life (Diez *et al*., 2020; Stevenson *et al*., 2021). Overall, contraception can aid in removing obstacles to education and raising chances for success by lowering unintended pregnancies and giving women the power to make decisions about their life.

In addition, after controlling for individual characteristics, a study from West Africa reported that

community-level factors such as community literacy and level of socioeconomic deprivation were found to be predictors of union formation and childbearing. In more affluent communities and communities with higher levels of education, young people tend to delay sexual activity and use contraception more consistently. In contrast, in communities with lower socioeconomic status and limited education, young people are more likely to engage in risky sexual behavior, have higher rates of unintended pregnancies, and are less likely to use contraception. Ultimately, community affluence and education can greatly impact the reproductive behaviors of youth and their overall health outcomes (Avogo & Somefun, 2019).

Holding the perspective that both endowment and structural effects are needed to evaluate mechanisms of closing the gender gap in the timing of the reproductive transition, both individual and community-level factors are used. Therefore, our study aims at comparing the reproductive transition experiences of male and female youths in their life course before age 25. The structural elements and underlying characteristics differentials that contributed to the gender disparity have also been evaluated using a decomposition analysis framework.

2. Data and methods

2.1. Data source

The data for this study were drawn from the two most recent Ethiopian Demographic and Health Surveys (EDHS), which were conducted in 2011 and 2016. The EDHS was a large-scale cross-sectional survey conducted to offer estimates of key demographic and health variables for the nation as a whole, urban, and rural areas separately, and each of the nine regions of Ethiopia and two city administrations separately. The data were gathered using a stratified two-stage cluster sampling technique. The probability proportional to size technique was used to select 624 clusters in the 2011 and 645 clusters in the 2016 survey. During stage two selection, a full listing of households in the selected clusters was conducted, and 28 households were chosen from the list of households (CSA [Ethiopia] & ICF International, 2012, 2016). The investigation was limited to the Oromia Regional National State because the region is home to a substantial portion of Ethiopia's youth population (38.3%), who come from a variety of cultural backgrounds (Ethiopia Statistics Service, 2021; Yates, 2011; 2020). Although both male and female data were utilized, the gender gap decomposition analysis is focused only on the data drawn from the 2016 EDHS. The data utilized for our study are publicly available at the following web address (http://www.measuredhs.com/data/available-datasets.cfm) and can be accessed free-of-charge.

2.2. Variables and measurements

The main outcome variables of the study are the gender gap in distributions of the reproductive transitions of youths. The gender gap in these reproductive indicators is assessed using the cumulative incidence functions (CIFs) of these reproductive events over the age of youths. Rather than an instantaneous measure of the risk of reproductive transition, CIF gives the proportion of youths that have ever experienced an event at any given time (Hinchliffe & Lambert, 2013; Latouche *et al*., 2013). This property of CIF makes it desirable for the gender gap analysis over the instantaneous measure. The detailed gender gap decomposition was made for debut to sex and parenthood experiences at ages 20 and 25. For the transition to first sex, the timing of first sex either prior or within marriage was considered.

Individual and group-level variables (i.e., household and community level) are considered predictors in the gender gap decomposition analysis. The description of these variables is available in the standard recode manual of the Demographic and Health Survey (DHS) (ICF, 2018). The list of variables, their coding, and descriptions is shown in Table 1.

2.3. Data processing and analysis

The data management, editing, and analysis were conducted using STATA 17.0 (StataCorp, 2021). First, a sex- and birth cohort-specific cumulative incidence of events was computed using the command *stcompet* (Coviello & Boggess, 2004). The command creates CIF in the presence of competing risks. For the transition to parenthood, however, the CIF was computed using the complement of the Kaplan–Meier estimate. The inter-cohort differences of the cumulative incidence of events were tested using competing risk regression analysis (He *et al*., 2016). These comparisons were made for CIFs accounting for intra-class correlation for clusters of enumeration areas. First-order interactions between birth cohort and sex were tested and significant results were retained.

Second, the gender gap in debut to sex and parenthood experiences at age 20 and 25 was tested for the recent birth cohort (1985 – 1989). Where significant, the gap was decomposed using Blinder Oaxaca decomposition for logistic regression model. This analysis was carried out using the user-written *oaxaca* command. During the analysis, the command was issued to take into account the survey design (Jann, 2008; Kaiser, 2015; Rahimi & Hashemi Nazari, 2021; Sinning *et al*., 2008). *P*-value of 5% was used to declare statistical significance in all analyses including the decomposition analysis.

The Blinder-Oaxaca decomposition technique splits the overall gender gap into two parts. The first component

Table 1. Description of variables and their measurement used in the analysis

Type	Name and label	Description and measurement	Source
Control (categorical)	Birth cohort	Two groups of birth cohorts, that is, those born in the years 1980 – 1984 and 1985 – 1989 were used to compare the reproductive transitions of youths. It was computed from the birth date data of respondents (v011/mv011)	Computed
Grouping or comparison (categorical)	Sex of respondents (sex)	This variable was created during the merging of data of male and female youths (0=Male, 1=Female). It is used as a grouping variable during the decomposition analysis	Computed
Independent (categorical)	Early initiation of sex (debut to sex before the age of 20) (v531/mv531)	This is a binary variable that indicates whether the respondent is sexually active or transitioned to marriage before age 20 (0=No, 1=Yes)	Computed
Independent (categorical)	Educational level (v106/ mv106)	Highest education level attended. This is a variable that shows the level of education in the following categories: 0=Not educated, 1=Educated	Individual interview data
Independent (categorical)	Exposure to media (Radio/ TV) (v158, v159/mv158, mv159)	Exposure to media (radio/TV) of respondents. It was computed from interview data and recoded as 0=None, 1=Infrequent, 2=Frequent	Computed from individual interview
Independent (categorical)	Contraceptive use (v313/mv313)	Current use of any type of modern contraceptive use. It was computed from interview data and recoded as 0=No, not using a modern method, 1=Yes, using a modern method	Computed from individual interview data
Independent (categorical)	Household wealth (v190/mv190)	Households falling in the richer or richest wealth quintile. It was computed from interview data and recoded as 0=No, 1=Yes	Computed from household data
Independent (numeric)	Community-level Youth Industry Employment	Percentage of industry-employed youths of all youths in a community (enumeration area)	Computed from household data
Independent (numeric)	Community affluence	Percentage of the population living in a well-off household in a community (enumeration area)	Computed from household data
Independent (numeric)	Community literacy	Percentage of population (age-appropriate) with at least a secondary level of education in a community (enumeration area)	Computed from household data

is referred to as the endowment effect; it extracts part of the gender gap that is attributable to differences in characteristics of the two groups. The second part referred to as the coefficient or structural effect shows the discriminatory effect of the covariates and the effects of unknown factors (Jann, 2008; Kaiser, 2015). In our analysis, the coefficients for the pooled model were considered the non-discriminatory coefficients or reference coefficients. It should be noted that the decomposition of the gender gap in reproductive transition was made from the viewpoint of male youths. That is, the female-to-male gender gap was decomposed into components.

The study made use of data from the Demographic and Health Surveys Program. The ICF/ORC Institutional Review Board reviewed and approved the methods and questionnaires for standard Demographic and Health Surveys. Ethiopian DHS was also ethically approved by the Institutional Review Board offices of Ethiopia's Ministry of Science and Technology and the Ethiopian Health and Nutrition Research Institute. The interviews were conducted with the express permission of the respondents. To protect respondents' privacy, names and other unique identifiers were removed from the final data that was made public.

3. Results

The sample constituted 1775 respondents from the 1980–1984 and 1753 respondents from the 1985–1989 birth cohorts. The recent birth cohort of youths consisted of 1003 females and 750 males, whereas the 1980–1984 birth cohort had 776 male and 999 female respondents. The 1985–1989 birth cohort of male youths were better educated, had better exposure to media, and live in well-off households than their female contemporaries. Contrarily, female youths of the recent cohort started their reproductive transition earlier and were slightly disadvantaged in terms of modern contraceptive utilization (Table 2).

The cumulative incidence of the debut to premarital sex (PMS) among the recent birth cohort of male youths has substantially increased over age, with the inter-cohort gap growing progressively starting at age 15 (Figure 1A). In contrast, for female youths, the inter-cohort gap in cumulative incidence of the debut to PMS remained consistent over age. Furthermore, the cumulative

incidence of transition to PMS among female youths in the most recent birth cohort was found to be higher than the corresponding male youths (Figure 1D). Concerning the transition to marriage, a significant reduction in the cumulative incidence rate in both male and female youths was observed. For male youths, the inter-cohort gap became noticeable after age 19; while for female youths, the gap started to steadily expand starting at age 15 (Figure 1B and E).

The transition to parenthood after the onset of PMS or marriage, however, revealed a marginally positive but statistically insignificant gap between birth cohorts of both male and female youths. By the age of 15, one in every five female youths had begun childbearing, whereas the transition to parenthood for male youths was completely absent. In addition, the results showed that a large volume of the transition to parenthood of female youths happened before age 20; however, for male youths, a large proportion of it occurs after age 20 (Figure 1C and F).

The competing risk regression analysis result showed that the inter-cohort differences in the CIF of premarital sex and marriage were significant and the difference is not the same for male and female youths. For premarital sex, the inter-cohort difference has shown a statistically significant increase, and an extremely higher rate of increase was observed among female youths than males. Contrarily, the transition to marriage has shown a significant risk reduction with female youths having a higher risk reduction than males. For transition to parenthood, although females were at a higher risk of transition to parenthood than males, the birth cohorts had a similar risk of transition to parenthood for both sexes (Table 3).

Distribution of debut to sex, either PMS or marriage, at ages 20 and 25 was compared and decomposed into components for male and female youths. The gender gap in the prevalence of debut to sex at age 20 amounted to 28.4% and the corresponding figure at age 25 was

Table 2: Percent distribution of characteristics of youths of the 1985–1989 birth cohort by sex

Characteristics	1985 – 1989 birth cohort	
	Male (n = 750)	Female (n = 1003)
Attended primary and above level of education	72.7	32.5
Have exposure to media	66.8	39.2
Living in a well-off household	43.5	39.6
Use modern contraceptive method	31.7	28.3
Became sexually active before age 20	45.7	79.3

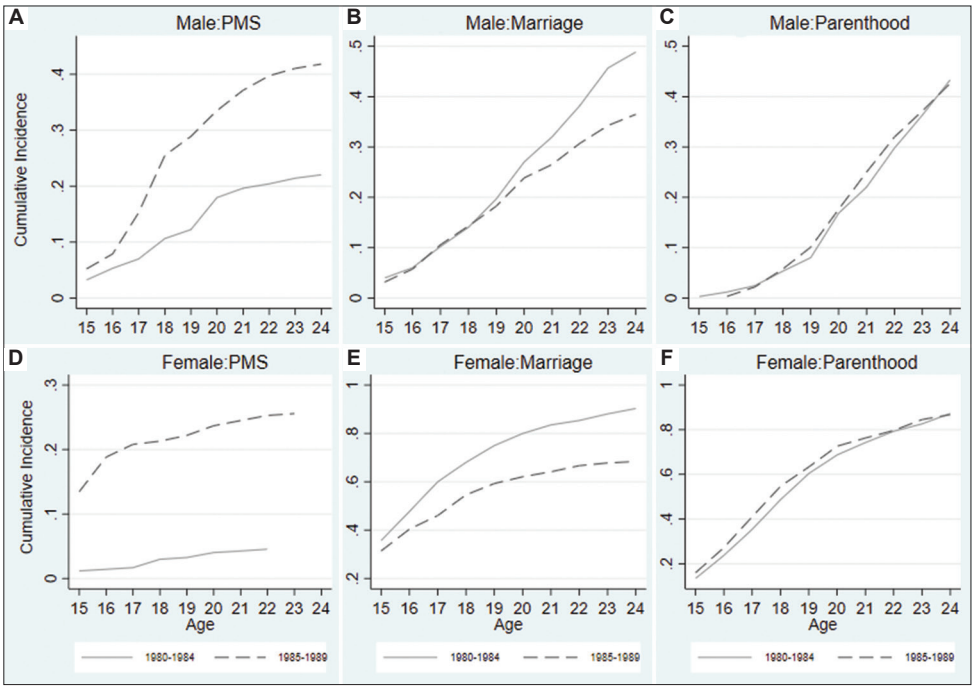

Figure 1. Cumulative incidence of premarital sex, marriage, and parenthood among youths
Note: (A) displays the cumulative incidence for male youths for the two birth cohorts. (B) shows the cumulative incidence for transition to first marriage for male youths for the two birth cohorts. (C) portrays the cumulative incidence of transition to first fatherhood for the two birth cohorts. (D) captures the cumulative incidence for female youths for the two birth cohorts. (E) displays the cumulative incidence for transition to first marriage for female youths for the two birth cohorts. (F) shows the cumulative incidence of transition to first motherhood for the two birth.

15.7%. While 28% of the gender gap in debut to sex at age 20 (0.079) was explained as a result of differences in characteristics, it was a quarter (25.5%) of the gender gap at age 25 (0.040) that was explained by the difference in the distribution of characteristics. Further, inequality in the level of educational achievement was the sole factor that significantly contributed to the gender gap in the distribution of debut to sex, approximately 30%, at both ages 20 and 25 (Table 4).

Differential effects of predictors were also responsible for the gender gap in the distribution of debut to sex at age 20. The negative contributions of above-primary level educational attainment (−0.100) and community affluence (−0.178) indicate that these factors significantly reduced the prevalence of debut to sex at age 20 for female youths more than otherwise expected. On the other hand, the discriminatory effect of household wealth (0.063) contributed to about 22% of the gender gap in the deput to sex. No significant contribution of individual predictors was reported for the coefficient effect at age 25 (Table 4).

The transition to parenthood was also the focus of the gender gap decomposition analysis. The decomposition analysis was made at two points, that is, at ages 20 and 25. At the age of 20, there was a 55% of difference in the percentage of female and male youths that transitioned to parenthood. The gender gap in transition to parenthood at age 25, however, shrunk to 34% from 55% at age 20.

Table 3. Cox and competing risk regression analysis

Variables and characteristics	PMS	Marriage	Parenthood
	SHR	SHR	HR
Birth cohort			
1980–1984 [Ref]	1.00	1.00	1.00
1985–1989	2.10***	0.72***	1.04
Sex			
Male [Ref]	1.00	1.00	1.00
Female	0.19***	3.66***	3.62***
Birth cohort # Sex (Interaction)			
1985 – 1989 # Female	3.17***	0.81**	

Note: PMS: Premarital sex; SHR: Sub-hazard ratio; HR: Hazard ratio. Statistical significance is indicated with **p<0.05; ***p<0.01.

Table 4. Decomposition analysis of gender gap in reproductive transition

Overall and components of decomposition	Debut to Sex		Parenthood	
	Age 20	Age 25	Age 20	Age 25
Overall gap (%)	0.284***	0.157***	0.550***	0.341***
Endowments (%)	0.079**	0.040**	0.205***	0.191***
Attended primary and above level of education	0.086***	0.049***	0.050***	0.078***
Have exposure to media	−0.007	−0.012	−0.016	0.006
Living in a well-off household	−0.002	0.001	0.002	−0.001
Use modern contraceptive method			−0.001	−0.008
Became sexually active before age 20			0.169***	0.113***
Community affluence	0.001	0.001	0.002	0.003
Community literacy	0.000	0.001	0.000	0.000
Level of youth employment in industry	0.000	0.000	0.000	0.000
Coefficients (%)	0.205***	0.117***	0.345***	0.150***
Attended primary and above level of education	−0.100***	−0.027	−0.091	−0.002
Have exposure to media	0.015	0.014	0.034**	0.024
Living in a well-off household	0.063**	0.010	0.094	0.017
Use modern contraceptive method			0.041	0.035**
Became sexually active before age 20			0.095	0.103***
Community affluence	−0.178***	−0.063	−0.118	−0.003
Community literacy	0.058	−0.001	0.145**	0.021
Level of youth employment in industry	−0.022	0.013	−0.083	−0.010
Constant	0.368***	0.170***	0.227	−0.035

Note: The number indicate proportion of contribution to the gender gap in reproductive transition. Endowments indicate contribution of differences in characteristics between male and female to the gender gap. Coefficients, on the other hand, show the contribution of structural differences to the gender gap. Statistical significance is indicated with **p<0.05; ***p<0.01.

The gender gap decomposition analysis revealed that approximately 37% of the difference at age 20 and 56% at age 25 was due to differences in characteristics of male and female youths. The differential influence of confounders, including the overall effect of unknown factors, contributed to the remaining gender gap. The detailed decomposition provided the contribution of each of the predictors to both the endowment and coefficient effects (Table 4).

The difference in the proportion of sexually active before the age of 20 contributed the most (0.169) to the gender gap in the transition to parenthood at age 20. Interpreted another way, a reduction in the difference in the prevalence of early sexual debut will lead to a reduction of approximately 31% of the total gender gap in parenthood at age 20. Furthermore, the difference in attainment of at least a primary level of education (0.050) between the sexes contributed to 9% of the gender gap in the transition to parenthood at age 20. The differential effects of community literacy (0.145) and exposure to media (0.034) significantly contributed to the gender gap in early parenthood. A significant portion of the gender gap in parenthood at age 25 was explained by differences in the proportion of early debut to sex (0.113) and level of education (0.078) between female and male youths. On the other hand, it was the differential influence of early debut to sex and contraceptive use that significantly predicted the gap in transition to parenthood (Table 4).

4. Discussion

The study used a decomposition analysis framework to assess the gender gap in the reproductive transition of youths and its components. Individual and community-level factors were used in our analysis. The results demonstrated that a large proportion of the gender gap happens during adolescence and results from structural effects of factors than differences in characteristics between male and female youths. The findings imply the mere fact that the elimination of disparities in individual-level socioeconomic and community-level factors is not sufficient to close the gender gap.

4.1. Expanding school attendance promotes the delayed reproductive transition of female youths

Rates of the debut to premarital sex and entry into marriage have grown in contrast to one another over birth cohorts. The gender gap in the magnitude of early debuts to sex, either premarital or within a marital context, was solely determined by the difference in the level of education of male and female youths. Studies have shown that delaying early marriage can be accomplished by encouraging female youths to continue their education past the primary level and supporting them in building and expanding their social networks (Bezie & Addisu, 2019; Erulkar & Muthengi, 2009; Liang & Yu, 2022; Raj *et al*., 2019). In line with this, in a study from Tanzania, a relatively higher cost of schooling and an increasing prevalence of premarital sex were cited as leading factors for entering into marital life at an early age (Stark, 2018). Hence, working toward removing the barriers to adolescent girls' education to pursue beyond the primary level can act as a leaven to improve youth reproductive transitions.

4.2. The gender gap in the reproductive transition of youths is the highest during adolescence

Although the transition to parenthood was consistent across birth cohorts for both sexes, a substantial gender gap was observed in the transition profile having a maximal gap during adolescence. The primary driving factor for the gender gap in the transition to parenthood was the difference in the early timing and magnitude of youths' debut to sex and entry into marriage. Female youths faced significant disadvantages compared to their male peers because they typically initiate sex early and utilize contraception inadequately during their sexual encounters. Studies that concur with our findings have indicated that young women's transition to parenthood was positively impacted by contraceptive counseling and addressing their demand for contraception (Brittain *et al*., 2015; Diez *et al*., 2020; Sánchez-Páez & Ortega, 2018).

4.3. The gender gap in the reproductive transition of youths was largely determined by structural differences than socio-economic inequalities

The findings support the premise that the gender gap in the reproductive transition of youths was not only a product of socioeconomic inequalities but also a result of discriminatory effects of socioeconomic factors. The educational level of adolescent girls had a stronger influence on delaying their debut to sex than it had for adolescent boys. This finding affirms previous findings that reported a stronger return to education in delaying debut to sex and entry into marriage among adolescent girls (Ahonsi *et al*., 2019; Misunas *et al*., 2021; Petroni *et al*., 2017). On the other hand, the fact that household wealth and community affluence played a contrasting discriminating role in youths' debut to sex is an interesting finding of this study. While female youths living in well-off households had an increased risk of the debut to sex than males, in contrast, community affluence by far protects female adolescent youths.

The findings indicated that as opposed to its impact on male adolescents, community literacy increased the risk of adolescent motherhood for adolescent girls. This suggests that the pro-natalist norm of highly educated

societies is more likely to be passed on to adolescent girls once they become sexually active than adolescent boys. Similar findings were reported from a study done among Zimbabwean adolescent women on modern contraceptive use stating that the odds of contraceptive use among adolescent women reduced with an increase in community literacy level of women (Ngome & Odimegwu, 2014). Further, it had been reported that exposure to mass media increases the use of contraception as a result of exposure to family planning messages and results in delayed parenthood (Ngome & Odimegwu, 2014; Petroni *et al*., 2017). The result reveals that well-informed female and male youths did not have an equal transition rate to parenthood. This differential effect of media exposure calls for targeting female adolescents in reaching information regarding family planning and encouraging the use of it once they are sexually active.

4.4. Strengths and limitations

Studies that inform our understanding of reproductive behavior focused on individual and community-level factors without reference to the structural effects of these factors. Hence, this study attempts to extend previous works by decomposing the gender gap in the reproductive transitions among youths into inequalities in and structural effects of variables. The study focused only on individual and community-level socioeconomic and reproductive-related factors to decompose the gender gap in the reproductive transition of youths. EDHS data were collected using an event history approach and the accuracy of information depends on the respondent's ability to recall the sequence of events that may be affected by memory lapse (Neal & Hosegood, 2015). As a result, caution is advised when interpreting the results. Moreover, event history data are collected for those who were available at the time of the survey. As a result, the analysis did not take into account or adequately represent the reproductive experiences of deceased and migrant youths.

5. Conclusions

The results demonstrate that the gender gap in reproductive transition was wider for adolescents. Family and institutional support to keep adolescent girls in school is required to curb the early transition of female adolescents to sex or marriage and motherhood. In addition, supporting youth-friendly family planning services in terms of advertising family planning methods and addressing the contraceptive demand of sexually active adolescent girls are issues to be given the utmost priority. Community interventions that target deprived communities and those with pro-natal norms can help reduce the structural components of the gender gap in the reproductive transition. Further research is also recommended to unveil unknown factors that could contribute to the gender disparity in the transition to premarital sex or marriage.

Acknowledgments

The authors would like to thank the Ethiopian Statistical Services (former Central Statistics Agency of Ethiopia) and Measure DHS for providing the data used for this manuscript.

Funding

None.

Conflict of interest

The authors declare that they have no competing interests.

Author contributions

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Data curation: Tariku Dejene
Formal analysis: Tariku Dejene
Methodology: Tariku Dejene, Eshetu Gurmu
Writing – original draft: Tariku Dejene
Writing – review & editing: Tariku Dejene, Eshetu Gurmu

Ethics approval and consent to participate

Secondary data from the 2011 and 2016 EDHS were used in this study. The methodologies and questionnaires for Demographic and Health Surveys were reviewed and approved by the ICF/ORC Institutional Review Board. In addition, the study protocols obtained ethical approval from the Ethiopian Ministry of Science and Technology's Institutional Review Board offices and the Ethiopian Health and Nutrition Research Institute. Interviews were conducted after gaining verbal consent from respondents.

Consent for publication

The final data did not contain respondents' names or other distinctive identifiers to protect their privacy. Thus, no consent was required as the analysis was based on publicly available dataset.

Availability of data

DHS data are publicly available for use free-of-charge and can be obtained on request at the following web address: https://dhsprogram.com/data/available-datasets.cfm

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ACCSCIENCE PUBLISHING

International Journal of Population Studies

RESEARCH ARTICLE

Exploring the most dominant drivers of inequalities in child survival in Ethiopia: Dominance analysis

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Abstract

Inequalities in child survival are a global public health concern. Over the past decade, Ethiopia has made remarkable progress in improving child survival. Despite this promising development, inequalities in child survival among the various population groups remained a pressing public health concern. The purpose of this paper is to examine the dominant drivers of inequality in child survival indicators (undernutrition, anemia, and under-five mortality) in Ethiopia. Dominance analysis was used based on a pooled total sample of 48,422 under-five children drawn from five rounds of Ethiopia Demographic and Health Surveys conducted from year 2000 to 2019. Childhood undernutrition, childhood anemia, and under-five mortality were the three outcome variables, and the five dimensions of inequality were considered as key predictor variables. The dominance analysis revealed that maternal education, place of residence, and household wealth index were the three most dominant drivers of inequalities in childhood undernutrition, accounting for 83.48% of the predicted variances. The regional category was found to be the first-ranked key driver of inequalities in childhood anemia, accounting for 50.56% of the predicted variance. The dominance analysis also indicated that maternal education, child sex, and place of residence were the three most dominant drivers of inequality in under-five mortality, accounting for 89.3% of the predicted variance. This study provides empirical evidence that maternal education (individual level), household asset based wealth index (household level), and place of residence (community level) were the most dominant drivers of inequality in child survival. This suggests interventions in reducing inequalities in child survival need to start at the community level, notwithstanding the importance of household and individual level influences.

Keywords: Dominant drivers; Dominance analysis; Inequalities; Child survival; Under-five mortality; Ethiopia

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Citation: Negussie S.T., & Nigatu R.G. (2023). Exploring the most dominant drivers of inequalities in child survival in Ethiopia: Dominance analysis. *International Journal of Population Studies,* 9(2): 12-25.
https://doi.org/10.36922/ijps.427

Received: December 19, 2022

Accepted: March 29, 2023

Published Online: April 14, 2023

1. Introduction

1.1. Background

Inequalities in child survival are a global public health concern (Brault *et al.*, 2020; Cha & Jin, 2020). Although reducing inequalities in child survival are given due attention

in sustainable development goals (SDGs) (Yourkavitch *et al.*, 2018), the inequality is widespread at global, regional and national levels (Sharrow *et al.*, 2022). According to the World Health Organization (WHO), children in Africa region are 10 times more likely to die before their fifth birth day compared to children in European Region (WHO, 2022). Two regions, sub-Saharan Africa and Central and Southern Asia, accounted for more than 80% of the 5.2 million under-five deaths, where sub-Saharan Africa remained the region with the highest under-five mortality (U5M) rate (a 1-in-13 rate) in the world in 2019 (WHO, 2020).

In Ethiopia, U5M rate varies across the administrative regions, ranging from 74 deaths/1000 live children in Afar to 29 deaths/1000 live children in Addis Ababa (Ethiopian Public Health Institute & ICF, 2021). Geographic inequality in U5M was higher in Benishagul-Gumuz, followed by Amhara, Afar, Gambela, and South Nation Nationality and People's Region (Liyew *et al.*, 2021). Inequality of anemia among under-five children also exists across regions in the country (Anteneh & Geertruyden, 2021; Endris *et al.*, 2021). Inequalities in childhood undernutrition by administrative region (Yayo Negasi, 2021) and maternal education status (Bras & Mandemakers, 2022) were also documented in the country. Thus, inequality in child survival remains a challenge in the country to achieve SDG targets, specifically among more disadvantageous population groups and emerging regions (Dheresa *et al.*, 2022).

Despite the marked improvement in the prevalence of U5M in Ethiopia, substantial inequalities in child health outcomes among the different socioeconomic subgroups persist and progress is uneven. On the top of this, answering the question "what are the most dominant drivers of inequalities in child survival in Ethiopia?" is essential to identify the key inequalities drivers that can be minimized and/or prevented. In this paper, the child survival indicators refer to childhood undernutrition and childhood anemia (Nkosi-Gondwe *et al.*, 2021) and U5M (Mosley & Chen, 2003).

To date, numerous studies (Agbadi *et al.*, 2021; Alao *et al.*, 2021; Balaj *et al.*, 2021; Ekholuenetale *et al.*, 2020; Endris *et al.*, 2021; Forde & Tripathi, 2018; Hasan *et al.*, 2021; Wang *et al.*, 2021; Yayo Negasi, 2021; Zegeye *et al.*, 2021) have examined the determinants of inequality in child survival. However, these studies have used regression modeling approaches that limit to identify the relative importance of the determinants for predicting inequalities in child survival. In addition, these studies have focused only on one or two child survival indicators; accordingly, identifying the dominant drivers of inequalities in child survival indicators (i.e., childhood undernutrition, anemia, and U5M) remains limited. Therefore, this paper seeks to redress the literature gap on the most dominant drivers of inequalities in child survival indicators in Ethiopia. The objective of this paper was to explore the dominant drivers of inequality in child survival indicators (undernutrition, anemia, and U5M) in Ethiopia by applying the dominance analysis technique developed to estimate relative importance of all predictors in a regression model in relation to an outcome variable (Azen & Traxel, 2009).

1.2. Conceptual framework

This study is mainly focused on five internationally conceptualized dimensions of inequality (WHO and International Center for Equity in Health, 2015). The five inequality dimensions (household wealth index, maternal educational status, place of residence, regional distribution, and child sex) are used as predictors of inequality in child survival to construct conceptual framework for this study. In addition, the five inequality dimensions are commonly used to exploring and comparing health inequalities in developing countries (Hosseinpoor *et al.*, 2016). Furthermore, these inequality drivers are most frequently reported predictors of child survival in Ethiopia (Bras & Mandemakers, 2022; Rebouças *et al.*, 2022). It is essential to understand that since before birth, children whose parents live in a situation of socioeconomic and geographic vulnerability may have worse health outcomes than who live in better situations (Pearce *et al.*, 2019). The ways in which living conditions affect child survival are complex and more driven by socioeconomic inequalities (Rebouças *et al.*, 2022). To identify the dominant drivers of inequality in child survival, it is essential to understand the conditions under which children are born and live, and consider socioeconomic and geographic stratifications among population groups. In this regard, the five drivers of inequality regrouped into socioeconomic (household wealth index, maternal educational status, and place of residence) and geographic (administrative regional distribution) stratifications (Houweling & Kunst, 2010), and the biological determinant (i.e., child sex) (Rebouças *et al.*, 2022). Furthermore, to consider the hierarchical nature of inequality drivers, the five drivers of inequality are grouped into community (administrative regions and place of residence), household (household wealth index), and individual (maternal education and sex of child) levels.

1.3. Background of Ethiopia

Ethiopia is one of the Sub-Saharan Africa countries with highest burden of U5M, ranking third in Africa, and tenth in the world (Dheresa *et al.*, 2022). Ethiopia is a landlocked country, sharing frontiers with Eritrea to the north and

northeast, Djibouti to the east, Somalia to the east and southeast, Kenya to the south, and South Sudan and Sudan to the west (FAO, 2016). The country is ethnically and culturally diverse and the second most populous country in Africa, and among the least urbanized countries in the world, with 82% of the population living in rural areas (USAID, 2021). Administratively, Ethiopia has 11 regional states (including newly established regions: Sidama and South West) and two city administrations (Addis Ababa and Dire Dawa). These regional states possibly vary in their levels of economic development, sociocultural, educational, and health service provision and settings (Bareke *et al.*, 2022).

Based on the development perspective, the old nine regional states and the two-city administrations are categorized into three as emerging (Afar, Somali, Benishangul-Gumuz, and Gambela), established (Tigray, Amhara, Oromia, Southern Nation Nationalities and People [SNNP], and Harari), and central (Addis Ababa and Dire Dawa city administrations) (Bareke *et al.*, 2022; Tesema & Braeken, 2018). The emerging regions are drought-affected areas, pastoralists, and marginalized in terms of basic infrastructure development (Bareke *et al.*, 2022).

Ethiopia is a low-income county having a gross domestic product per capital of US$ 855.80 in 2019 (Tangcharoensathien *et al.*, 2022), making it one of the poorest countries in the world (World Bank, 2020). About 69% of Ethiopia's population is multidimensionally poor in 2019 (UNDP, 2021). The multidimensional child poverty incidence and intensity varies across regions and place of residence in the country, where the multidimensional child poverty incidence ranges from 23% (lowest) in Addis Ababa to 98% (highest) in Somali region (Central Statistical Agency [CSA] & UNICEF, 2020). Likewise, the monetary child poverty incidence and depth varies across regions and areas with the highest incidence in Afar (39%) and Amhara regions (37%) and the lowest in Harari city administration (14%) and considerably higher in rural areas (31%) compared to large city areas (23%) (CSA & UNICEF, 2020).

Regarding child survival policies, the Government of Ethiopia (GoE) has realized pro-poor policies and strategies for child survival (Rono *et al.*, 2022). Since 2003, the country has implemented the Health Extension Program to improve child survival through primary healthcare (MOH, 2020). In addition, the country endorsed the first comprehensive National Child Survival Strategy (2005 – 2015), and the second strategic document the National Strategy for Newborn and Child Survival (2016 – 2020) in 2005 and 2015, respectively (FMOH-FDRE, 2016). GoE has demonstrated a strong policy commitment to nutrition through development of a National Nutrition Strategy in 2008, followed by implementation of National Nutrition Program I (2008 – 2015) and National Nutrition Program II (2016 – 2020) (Kennedy *et al.*, 2020). Ethiopia also joined the Scaling Up Nutrition movement in 2012 and endorsed the Seqota Declaration in 2015 with its high-level commitment to end childhood undernutrition by 2030 (FDRE, 2016). Furthermore, GoE has developed Food and Nutrition Policy to attain optimal nutritional status at all stages of life (FDRE, 2018).

2. Data and methods

2.1. Study design and data source

Retrospective cross-sectional study design is used for the present study, using the five rounds of Ethiopia Demographic and Health Surveys (EDHS) conducted in 2000, 2005, 2011, and 2016, including the 2019 mini EDHS. The datasets were downloaded from DHS website (http://dhsprogram.com) based on secured online permission. The study used children's files that contain information about socioeconomic, demographic, and geographic characteristics for under-five children, their parents, households, as well as their communities. However, anemia indicator was not collected in the 2000 EDHS and 2019 mini EDHS in the country. A pooled sample of 35,688, 19,699, and 48,422 under-five children were used for childhood undernutrition, childhood anemia, and U5M analysis, respectively. The outcome and explanatory variables were extracted from pooled data.

2.2. Study variables

2.2.1. Outcome variables

Childhood undernutrition, childhood anemia, and U5M were the three outcome variables of the study. Childhood undernutrition status categorized as undernourished and coded as 1 if child had any form of anthropometric failure, and as nourished with assigned value of 0 if the child had no failure. Childhood anemia was recoded into dummy variable where a child is considered to be anemic and assigned value of 1 if the child had severe, moderate, or mild anemia level, and 0 if child is not anemic. Under-five mortality was coded as 1 if the child died between 0 and 59 months and 0 if the child was alive at least until age of 59 months (CSA and ICF, 2016).

2.2.2. Predictor variables

The selection of predictor variables in the model was guided by the internationally conceptualized dimensions of inequality (WHO & International Center for Equity in Health, 2015)

and the review of literature and model building procedures. The review of most recent literatures (Bras & Mandemakers, 2022; Rebouças *et al.*, 2022) on the subject indicated that these variables are most frequently reported predictors of child survival in Ethiopia. The five internationally accepted dimensions of child survival inequalities were used as predictor variables in this paper to approximately measure inequality drivers (or as proxy measures of inequality drivers). Henceforth, the predictor variables are referred to as inequality drivers. Table 1 presents the coding for the predictor variables. Household asset-based wealth index was categorized into five quintiles and regrouped as poor (the first two quintiles: poorest and poorer) and non-poor (the last three quintiles: middle, richer and richest). Education was used to reflect the level of education attained by a child's mother, and grouped into two subgroups: no education and primary and above. Each of the place of residence (rural or urban) and child sex (female or male) was classified into two subgroups. The old nine regional states and the two city administrations were regrouped into three as emerging (Afar, Somali, Benishangul-Gumuz, and Gambela), established (Amhara, Oromia, SNNP, Tigray and Harari), and central (Addis Ababa and Dire Dawa city administrations) (Bareke *et al.*, 2022) (Table 1).

2.3. Statistical analysis

To reduce bias, about 3.2% of children with missing height/length, weight, and unknown responses were excluded from the analysis of undernutrition. For childhood anemia analysis, data from children aged 6 – 59 months were used. Descriptive statistics were used to describe the background characteristics of the study participants and the key variables. A correlation-based assessment was used to detect multicollinearity, and an absolute correlation coefficient of less than 0.6 was observed among predictors indicating the absence of multicollinearity (Senaviratna & Cooray, 2019). Logistic regression was used to identify significant drivers of inequality in child survival. Bivariate logistic regression analysis was used to establish the strength of the relationship between inequality drivers and outcome variables. Chi-square tests were computed to verify the significant association.

Table 1. Coding of proxy measures for the inequality drivers

Inequality drivers	Description
Sex of child	1=Female; 2=Male
Maternal education	1=No education; 2=Primary+
Household wealth index	1=Poor; 2=Non-poor
Place of residence	1=Rural; 2=Urban
Regional category	1=Emerging; 2=Established; 3=Central

Furthermore, to determine the relative importance of each predictor to the outcome, we used the dominance analysis (Azen & Traxel, 2009) by employing a user-developed STATA command "domin" (Luchman, 2021). Dominance analysis is a technique developed to estimate relative importance of all predictors in a logistic regression model in relation to an outcome variable (Tonidandel & LeBreton, 2010). It relies on estimating the regression values of all possible combinations of predictors and measures relative importance by doing comparisons of all predictors in the model as they relate to an outcome variable (Tighe and Schatschneider, 2014). The method also allows us in identifying the relative dominance of the predictors (Azen & Traxel, 2009; Lee & Dahinten, 2021). We also conducted sensitivity analysis to predict the outcome of a decision given a certain range of variables (Appendix B). All analyses were weighted and conducted using STATA version 15.

3. Results

3.1. Background characteristics of the study participants

Table 2 presents the background characteristics of the study participants by inequality dimensions. More than half (52.64%) of children were born to mothers residing in established regions, and majority (82.88%) of children were born in rural areas. More than half (51.21%) of children were born in households grouped as poor wealth index. Table 2 also shows that most (70.63%) of the children were born to uneducated mothers, and a little more than half (51.25%) of the children were male. About 51% and 55.06% of children were undernourished and anemic, respectively, and more than 8% of children were reported to have died (Table 2).

3.2. Bivariate logistic regression results

Table 3 presents results from the bivariate logistic regression analysis (with adjusted odds ratio) of the association between the outcome variables and inequality drivers. Table 3 shows that all socioeconomic (place of residence, household wealth index and maternal education), geographic (region), and biological (sex of child) inequality drivers were significantly associated with childhood undernutrition (at $p < 0.001$) and U5M (at $p < 0.05$). Likewise, the region, place of residence, household wealth index and maternal education status had statistically significant association with childhood anemia. The bivariate logistic regression analysis finding revealed that regional category, place of residence, household wealth index maternal education, and child sex are potential and significant drivers of inequality in childhood

Table 2. Background characteristics of study participants, Ethiopia, 2000 – 2019

Inequality drivers	N	%
Community level drivers		
Regional category		
Established	25,489	52.64
Emerging	18,321	37.84
Central	4612	9.52
Place of residence		
Rural	40,131	82.88
Urban	8291	17.12
Household level driver		
Household wealth index		
Poor	24,503	51.21
Non-poor	23,347	48.79
Individual level drivers		
Maternal education		
No education	34,200	70.63
Primary+	14,222	29.37
Sex of child		
Male	24,814	51.25
Female	23,608	48.75
Outcome variables		
Undernutrition (N=35,688)		
Nourished	17,602	49.32
Undernourished	18,086	50.68
Anemia* (N=19,699)		
Anemic	10,847	55.06
Not anemic	8852	44.94
Under-five mortality (N=48,422)		
No	44,485	91.87
Yes	3937	8.13

Note: *Anemia data were not collected in 2000 and 2019 EDHSs.
Source: Ethiopia Demographic and Health Surveys: 2000, 2005, 2011, 2016, and 2019.

undernutrition, childhood anemia, and U5M to explore through multivariable analysis (Table 3).

3.3. Dominance analysis results

Table 4 depicts dominance analysis of the drivers of inequality in child survival indicators. The dominance analysis revealed that maternal education, place of residence, and household wealth index were the three most dominant drivers of inequalities in childhood undernutrition, accounting for 83.48% of the predicted variance. Child sex was the lowest-ranked inequality driver in the dominance analysis, accounting for 1.61% of the predicted variance. In dominance analysis, the geographic predictor (region) was found to be the first-ranked dominant driver of inequalities in childhood anemia, accounting for more than half (50.56%) of the predicted variance. Dominance analysis also revealed that maternal education, child sex, and place of residence were the three top dominant drivers of inequality in U5M, accounting for 89.3% of the predicted variance (Table 4).

Moreover, we checked the ranking of the inequality drivers for a group of eight predictors by including three additional variables (sex of household head, maternal religion, and employment status) and found similar ranking results (Appendix A). Furthermore, we also conducted the sensitivity analysis to explore the predictors effect for undernutrition, anemia, and U5M using the five (region, place of residence, wealth index, maternal education, and child sex) and eight (region, place of residence, wealth index, maternal education and child sex, sex of household head, maternal religion, and employment status) inequality predictors. However, the predictive power of the model was relatively better with the eight predictors compared to the model with the five predictors (Appendix B).

4. Discussion

This study examined associations between the five inequality dimensions and three child survival indicators in Ethiopia based on pooled data from the five consecutive national surveys. The study identified the relative importance of the key drivers of inequality in line with WHO & International Center for Equity in Health (2015) in predicting inequality in child survival through dominance analysis. Maternal education, place of residence, and household wealth index were found to be the three most dominant drivers of childhood undernutrition inequality. This finding is consistent with the previous studies (Alao *et al.*, 2021; Ekholuenetale *et al.*, 2020; Hasan *et al.*, 2020; Yayo Negasi, 2021). The potential reason might be that maternal education could have an impact on feeding practice and healthcare (Lemessa *et al.*, 2022). Besides, place of residence could have effect on access to child health-care service and improved water that leads to better feeding practice (Nahalomo *et al.*, 2022). In addition, asset-based household socioeconomic status might be strongly linked with food insecurity, which directly affects childhood nutritional status (World Bank, 2020). Moreover, the richest households could have better opportunity to feed nutrition-rich food their children that could affect nutrition status of under-five children (Fenta *et al.*, 2021).Thus, these findings highlight the importance of interventions and policies that enhance socioeconomic

Table 3. Bivariate association between inequality drivers and outcome variables, Ethiopia, 2000 – 2019

Inequality drivers	Adjusted odds ratio	SE	[95% LB, UB]	χ^2
Undernutrition (N=35,688)				
Regional category (Central)				14.33
Established	2.580	649	[1.576, 4.225]***	
Emerging	2.022	493	[1.255, 3.259]***	
Place of residence (urban)				350.61
Rural	1.916	067	[1.790, 2.051]***	
Household wealth index (non-poor)				290.90
Poor	1.491	035	[1.424, 1.560]***	
Maternal education (primary+)				392.42
No education	1.647	042	[1.568, 1.731]***	
Child Sex (male)				24.70
Female	1.114	024	[1.068, 1.163]***	
Anemia (N=19,699)				
Regional category (Established)				4.94
Emerging	1.98	613	[1.079,3.634]**	
Central	1.32	531	[0.602, 2.908]	
Place of residence (urban)				102.09
Rural	1.639	080	[1.489, 1.804]***	
Household wealth index (non-poor)				119.86
Poor	1.424	046	[1.337, 1.517]***	
Maternal education (primary+)				12.26
No education	1.128	039	[1.055, 1.207]***	
Child sex (male)				0.24
Female	1.015	031	[0.956, 1.077]	
Under-five mortality (N=48,422)				
Regional category (Central)				7.92
Established	1.357	175	[1.053, 1.748]**	
Emerging	1.421	180	[1.109, 1.83]***	
Place of residence (urban)				28.59
Rural	1.353	076	[1.211, 1.511]***	
Household wealth index (non-poor)				18.58
Poor	1.169	042	[1.089, 1.255]***	
Maternal education (primary+)				63.68
No education	1.395	058	[1.285, 1.514]***	
Child sex (male)				43.70
Female	1.252	042	[1.171, 1.338]***	

Note: LB: Lower boundary, UB: Upper boundary; ***p<0.01, **p<0.05, *p<0.1.
Source: Ethiopia Demographic and Health Surveys: 2000, 2005, 2011, 2016, and 2019.

and livelihood of uneducated, the poor and the rural population groups to reduce inequalities in childhood undernutrition.

Moreover, our dominance analysis finding shows that administrative region, household wealth index and place of residence were found to be the three most dominant drivers of inequalities in childhood anemia. This finding is supported by other studies finding (Adeyinka *et al.*, 2019; Ekholuenetale *et al.*, 2022; Endris *et al.*, 2021; Jember *et al.*, 2021; Yadav & Nilima, 2021). The reason

Table 4. Dominance analysis of the outcome and inequality indicators in Ethiopia, 2000 – 2019

Inequality drivers	Dominance statistics	Standardized dominance statistics*	Ranking
Undernutrition (N=35,688)			
Region	0.0040	0.1459	4
Place of residence	0.0084	0.3030	2
Household wealth index	0.0057	0.2060	3
Maternal education	0.0090	0.3258	1
Child sex	0.0005	0.0193	5
Anemia (N=19,699)			
Region	0.0116	0.5056	1
Place of residence	0.0024	0.1041	3
Household wealth index	0.0075	0.3267	2
Maternal education	0.0014	0.0610	4
Child sex	0.0001	0.0025	5
Under-five mortality (N=48,422)			
Region	0.0001	0.0132	5
Place of residence	0.0010	0.1994	3
Household wealth index	0.0004	0.0522	4
Maternal education	0.0037	0.4158	1
Child sex	0.0016	0.2778	2

Note: *Standardized dominance statistics do not total to 1 due to rounding. Source: Ethiopia Demographic and Health Surveys: 2000, 2005, 2011, 2016, and 2019.

could be explained by existing disparities in geographical location, socioeconomic status, access to resources, level of education, cultural, and feeding practices as childhood anemia is nutritional disease (Gebreegziabher *et al.*, 2020). In addition, place of residence strongly affects access for basic education, child healthcare, and source of income that could be directly or indirectly related to poverty and risk of anemia (Gebreegziabher *et al.*, 2020). Moreover, household wealth index could be directly linked with nutritional intake and risk of childhood anemia, and the richest households might have better chance to address their children's nutritional and health needs (Amegbor *et al.*, 2022). Therefore, this study underscores the importance of implementation of interventions, especially target to geographic, urban-rural setting, and household status variations for accelerated reduction in childhood anemia.

Furthermore, our finding reveals that maternal education, place of residence, and child sex were the three most dominant drivers of inequalities under-five mortality, which is consistent with findings of other studies (Agbadi *et al.*, 2021; Balaj *et al.*, 2021; Forde & Tripathi, 2018; Zegeye *et al.*, 2021). It is evident that maternal education could have substantial impact on adopting better access to child healthcare, uptake of preventive vaccines, and safe water (Moradhvaj & Samir, 2023). Another reason could be that the existing gap in place of residence might result in disparity in accessing child health-care service, living standards, and child healthcare-seeking behavior (Tessema *et al.*, 2021) that may directly affect child survival in the country. Under-five mortality could be affected by sex differences in genetic and biological makeup (Pongou, 2013). This study finding emphasizes the importance of robust, and influencing policies and interventions for reducing inequalities in child mortality and improving the overall child survival through addressing urban-rural and maternal education gaps at community and individual levels.

4.1. Strengths and limitations of the study

The strengths of the present study were its large sample drawn from five rounds of nationally representative cross-sectional surveys and, use of dominance analysis to identify the key predictors of inequality in child survival indicators. There are some limitations in this study. First, this study shows drivers that are associated with inequalities in childhood undernutrition, anemia, and U5M and magnitude of associations, but no causal interpretation of the results is implied here as the cross-sectional survey data preclude causal inferences. Second, although the study focused on the five internationally accepted drivers of inequality, there might be some of important drivers of inequality that were not included in this paper, such as paternal education, household size, maternal and child health, and some community and macro-socioeconomic development indicators. Third, although dominance analysis is robust when all predictors are continuous variables, it has a limitation in dealing with non-continuous variables. For example, we observed different result, particularly for childhood anemia by changing classifications for region, maternal education and household wealth index and the result is annexed (Appendix C) for clarity.

5. Conclusions

This study provides empirical evidence that region and place of residence (community level), household asset based wealth index (household level), and maternal education (individual level) were the most dominant drivers of inequality in child survival in Ethiopia. This suggests that reducing inequalities in child survival need to start at higher hierarchical structure (regional and community levels), notwithstanding the importance of household and individual level influences. Further, improving the socioeconomic status of the poorest households, prioritizing emerging regions and rural areas

with the highest needs, and improving maternal education levels would most likely reduce child survival inequalities in the country.

Acknowledgments

We are grateful to the MEASURE DHS program for providing free access to the original data.

Funding

None.

Conflict of interest

The authors declare that they have no competing interest.

Author contributions

Conceptualization: Negussie Shiferaw Tessema
Formal analysis: Negussie Shiferaw Tessema
Investigation: Negussie Shiferaw Tessema
Methodology: Negussie Shiferaw Tessema
Writing – original draft: Negussie Shiferaw Tesema
Writing – review & editing: Nigatu Regessa Geda

Ethics approval and consent to participate

For the original conduct of the five rounds of Ethiopia Demographic and Health Surveys (DHSs), ethical approval was obtained from the Ethical Committee of the ICF. The enumerators obtained informed consent and authorization to anonymously use the data from all survey participants. In our study, we obtained permission to use the data from the DHS program. No further ethical approval was required, as our study solely involved secondary data analysis of publicly available data that does not contain any identifiable information that links to the actual survey participants. Authors also confirm that all methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Availability of data

The dataset can be accessed at https://dhsprogram.com/data/available-datasets.cfm

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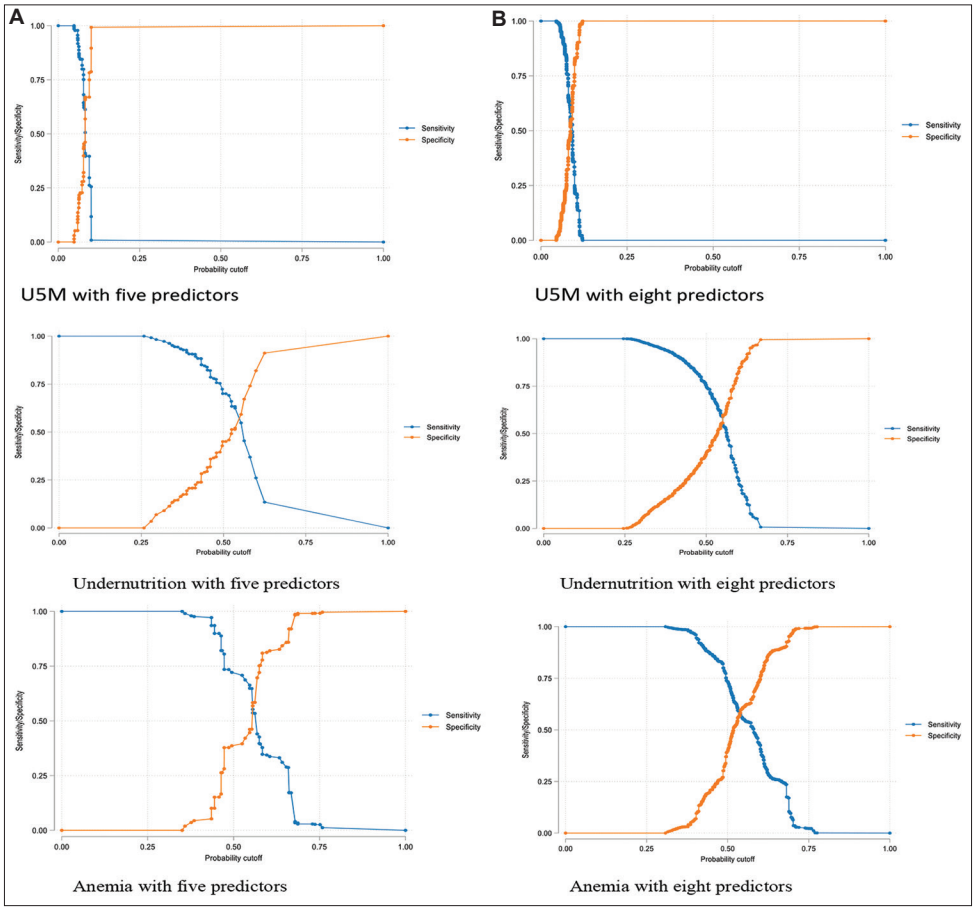
Appendixes

Appendix A: Dominance analysis results of outcome with eight predicators in Ethiopia, 2000 – 2019

Inequality drivers	Dominance statistics	Standardized dominance statistics*	Ranking
Undernutrition (N=35,688)			
Region	0.0029	0.1083	4
Place of residence	0.0080	0.2985	2
Household wealth index	0.0057	0.2119	3
Maternal education	0.0083	0.3100	1
Child Sex	0.0005	0.0172	7
Religion	0.0005	0.0185	6
Sex of Household head	0.0000	0.0018	7
Employment status	0.0009	0.0338	5
Anemia (N=19,699)			
Region	0.0097	0.3329	1
Place of residence	0.0070	0. 2384	3
Household wealth index	0.0071	0.2452	2
Maternal education	0.0013	0.0452	6
Child sex	0.0001	0.0019	8
Religion	0.0017	0.0599	5
Sex of household head	0.0002	0.0007	7
Employment status	0.0021	0. 0709	4
Under-five mortality (N=48,422)			
Region	0.0001	0.0141	6
Place of residence	0.0013	0.1863	3
Household wealth index	0.0005	0.0792	5
Maternal education	0.0025	0.3627	1
Child sex	0.0016	0.2411	2
Religion	0.0000	0.0011	8
Sex of household head	0.0001	0.0127	7
Employment status	0.0007	0.1027	4

Note: *Standardized dominance statistics do not total to 1 due to rounding. Source: Ethiopia Demographic and Health Surveys: 2000, 2005, 2011, 2016, and 2019.



Appendix B. (A and B) Sensitivity analysis results

Appendix C: Dominance analysis based on changed classification of predictors in Ethiopia, 2000 – 2019

Inequality drivers	Dominance statistics	Standardized dominance statistics*	Ranking
Undernutrition (N=35,688)			
Region	0.0063	0.1942	4
Place of residence	0.0068	0.2100	2
Household wealth index	0.0065	0.2022	3
Maternal education	0.0122	0.3776	1
Child sex	0.0005	0.0161	5
Anemia (N=19,699)			
Region	0.0003	0.0256	4
Place of residence	0.0010	0.0779	3
Household wealth index	0.0096	0.7757	1
Maternal education	0.0014	0.1160	2
Child Sex	0.0001	0.0047	5
Under-five mortality (N=48,422)			
Region	0.0001	0.0051	5
Place of residence	0.0010	0.0051	3
Household wealth index	0.0004	0.0581	4
Maternal education	0.0037	0.5225	1
Child Sex	0.0016	0.4093	2

Note: *Standardized dominance statistics do not total to 1 due to rounding.

ACCSCIENCE PUBLISHING

International Journal of Population Studies

RESEARCH ARTICLE

"I can't breathe": The effect of intersectionality on access to COVID-19 diagnostic tests in Brazil

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Citation: da Silva, J.C., de Mattos Russo Rafael, R., Alcântara, D.C., de Carvalho, C.M.S.M., Porphirio, M.F.C., Porphirio, M.C.C., *et al.* (2023). "I can't breathe": The effect of intersectionality on access to COVID-19 diagnostic tests in Brazil. *International Journal of Population Studies,* 9(2): 26-36. https://doi.org/10.36922/ijps.0865

Received: April 27, 2023

Accepted: July 14, 2023

Published Online: July 28, 2023

Abstract

This research aimed to analyze the effect of intersectionality on patients' access to COVID-19 diagnostic tests during the outbreak of severe acute respiratory syndrome (SARS) in Brazil. A cross-sectional study was conducted, utilizing a secondary analysis of Brazilian patient records from March to June 2020. The first 4 months of the COVID-19 epidemic were selected as this was the period during which countries organized themselves to provide care for COVID-19 patients. Crude and adjusted odds ratios (OR) were calculated using logistic regression. Interactions with education were tested, considering it a proxy for social class. Statistical analysis was performed using Stata SE 15 software. Out of the 179,295 records examined, 6,326 (3.53%) patients were not tested, and 4,512 (71.32%) of the untested patients were black. The odds of not being tested were higher for black males (OR: 2.30) and black females (OR: 2.58) compared to other racial and gender groups. Black males exhibited a higher likelihood of non-testing than black females, while black females had a higher likelihood than both white males and females. Race, when modulated by social class, showed significant effects on failure to perform diagnostic testing in patients with SARS. The results suggest that structural racism, gender, and social class inequalities significantly impact access to diagnostic testing. Therefore, it is necessary for public policies to consider these findings to address not only the symptoms but also the underlying causes of racism within the social structure.

Keywords: Gender and health; Ethnic groups; Social class; Racism; COVID-19; Brazil

1. Introduction

The COVID-19 pandemic has resulted in millions of infections and deaths worldwide, making it the most significant public health emergency of the past 100 years (Rafael *et al.*, 2020). Studies have shown that the challenges in controlling COVID-19 stem not only from the dynamics of transmission and a lack of specific immunobiological factors but also from its severity being associated with clinical and demographic characteristics, for example, older adults and individuals with underlying chronic conditions, such as lung, heart and kidney diseases, among others, are particularly vulnerable to experiencing more severe symptoms (Cen *et al.*, 2020).

The health systems in low- and middle-income countries, which may not be able to serve the entire population (particularly when their social inequalities are so extreme), have difficulty detecting and controlling various diseases. Predictive models applied to Brazil have shown that limited diagnostic testing can lead to an underestimation of the epidemic and hinder the implementation of health measures based on accurate information (Mellan *et al.*, 2020).

With its vast geographical expanse, Brazil encompasses a rich tapestry of ethnicities and cultures. With a population of 203.1 million, Brazil holds notable political and economic significance in Latin America. However, the country faces substantial challenges rooted in ethnic, gender, and economic inequalities. It is worth noting that 56.1% of the population self-identifies as black, encompassing individuals who identify as black or of mixed race, while women comprise 51.3% of the population. These disparities are further compounded by regional variations. The Southern and Southeastern regions enjoy greater economic prosperity compared to the Northeast, Midwest, and Northern regions, which are home to significant populations of black and indigenous Brazilians (IBGE, 2022).

On the other hand, Brazil is grappling with the profound impacts of structural racism on the daily lives of black people and minority groups. This issue is further exacerbated by the negligence of health authorities in implementing effective health policies. Recent studies have shed light on the disproportionate risks faced by individuals during the COVID-19 pandemic, with factors such as gender, ethnicity, and social class playing significant roles (Wenham *et al.*, 2020). Notably, a recent study conducted in Brazil highlights the correlation between ethnicity and increased mortality rates from COVID-19, as well as a strong association with the most impoverished regions of the country (Baqui *et al.*, 2020). These findings underscore the urgent need for targeted interventions to address the systemic inequities and socioeconomic disparities that perpetuate these disparities in health outcomes.

The impact of race/color on COVID-19 mortality is likely to be connected more with structural issues in societies. A recent study conducted in the United States has shed light on these findings, revealing that even in cities with a lower proportion of African Americans, a significant number of COVID-19 deaths occurred among individuals of black ethnicity. The suggested explanatory hypothesis for these disparities revolves around barriers to accessing health-care services and other structural obstacles, which may have contributed to the observed differences.

These findings further reinforce the impact of structural racism, as well as gender and social class inequalities, which can be explained using intersectionality theories (Bowleg, 2020). The intersectional perspective considers the structuring influences of intersecting social, economic, and political terrains of race, ethnicity, gender, and class, which intensify oppression (Crenshaw, 2002). Race, social class, and gender emerge as determinants of the health, life, and death of population groups, with these factors potentially exacerbated in the current pandemic context.

Accordingly, by utilizing access to COVID-19 tests among patients with severe acute respiratory syndrome (SARS) as an analytical device, this study, without necessarily exhausting all the analytical possibilities, examines the differences that produce and perpetuate inequalities through intersectionality. While recognizing the importance of intersectionality, this study will specifically focus on exploring the role of race/color.

Previous studies have also concentrated on acknowledging and explaining the incidence and mortality rates in populations affected by COVID-19. However, few studies have examined access to health services and consequently, COVID-19 diagnostic testing as an outcome measure. Neglecting to account for the population's access to COVID-19 tests may potentially lead to underestimation of the associated estimates. The present study thus examined the combined influence of race, gender, and social class on the accessibility of COVID-19 diagnostic testing among patients with SARS in Brazil.

2. Data and methods

2.1. Design and sample

A cross-sectional study was conducted, utilizing secondary analysis of the database from the Influenza Epidemiological Surveillance Information System (SIVEP-Influenza). The study focused on patients diagnosed with SARS and covered the period from the 12th epidemiological week (15 – 21 March) to the 25th week (from 14 to 20 June)

of 2020 (Ministry of Health [Brazil], 2020). The study period was chosen to align with the official declaration of COVID-19 community transmission in Brazil, starting from the 12th epidemiological week and concluding with the final data provided by the Brazilian government on June 16, 2020.

The target population for this study (n = 284,928) consisted of individuals selected based on notifications of SARS obtained from the data input of SIVEP-Influenza. Specifically, individuals included in the study exhibited clinical conditions consistent with flu-like syndromes (fever and cough or sore throat), along with respiratory distress (dyspnea, oxygen saturation below 95% in ambient air, or difficulty breathing).

Notifications that contained "Missing" or "Unknown" data regarding diagnostic tests, race, and gender were excluded from the study, as these variables were of interest to the study. Additionally, notifications representing race as "Asian descendant" and "Indigenous" populations were excluded from the study (these populations are underrepresented in the databases and may suffer other forms of racism). This methodological option was chosen following the technique employed in a previous study examining ethnicity and gender in Brazil (Smolen *et al.*, 2018).

2.2. Measurements and conceptual framework

The outcome of the present study was determined by assessing the failure to perform diagnostic testing for COVID-19 and other respiratory viruses. It was determined by the question, "Was a sample collected for diagnostic testing?"

In the study, the variables, namely "race (ethnicity)" and "gender," were considered to be exposures of interest. The categories of "*pardo* (mixed-race Brazilians)" and "black" were combined to form a new category: "black," in line with the theoretical assumptions of the study. The other covariables were included in the model due to their potential role as confounding and mediation variables, which could have an impact on the outcome of the "diagnostic test." These covariables were further subdivided into markers following the relevant literature, as depicted in Figure 1, which shows the conceptual framework of the study.

The variables "age," "geographical region of residence," and "chest X-ray" were grouped into a theoretical block of access markers. The variable "age" was represented in the study as both a continuous variable and a categorical variable, with the numerical form of age being used in the final model. Access to health-care services is commonly associated with "age" and "geographical region of residence." "Chest X-ray" – often required for clinical investigations of respiratory syndromes and part of the protocol for COVID-19 case follow-up – was considered an access marker, as it assumes contact with and use of public or private health facilities.

Clinical severity markers, such as belonging to a COVID-19 risk group, having been hospitalized, and having been admitted to an ICU and placed on ventilatory support, have suggested the need for healthcare workers to provide more appropriate treatment for patients' clinical-etiological conditions. Accordingly, it was hypothesized that there would be a greater probability of undergoing diagnostic testing among individuals with these clinical severity markers, which are considered potential confounding factors in the association being investigated in this study.

Clinical severity marker covariables were treated dichotomous (Unrecord/Record). It is important to note that the "risk group" variable was specified, considering the risk groups for SARS, including a positive response for at least one of the following variables: current pregnancy, current puerperium, current or previous history of heart disease, hematogenous disease, Down syndrome, hepatopathy, asthma, diabetes, neuropathy, pneumopathy, immunodepression, nephropathy, obesity, and other comorbidities (Cen *et al.*, 2020).

Education has been identified as one of the determinants of socioeconomic position and influences access to material resources and health services (van Gaans & Dent, 2018). Accordingly, the present study employed "education" as a proxy for social class. The conceptual model applied in the present study (Figure 1) thus assumes that "education" has the potential to modify the impact of the association between race and gender on access to diagnostic testing. While the "missing data" category was excluded from the analysis of other variables, it was retained for the variable "education" to examine the statistical modeling's behavior in relation to the "unknown" stratum. It is important to note that the category "does not apply" was assigned to cases of children aged 7 years old or younger.

2.3. Statistical analyses

The dataset was subjected to, initially univariate, statistical processing using Stata SE 15 software to better understand the data distribution, as well as to calculate proportions along with their corresponding 95% confidence intervals. Crude odds ratios (cOR) and p-values were calculated using the chi-square test during bivariate analysis. All variables included in the conceptual framework were incorporated in the multiple logistic regression analysis.

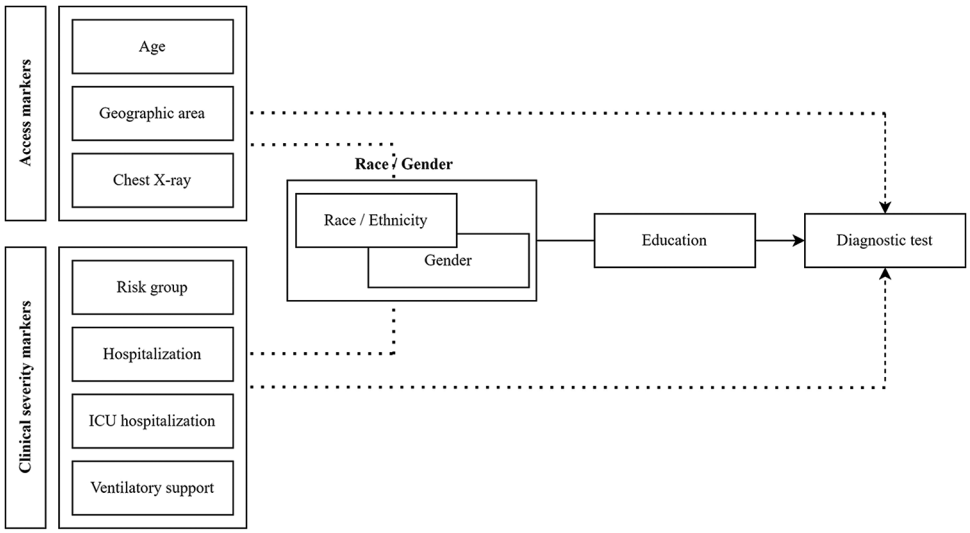

Figure 1. Conceptual framework of the study.

The final logistic regression model comprised the confounding variables identified (adjusted odds ratios [aOR]). Furthermore, interactions with the "education" variable (income proxy) were tested within the model, assessing the relationships through the Wald test. The adjustment of these interactions and the confounding variables from the conceptual framework was evaluated using the likelihood ratio test, which assesses the overall model fit.

2.4. Ethical considerations

As the dataset used in this study consists of information systematically collected by Brazilian healthcare institutions and is publicly available in an open data format provided by the Ministry of Health (Ministry of Health [Brazil], 2020), the present study, in accordance with national regulations on research involving human subjects, did not require approval from a research ethics committee and did not use terms of informed consent.

3. Results

Of the 284,928 records composing the dataset of patients with SARS in the study period, 14,732 (5.17%) lacked information on diagnostic testing, 94,188 (33.06%) did not have record "race" (missing data) or classified race as "unknown," 2,525 (0.89%) classified the individual as Asian-descendant and 655 (0.23%) identified as indigenous. Furthermore, 107 (0.04%) observations were missing information on the variable "gender." After applying the exclusion criteria, the final study population comprised 179,295 records.

As shown in Table 1, more than half of the study population comprised males (n = 98,199; 54.77%). Among the study population, 92,531individuals (51.61%) self-identified as black, 113,419 (63.26%) were aged 50 years old or older, 68,718 (41,06%) had attained some level of education, and the majority (n = 158,515; 94.97%) resided in urban areas. Most of the individuals had undergone chest X-rays (n = 87,912; 73.63%), had comorbidities classifying them as being in a risk group (n = 123,687; 68.99%), and had been hospitalized (n = 163,864; 91.39%). However, a significant number of records lacked information regarding education (n = 92,046; 51.34%), chest X-ray results (n = 59,899; 33.41%), ICU hospitalization (n = 28,536; 15.91%), mechanical ventilation (n = 25,987; 14.49%), and geographical region of residence (n = 12,379; 6.90%).

It was found that 6,326 individuals (n = 3.53%; 95% CI: 3.44 – 3.61) with SARS did not undergo diagnostic testing to identify the etiological agent of the disease. Among these individuals, 4,512 (71.32%; $p < 0.001$) were identified as black, and 3,473 (54.90%; $p = 0.831$) were male. Table 1 also presents the cOR and the effects of exposure variables adjusted for the confounding variables as predicted in the conceptual framework. Notably, in the adjusted model, statistically significant differences were observed between black females (aOR = 2.52; $p < 0.001$) and males (aOR = 2.38; $p < 0.001$).

Table 2 illustrates the interactions between the variables "gender/race" and "education." The variable "education" did not yield any changes in effect among white people. On the other hand, for the black population, lower levels of education had a more significant impact on the non-testing of females (aOR = 3.22; $p = 0.001$) and, to a lesser extent, males (aOR = 2.61; $p < 0.001$) compared to white males. Higher levels of education reversed the effects on non-testing in the black population: males displayed a

Table 1. Study sample characteristics, bivariate analysis, and model fit, comparing target independent variables and the dependent variable (lack of diagnostic testing) in individuals with SARS during the COVID-19 pandemic in Brazil, 2020 (*n*=179,295)

Variables	Distribution		No diagnostic test			
	n	% (95% CI)	cOR (95% CI)	*p*	aOR (95%CI)*	*p*
Race and gender						
White males	46,263	22.80 (25.60 – 26.00)	1.0		1.0	
White females	40,501	22.59 (22.40 – 22.78)	1.10 (1.00 – 1.20)	0.050	1.12 (0.98 – 1.28)	0.086
Black males	40,595	22.64 (22.45 – 22.84)	2.52 (2.34 – 2.72)	<0.001	2.38 (2.13 – 2.66)	<0.001
Black females	51,936	28.97 (28.76 – 29.18)	2.49 (2.30 – 2.69)	<0.001	2.52 (2.24 – 2.83)	<0.001
Education						
Higher education	11,919	6.65 (6.53 – 6.76)	1.0		1.0	
Primary school	43,696	24.37 (24.17 – 24.57)	1.38 (1.22 – 1.55)	<0.001	1.26 (1.03 – 1.53)	0.019
Secondary school	25,022	13.96 (13.80 – 14.11)	1.14 (1.00 – 1.29)	0.052	1.16 (0.94 – 1.42)	0.166
Not applicable	6,612	3.69 (3.60 – 3.78)	1.20 (1.01 – 1.43)	0.036	1.79 (1.37 – 2.34)	<0.001
Unknown	92,046	51.34 (51.11 – 51.57)	1.33 (1.19 – 1.50)	<0.001	1.34 (1.11 – 1.62)	0.002
Age (years)**						
<10	9,661	5.39 (5.28 – 5.49)	1.0			
10 – 19	4,045	2.26 (2.19 – 2.32)	1.00 (0.81 – 1.21)	0.923		
20 – 29	9,860	5.50 (5.39 – 5.60)	0.86 (0.73 – 1.01)	0.064		
30 – 39	18,728	10.45 (10.30 – 10.59)	0.91 (0.79 – 1.04)	0.168		
40 – 49	23,582	13.15 (13.00 – 13.31)	0.92 (0.81 – 1.05)	0.244		
50 – 59	28,220	15.74 (15.57 – 15.91)	1.04 (0.91 – 1.18)	0.567		
60 – 69	31,356	17.49 (17.31–17.66)	1.04 (0.92 – 1.18)	0.517		
70 – 79	28,073	15.66 (15.49 – 15.83)	1.18 (1.04 – 1.34)	0.009		
≥80	25,770	14.37 (14.21 – 14.54)	1.18 (1.00 – 1.35)	0.008		
Region of residence						
Urban	158,515	94.97 (94.86 – 95.07)	1.0			
Rural/peri-urban	8,401	5.03 (4.93 – 5.14)	1.42 (1.28 – 1.58)	<0.001		
Chest X-ray						
Normal	8,859	7.42 (7.27 – 7.57)	1.0			
Abnormal	79,053	66.21 (65.94 – 66.48)	0.88 (0.78 – 1.01)	0.066		
None	31,484	26.37 (26.12 – 26.62)	1.49 (1.31 – 1.71)			
Risk group						
Unrecord	55,608	31.01 (30.80 – 31.23)	1.0			
Record	123,687	68.99 (68.77 – 69.20)	1.07 (1.01 – 1.13)	0.012		
Hospitalization						
Unrecord	15,431	8.61 (8.48 – 8.73)	1.0			
Record	163,864	91.39 (91.26 – 91.52)	0.45 (0.42 – 0.48)	<0.001		
ICU hospitalization						
Unrecord	104,924	69.60 (69.36 – 69.83)	1.0			
Record	45,835	30.40 (30.17 – 30.63)	0.67 (0.63 – 0.72)	<0.001		
Ventilatory support						
Unrecord	57,753	37.67 (37.43 – 37.91)	1.0			
Record	95,555	62.33 (62.08 – 62.57)	0.84 (0.78 – 0.88)	<0.001		

Note: *aOR: Odds ratio adjusted for all variables in the conceptual framework. **The cOR (crude odds ratio) for the age variable in its continuous numerical form was 1.004 (95% CI: 1.003 – 1.005; *P*<0.001). It is noteworthy that the adjusted model used the continuous numerical form of the age variable. SARS: Severe acute respiratory syndrome.

Table 2. Multiple analyses of race, gender, and lack diagnostic testing, by level of education, in individuals with SARS during the COVID-19 pandemic in Brazil, 2020 (*n*=179,295)

Variables	No diagnostic test	
	aOR (95% CI)*	*p*
Higher education		
White males	1.0	
White females	1.18 (0.69 – 2.02)	0.533
Black males	3.59 (2.19 – 5.89)	<0.001
Black females	2.61 (1.51 – 4.52)	0.001
Primary school		
White males	1.0	
White females	0.90 (0.68 – 1.18)	0.451
Black males	2.70 (2.18 – 3.34)	<0.001
Black females	3.22 (2.59 – 4.00)	0.001
Secondary school		
White males	1.0	
White females	1.15 (0.81 – 1.63)	0.423
Black males	2.59 (1.93 – 3.48)	<0.001
Black females	2.20 (1.60 – 3.03)	<0.001
Not applicable		
White males	1.0	
White females	1.54 (0.85 – 2.79)	0.149
Black males	2.48 (1.47 – 4.20)	0.001
Black females	2.13 (1.22 – 3.72)	0.008
Unknown		
White males	1.0	
White females	1.18 (0.99 – 1.42)	0.062
Black males	2.09 (1.78 – 2.44)	<0.001
Black females	2.29 (1.95 – 2.70)	<0.001

Note: *aOR: Odds ratio adjusted for all variables in the conceptual framework.

stronger effect (aOR = 3.59; $p < 0.001$) compared to females (aOR = 2.61; $p = 0.010$).

With respect to the category of "education unknown," where it was not possible to specify participants' level of education, similarities in the magnitudes were observed in the bivariate analysis. Specifically, black females and males, in that order, were less likely to undergo diagnostic testing. Finally, similar behavior was observed with regard to "education records not applicable," which corresponds to children under 7 years old. Once again, black males and females were tested less frequently than white males. The likelihood ratio test yielded a Chi-square statistic of 34.99 with 12 degrees of freedom and a $p < 0.001$.

4. Discussion

The main findings of this study highlight the combined effects of gender and race on the likelihood of undergoing diagnostic testing among individuals with SARS during the COVID-19 pandemic. Even after controlling for clinical severity markers and access-related variables that could influence the likelihood of receiving diagnostic testing, it was observed that black females and males had less access to diagnostic tests compared to white individuals. Furthermore, the study identified a difference between black females and males in terms of accessibility to diagnostic testing, which varied based on their social class: black females with lower levels of education had reduced access to diagnostic tests, whereas black males with higher levels of education faced even greater barriers to accessing diagnostic testing.

Recent studies have highlighted the significant barriers that black males and females face when accessing essential healthcare services, particularly in preventive care (Chinn *et al.*, 2021; Silva *et al.*, 2020). These barriers have far-reaching implications for their overall quality of life. Internationally, it is evident that institutional and structural factors play a pivotal role in the perpetuation of these disparities in healthcare access, encompassing systemic discrimination within healthcare institutions (Parker *et al.*, 2017) and limited employment prospects within the affected population (Mullany *et al.*, 2021).

A qualitative study has brought to light the lower utilization of health-care services among male groups, even among higher social classes, in Brazil. This can be attributed to two prevalent factors in Brazilian culture. Firstly, the fear of job loss plays a significant role, as many jobs in Brazil, particularly for the black population, are often precarious. The fear of losing employment dissuades individuals, including those from higher socioeconomic backgrounds, from seeking healthcare services due to potential negative consequences for their job security. Secondly, the influence of a sexist culture further contributes to the understanding of reduced access to healthcare services among men. This cultural phenomenon leads men, regardless of their socioeconomic status, to downplay or ignore their health concerns. Seeking healthcare may be viewed as a sign of weakness or vulnerability, leading to avoidance of preventive care and delays in seeking medical attention (Gomes *et al.*, 2007).

In the Brazilian context, health-care inequities persist among black individuals, transcending social class boundaries (Silva *et al.*, 2020). Notably, individuals from higher socioeconomic backgrounds, including black males, tend to rely less on public healthcare services compared to their counterparts from lower economic strata (Souza Júnior *et al.*, 2021). This observation offers

valuable insights into the intricate interplay between social class and race, which shapes the healthcare-seeking behaviors of vulnerable populations. During the early stages of the COVID-19 pandemic in Brazil, public healthcare systems predominantly focused on managing SARS cases. However, it is conceivable that black men with higher incomes gravitated toward private healthcare services, potentially encountering additional barriers to access compared to women who, due to prevailing gender inequalities, predominantly rely on public health-care provisions. Nevertheless, it is imperative to conduct further rigorous research to delve deeper into these findings and validate them through future investigations.

This study is one of the few to assess the combined effects of gender, race, and social class in the context of COVID-19 in Brazil. However, other investigations have also indicated the disproportionate risks faced by black and ethnic minority groups. For example, a study published in Respiratory Medicine by The Lancet found that, in the United Kingdom, mortality rates were 3.5 times higher among black individuals of African descent, 1.7 times higher among black individuals of Caribbean descent, and 2.7 times higher among individuals of Pakistani descents compared to white individuals. Similarly, black Americans were found to have a mortality rate 2.04 times higher than white Americans. These factors have direct effects on clinical practice and should thus be taken into consideration by health professionals (Kirby, 2020).

Another study conducted in the United States highlighted the "color of COVID-19" by examining the COVID-19-related death rates among individuals older than 65 years, a group considered to be at higher risk. The findings revealed that the death rate among black Americans in this group was 2.9 times higher compared to white Americans. That study reinforced the idea that these differences transcend purely biological aspects by comparing mortality rates among Latino and white Americans, where it found a ratio of approximately 2:1 (Garcia *et al.*, 2020).

A prominent complicating factor in the Brazilian context is the way that certain population groups, such as black people, are exposed to healthcare access barriers. Race is a concept that emerged through a socio-historical process known as the racialization of black people. The reproduction of the logic that determines social divisions based on the existence of races is a social technology developed by capitalist sociability with the intention of strengthening differences and establishing domination by means of the reductive objectification of black people.

Racism in Brazil extends beyond individual beliefs and actions. It is a complex system that perpetuates racial inequalities, acting as a social technology that organizes and controls society. This system shapes relationships and hierarchies among racial groups, much like how technology utilizes knowledge, skills, and tools to achieve specific objectives. Therefore, technology should be understood beyond tangible devices such as computers, machines, or tools in this context. It encompasses organizational systems, production processes, concepts, and ideas that shape how individuals perceive and experience the world. Racism carries values, perspectives, and socioeconomic impacts. Considering racism as a social technology is a valid approach because it acknowledges its complexity in constructing subjectivities, spatial segregation, violence, denial of opportunities, and the maintenance of privilege. As a social technology, racism can be refined and adapted, manifesting in various ways to produce inequalities. This perspective highlights the intricate nature and broad reach of racism as a social issue (Almeida, 2018; Staudigl, 2012).

Following that logic, the creation of the category of a black race establishes a separation between those deemed fully human and those considered incapable of self-government, and all kinds of conceptions, prejudices, and racism are projected onto the latter. This separation produces modern humanity guided by the logic of neo-colonialism, which naturalizes the exercise of power over and government of the other (Mbembe, 2018).

Racism is a social technology that systematically uses, whether consciously or unconsciously, race as a foundation for managing the regulatory economy and the distribution of death in favor of the exercise of biopower, enabling the murderous functions of the government, providing the conditions for naturalizing the government's right to allow to live or let die. In this context, racism functions as a structural and pervasive strategy within capitalist societies, stemming from political, economic, legal, and interpersonal dynamics that determine the value placed on the lives of specific population groups, such as black individuals (Almeida, 2018).

This construction rests on the myth of racial democracy, adopted historically in Brazil to reduce race tensions. Thus, invisible subordinate relations operate through an idea of symmetrical miscegenation and a society free from racism. This ideology has delayed the race debate in Brazil and impeded progress in discussing and implementing public policies for specific population groups (Almeida, 2018; Mbembe, 2018). The authors believe this construction plays a major role in social dynamics and affects even the production of public policies and health measures – in the specific case of this manuscript – producing disproportionate and race-specific actions during the COVID-19 pandemic.

Intrigued by the question, "Does COVID-19 affect women and men differently?" a study conducted by Rozenberg *et al.* (2020) found that countries reporting COVID-19 data by gender, such as the United States (mainly in New York), Denmark, France, and Belgium, recorded a higher number of hospitalizations and deaths among males. On the other hand, the study also highlighted the need for caution in interpreting these findings due to variations in testing capabilities among different countries: lower testing rates in certain groups could result in fewer recorded cases. A separate study conducted in Rio de Janeiro investigated the influence of income on the cumulative incidence rate of COVID-19 and yielded similar findings (Rafael *et al.*, 2020). It revealed lower testing rates in lower-income neighborhoods, highlighting the issue of under-reporting due to insufficient testing. Inequity ceases to exist to the extent that individuals do not know about it.

These findings underline that unequal behavior arises from the intersection of gender, race, and class, which are evident in various outcomes investigated in Brazil. For instance, a study examining resistant tuberculosis in different municipalities in Brazil found a correlation between the supply of culture tests and socioeconomic indicators (Jacobs & Pinto Junior, 2019).

Unlike insurance-based health systems, Brazil's Unified Health System (*Sistema Único de Saúde*, SUS) is essentially public and operates on a universalist proposal based on equal and non-discriminatory access, at least in constitutional principle. However, the proposal to produce equity has been significantly threatened by extensive underfunding over the twenty years of the SUS's existence. At the same time, the private subsystem has grown and, to a point, has filled gaps in the public structure (Glantz *et al.*, 2019).

Ultimately, inequality has increased over the years since higher-income white individuals tend to have more access to health services than poor, peripheral black individuals. This phenomenon may explain the differences in health service access found in this study between black females and males based on socioeconomic status. The latest national survey to investigate access to health insurance in Brazil showed that females, whites, and higher-schooled individuals use these private services more often (Barros *et al.*, 2016), which may explain their greater access to COVID-19 diagnostic tests.

It is essential to think about how the findings of this study may relate to the need to broaden perspectives on the COVID-19 pandemic and how the cumulative effects of race, gender, and social class can produce inequities in individuals' chances of living and dying, even among black children, as suggested in the "non-applicable" education findings. This result is compatible with studies of child mortality in Brazil because it corroborates the race-mediated structuring of unequal relationships in Brazilian society from childhood (Alberto *et al.*, 2019).

Finally, even when considering the education "unknown" category (a proxy for social class), the race and gender effects on health-care disparities remain. Consistent with the observations made by Bowleg (2020), deadly pathogens turn the spotlight on the social fissures and inequalities that underlie power relationships related to life and death in societies. These disparities extend beyond the pathogenesis of etiological agents and are rooted in the colonialist structures that have shaped these societies.

It is worth reflecting on the concept of *necropolicy* and its operation within capitalism. In this regard, the *necropolicy* introduced into the role of the government calls for the division of society into social segments and, by regulating and naturalizing (bio) political power over lives, institutionally authorizes who should live and who should die. On this logic, the government organizes its actions and policies by ranking bodies and distributing the right to life in a discriminatory fashion, despite the individual caregiver's morality. Therefore, we emphasize that making data on the black population unviable, as well as the evidently low number of diagnostic tests carried out on this population group, are necropolitical actions of the government that establish a genocidal pattern of racialized populations. Structural racism legitimizes the right to let others die and/or to kill to protect or preserve certain ways of living regarded as more legitimate than others (Mbembe, 2018).

4.1. Limitations

The findings of this study must be interpreted in the light of some limitations. The first relates to the records on which the investigation was based. The large number of records with missing information on exposure variables (gender and race) and level of education (over half marked as missing or unknown) may have produced differences in the observed effects; this gap must be bridged by building more robust databases into the health service routine. Another limitation of this study pertains to the method of gender records, which is guided by the binary model of males and females. This approach constrains the comprehensiveness of the data, particularly in relation to transgender and non-binary individuals. As a result, these individuals may be categorized as unknown or according to their assigned sex at birth, leading to significant underrepresentation and potential misclassification within the dataset. It is urgent and essential to produce more robust databases to address this and other (future) health crises in Brazil. However,

this limitation merely corroborates the traditional and indefensible idea that race, gender, and social class are not objects of care in health systems.

Another limitation lies in the probable underreporting of cases by facilities connected exclusively with private health subsystems. Bearing in mind that white individuals and those belonging to upper socioeconomic strata are the main users of private systems in Brazil and that they potentially have more access to COVID-19 diagnostic tests, it can be assumed that the effect of race and socioeconomic status is even greater than observed in this study.

It is important to consider that the present study examined a group of individuals at the most severe stages of respiratory syndrome, creating the expectation that they would have easier access to diagnostic tests for COVID-19 and other etiological agents. It is also important to clarify that the data analyzed in this investigation refer to the early period of the COVID-19 pandemic in Brazil. It is natural to imagine that these findings may be even more deleterious in scenarios where respiratory syndromes have been milder during the pandemic. Thus, the harmful effects of gender, race, and class inequality are possibly even greater in mild manifestations of respiratory infections caused by COVID-19, thus requiring attention from health professionals, especially those in nursing homes, during respiratory screening in the pandemic context.

Despite the limitations, the present study represents a valuable contribution to the field, as it sheds light on the deleterious effects caused by gender, race, and class disparities. These findings emphasize the urgent need for policymakers to consider the implications and address these inequities when formulating public policies. By recognizing and addressing these issues, we can work towards creating a more just and equitable society.

5. Conclusions

This study showed the effects on access to diagnostic testing of patients with respiratory syndromes in Brazil. It also reasoned about the deleterious effects of structural racism and the modulating effects of gender and social class inequalities on individuals' lives. It also gave grounds for thinking about how black females and males are more brutally exposed to the ills of precarious conditions. Moreover, throughout the COVID-19 pandemic, they have been made even more susceptible to structural disadvantages, in the specific case of this study, difficulty in accessing certain levels and procedures of the health-care system.

Acknowledgments

None.

Funding

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil ([Coordination for the Improvement of Higher Education Personnel - Brazil] CAPES), Finance Code 001, and the Carlos Chagas Filho Research Support Foundation of the State of Rio de Janeiro (FAPERJ). Ricardo de Mattos Russo Rafael acknowledges funding from the Brazilian Research Council (National Council for Scientific and Technological Development - CNPq). Ricardo de Mattos Russo Rafael, Mercedes Neto, and Tiago Braga do Espírito Santo also acknowledge the funding from the University of Rio de Janeiro State (Program for Incentives to Scientific, Technical and Artistic Production of the Rio de Janeiro State University - PROCIENCIA/UERJ).

Conflict of interest

The authors declare they have no competing interests.

Author contributions

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Formal analysis: Ricardo de Mattos Russo Rafael
Investigation: All authors
Methodology: Juçara Cezario da Silva, Ricardo de Mattos Russo Rafael
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Writing – review & editing: All authors

Ethics approval and consent to participate

As the information included in the dataset is systematically collected by Brazilian healthcare institutions and made available in an open, public data format by the Ministry of Health, the present study, in accordance with national regulations on research involving human subjects, did not require approval from a research ethics committee and did not use terms of informed consent.

Consent for publication

Not applicable.

Availability of data

The data is available from the Brazilian Ministry of Health's Integrated Health Information Platform. Specifically, the data is available at http://plataforma.saude.gov.br/coronavirus/dados-abertos/.

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ACCSCIENCE PUBLISHING

International Journal of Population Studies

RESEARCH ARTICLE

Professional quality of life in the child protection system: The mediating role of attachment security and closeness in the child-employee dyad

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Abstract

Child protection workers who interact with vulnerable children daily are indirectly exposed to multiple traumatic events, and the possibility of experiencing burnout and secondary traumatic stress (STS) is high. Concurrently with these outcomes, positive results can occur in this type of activity, which are experienced in the form of compassion satisfaction. The purpose of this study is to explain the effect personal adverse childhood experiences (ACEs) exert on the professional quality of life (ProQOL) of selected categories of employees (foster parents, psychologists, and social workers), via the employees' attachment security and closeness toward the children they work with. This study is the first to investigate factors that influence the development of ProQOL in a more complex sample of child protection workers. Data were collected at a single point in time with the help of 11 Child Protection Services Bureaus from Romania, using an online survey, yielding 223 participants, including 130 foster parents and 93 specialists. The mediating model was tested with structural equation modeling. The overall fit of the model is acceptable. The indirect effects of ACEs on the components of ProQOL are statistically significant, and attachment security and closeness in the child-employee dyad act as protective factors against the development of burnout and STS in this sample. Findings confirm the beneficial effects of employee attachment security and closeness towards children they work with on their ProQOL. These results could be implemented by considering attachment-based approaches in supporting professionals.

Keywords: Child welfare professionals; Adverse childhood experiences; Attachment security; Closeness; Professional quality of life; Romania

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Citation: Teculeasa, F., Golu, F., & Gorbănescu, A. (2023). Professional quality of life in the child protection system: The mediating role of attachment security and closeness in the child-employee dyad. *International Journal of Population Studies*, 9(2): 37-48.
https://doi.org/10.36922/ijps.0884

Received: April 30, 2023

Accepted: July 13, 2023

Published Online: August 1, 2023

1. Introduction

1.1. Child protection workers and their professional activity

In recent years, there has been increased awareness of the negative consequences experienced by social workers who treat trauma victims (Dagan *et al.*, 2016). Children who are victims of abuse and neglect and who are placed in foster care represent a category of trauma victims. It is notable that, according to Carew's (2016) research, almost all of the children who are placed in foster care have gone through a traumatizing experience. Burnout and secondary traumatization are examples of these negative

consequences, and it is possible that the employees are not even fully aware of these phenomena. Thus, child welfare organizations are morally bound to assist their staff in managing any emotional or mental angst that could arise due to their job duties. The focus of this study is on employees of the child protection system, such as care and education workers (foster parents), social workers, and psychologists. In this paper, we consider foster parents as professionals who are employed and receive salaries but acknowledge that there are contrasting conceptions in Europe as to what professionalism in the field of foster care means (Reimer, 2021). In some countries such as Romania and France foster parents are considered employees of the child protection system, but in other countries such as Austria and Germany foster parents receive a foster care allowance. The reason why these categories of child protection workers were brought together in this study is that both care and education workers and specialists work directly with children involved in the child protection system and represent some of the employees who have the strongest exposure to the traumatic experiences of children.

Foster parents have direct and indirect access to the traumatic material of foster children, through the existing information from the case files, what children can express about the traumatic experiences according to their developmental stage, witnessing the emotional and behavioral expressions of trauma, and sometimes seeing obvious bodily signs of physical abuse or even assisting the child in recuperating from physical harm following their removal from an abusive setting. According to Blythe *et al.* (2014), taking care of foster children can be challenging for foster parents due to their complicated social, emotional, behavioral, educational, and physical needs that require daily attention, nurturing, and behavioral guidance.

A large number of studies are supporting the fact that social workers have an emotionally demanding job, especially in the child protection system. Social workers have difficult tasks such as probing allegations of child mistreatment, taking the child victims from their biological families, working with trauma victims, as well as acting in the children's best interest overall (Bolic, 2019). Some specialists, such as psychologists, conduct psychological evaluations, and implement different intervention techniques to reduce the psychological consequences of traumatic events that happened to children before entering the child protection system.

1.2. Professional quality of life (ProQOL) among child protection workers

The concept of ProQOL pertains to the level of satisfaction and fulfillment that an individual experiences toward their work as a helper (Stamm, 2010). Figley (1995) and Stamm (1995) introduced the notions of compassion fatigue (CF) and STS, which highlighted the adverse impact on caregivers who assist individuals affected by trauma. For many years, various fields such as nursing, social work, psychology, mental health, and case management have studied the impact of trauma on professionals who came into direct contact with clients (Bloomquist *etal.*, 2015). According to Stamm (2010), the idea of one's PQL is multifaceted as it involves aspects of both their work surroundings (organizational and occupational), their personal traits, and their exposure to primary and secondary trauma while on the job. The job characteristics of social workers, psychologists, and foster parents and the fact that they work with vulnerable children are important aspects that need to be addressed in their professional activity, within a preventive framework. Otherwise, limitations in the quality of the services they provide, re-traumatization, and an increase in turnover rates are just some of the consequences child protection systems have to deal with.

PQL includes CF and compassion satisfaction concepts. CF contains STS and burnout. Boscarino *et al.* (2004) suggested that excessive exposure to traumatized individuals and a high level of empathy among professionals can lead to CF. The presence of CF was reported on a large scale among many specialists working with traumatized people (Boscarino *et al.* 2004; Carmel & Friedlander, 2009).

Figley (1995) defines STS as the exposure to traumatic events indirectly, through personal or professional associations with one or more individuals who have experienced trauma and may share their experiences repeatedly. According to the National Child Traumatic Stress Network (NCTSN, 2018), encountering STS is a frequent occupational risk for professionals who work with children who have experienced trauma. STS is a frequently encountered problem among foster parents as well, according to Bridger *et al.* (2019) and Hannah and Woolgar (2018), even though it came to the attention of the scientific literature only recently through the research conducted by Carew (2016).

Numerous research on the presence of burnout in the child protection system supports the intuitive hypothesis that these employees have high scores on burnout (Baugerud *et al.*, 2017; Louison Vang *et al.*, 2020). In the field of social work, the burnout phenomenon of social workers was first examined by Schaufeli *et al.* (2009). The causes of burnout were attributed to the overwhelming number of cases, a sense of powerlessness due to the system, and a feeling of unfairness. However, not only negative results

can occur in this type of activity. Compassion satisfaction (CS) is the term used to describe the positive emotional state that arises from aiding others and obtaining a sense of accomplishment in one's work, according to Baugerud *et al.* (2017).

1.3. Adverse childhood experiences (ACEs) and the ProQOL

Carew (2016) states that social work as a career is often linked to experiences of psychosocial traumas during childhood. Steen *et al.* (2021) have pointed out in their research that child welfare professionals have higher ACE scores than the general population. Lee *et al.* (2017) and Steen *et al.* (2021) identified that child welfare professionals' ACE score was associated with higher work stress. Concurrently, whether foster parents experienced ACEs represents an area in which little is known. When Cooley *et al.* (2020) conducted their study, there were no published works that reported on the frequency of ACEs among foster parents. It is significant to examine this topic because experiencing abuse, neglect, or trauma during childhood has been linked to elevated levels of parental stress or adverse parenting behaviors among parents in the general population (Steele *et al.*, 2016).

Research has shown that the relationship between a social worker/counselor's prior traumatic experiences and their susceptibility to secondary trauma has been extensively studied. Most studies, including those conducted by Bride (2007) and Nelson-Gardell & Harris (2003), have found a link between these two concepts. An important number of studies identified that ACEs represent a factor that contributes to the increasing risk of developing negative results in compassion (Bride *et al.*, 2004; Bridger *et al.* 2019; Nelson-Gardell & Harris, 2003).

1.4. Attachment as a mediator

The results regarding how attachment mediates the relationship between ACEs and negative psychological outcomes in adults have been inconsistent among non-clinical populations. One instance is when attachment played an important role in linking childhood maltreatment to negative psychological outcomes such as distress, internalizing symptoms, and depression among at-risk individuals who were not receiving medical treatment. This was supported by studies conducted by Dion *et al.* (2019), Muller *et al.* (2008), Bifulco *et al.* (2006), and Widom *et al.* (2018). However, in the studies performed by Dion *et al.* (2019) and Widom *et al.* (2018), only the anxiety dimension, and not avoidance was identified as a significant mediator, whereas Bifulco *et al.* (2006) concluded that both dimensions, with different intensities, mediated the effect. The study conducted by Fowler *et al.* (2013) used a clinical population and identified that attachment mediated the effect of interpersonal trauma on the severity of depression. According to Dimitrova *et al.* (2010), it was crucial to verify if attachment plays a role in connecting childhood sexual abuse to adult mental health. Their study concluded that the ability to maintain close relationships among survivors of childhood sexual abuse was the factor that connects childhood abuse to future psychological outcomes. The researchers could not establish a connection between the anxiety and avoidant dimensions of attachment and psychological outcomes in adults.

Researchers have noticed that there are many different ways of measuring and classifying attachment styles in scientific studies, which can make it difficult to consistently link a particular style to a certain disorder (Bifulco *et al.*, 2006). Bowlby (1988) states that attachment styles cover a spectrum from secure, which is defined by seeing others as reliable and honest, to insecure, which is defined by seeing others as untrustworthy. Research indicates that individuals who have had traumatic experiences in their childhood tend to have lower expectations of others' reliability (Munoz *et al.*, 2021). The classification of secure and insecure attachment styles is used in the present study, in accordance with the model presented by Munoz *et al.* (2021). In their study, the authors examined the mediator role of attachment security in the relationship between ACEs and hope and concluded that the effect of ACEs on lower hope can be better explained through attachment insecurity.

1.5. Employees' closeness towards children in the child protection system

Research indicates that maintaining a close care dyad relationship has consistently resulted in positive effects for a person receiving care. However, the outcomes for caregivers are variable. While there is proof that shows a correlation between relationship closeness/quality and the well-being and health of caregivers, it is uncertain whether closeness functions as a protective or detrimental factor (Fauth *et al.*, 2012).

The closeness of the employees toward the children with whom they work is conceptualized in this study as the employee's perception of the relationship between the worker and the child, as more or less close and empathetic. In the study conducted by Blythe *et al.* (2013), it was discovered that foster parents who offer extended foster care to a child recognize themselves as parents. Having close relationships between parents and children

in families involved with child welfare has resulted in diminished instances of internalizing and externalizing behaviors in children. This can be observed in foster care families where strong bonds between caregivers and children have been found to decrease disruptive behavior, criminal activity, and substance abuse (Cederbaum *et al.*, 2017) thus leading to positive outcomes for all parties involved.

1.6. Gaps in the scientific literature and aims of the current study

Although prior research has linked ACEs with attachment and negative results in compassion, insufficient and mixed results were identified. Therefore, it is necessary to advance the research on the subject of child welfare PQL, and implicitly on compassion fatigue and compassion satisfaction.

Limitations in the current state of knowledge were identified regarding the development of PQL in different categories of employees from social services. The studies conducted before analyzed PQL in individual professions, such as foster parents (Bridger *et al.*, 2019; Carew, 2016; Hannah & Woolgar, 2018), social workers (Senreich *et al.*, 2020), or on child welfare specialists as a general group (Bolic, 2019). There were no identified studies on the population of child protection professionals, more precisely on psychologists, social workers, and foster parents

Following an extensive search in the scientific literature, it can be concluded that the present study is the first to tackle the issue of PQL among certain categories of employees in the child protection system. This study brings an important contribution to the understanding of how employees in child protection services can be affected by the psychological consequences of working with traumatized children, and what measures can be implemented.

Individuals working in fields such as social work, foster care, and child protection psychology encounter trauma frequently while performing their job duties. It becomes challenging for them to have a sustained break from exposure to traumatic events, which could aid in returning to their normal level of work performance before being subjected to future trauma. As a result of prolonged exposure, it is crucial for organizations to be proactive in recognizing and addressing symptoms and reactions, even if they appear minor (Hiles Howard *et al.*, 2015).

The current study aims to explain the contribution of ACEs to the ProQOL of selected categories of employees in the child protection system. Furthermore, the mediating role of attachment security and closeness in the child-employee dyad in the relationship between ACEs and ProQOL will be examined. The authors proposed the following hypotheses:

1. There is a significant direct effect of ACEs on attachment security, closeness in the child-employee dyad, CF, and compassion satisfaction.
2. The attachment security of employees and closeness towards the children act as mediators in the link between the ACE variable and the CF and compassion satisfaction variables. More specifically, it is expected that the effect of ACEs on CF mediated by attachment security, and the effect mediated by closeness towards the children is positive. Simultaneously, it is expected that the effect of ACEs on compassion satisfaction is mediated by attachment security, and the effect mediated by closeness toward the children is negative.

To do this, self-report measures are used to assess the above-mentioned variables. Structural equation modeling (SEM) is utilized to understand the relationship between variables and to perform mediation analyses. A greater understanding of the ProQOL in the child protection system, the associations with ACEs, and how the employees' attachment security and closeness in the child-employee dyad can act as risk or protective factors will benefit local authorities which manage foster carers. The need for increased support for employees who directly work with vulnerable children is becoming increasingly evident. This includes raising awareness about the subject and providing targeted interventions to address their specific needs. By promoting role retention and improved ProQOL, foster parents, psychologists, and social workers can better contribute to the ultimate goal, the protection of foster children.

2. Methods

2.1. Procedure

This cross-sectional research was conducted in collaboration with 11 child protection institutions from districts all over Romania. The recruitment procedure is similar to the one used in a previous study conducted by the authors on a sample of foster parents (Teculeasa *et al.*, 2022). One of the authors sent official invitations to the institutions through email, stating the general purpose of the study, its significance for practice, and how important is the participation of employees. The Survey AnyPlace (2020) software was utilized to generate an online questionnaire, which the participants were requested to complete. The questionnaire included separate items differently phrased in accordance with the job characteristics of foster parents and specialists in child protection services. The authors included a page

containing consent information in the online version of the questionnaire. On this page, the authors explained that the questionnaire includes some potentially distressing items. In that respect, the respondents were directed to support resources appropriate for child protective employees. Moreover, the authors provided their contact information on the consent page for further details about the study and stated that respondents could drop out of the process at any time with no consequences. Pressing the "Continue" button represented the employee's approval to participate in the study, understanding its voluntary nature. No incentives were used in this study. Approval to perform this study was granted by the Ethics Committee of the University of Bucharest (23.04.2020/No. 22).

2.2. Participants

The required sample size was computed with the help of the semTools package (Jorgensen *et al.*, 2021) from R (R Core Team, 2020). Hence, to reach $\alpha = 0.05$, *RMSEA* = 0.08, and a power of.80, the sample size would have to consist of 295 participants. At first, 348 foster parents and 172 specialists were interested in completing the survey containing the proposed questionnaires. Unfortunately, 173 (50%) foster parents and 68 (39%) specialists did not manage to finish the task; therefore, the authors were unable to obtain the suggested sample size after performing the power analysis. In addition to this, 56 surveys were deleted due to a substantial amount of missing data. In the end, 223 participants including 130 foster parents and 93 specialists completed the online survey. The group of foster parents included in the present research is a subset of a bigger pool ($n = 165$) that was previously studied to investigate the impact of foster parent sensitivity toward child trauma on their job satisfaction (Teculeasa *et al.*, 2022).

The mean age of the sample ($n = 223$) is 50.17 years (SD = 8.03) for foster parents and 46.44 years (SD = 9.48) for specialists. Regarding the gender of the sample, 92% of the participants are females, and 8% are males. Of the total sample, 58% is represented by foster parents, and 42% is represented by specialists. As for the work experience of the employees, 58% of foster parents and 48% of specialists have been employed in the institutions for more than 10 years.

2.3. Measures

2.3.1. ProQOL questionnaire

Stamm (2010) states that the ProQOL questionnaire serves as the primary assessment tool for gauging the beneficial or detrimental impact of dealing with individuals who have encountered highly traumatic situations. The questionnaire measures 3 components: Compassion satisfaction, burnout, and STS. The last two components form the CF scale. A composite score cannot be computed. Respondents rate each one of the 30 statements on a five-point Likert scale (1 = "Never" to 5 = "Very often"). In this research, the subsets measuring secondary trauma, burnout, and compassion satisfaction all show favorable levels of internal reliability as indicated by the values of Cronbach's alpha, which are 0.73, 0.80, and 0.86 respectively. The alpha scale reliability is 0.88 for compassion satisfaction, 0.75 for burnout, and 0.81 for STS, as extracted from the ProQoL Manual (Stamm, 2010).

2.3.2. ACEs international questionnaire (ACE-IQ)

The World Health Organization's ACE-IQ (n.d.), is aimed at assessing ACEs of adults worldwide and determining their link with subsequent risk-taking behaviors. Questions cover a total of 13 categories of childhood experiences such as physical, sexual, and emotional abuse and neglect by parents or caregivers, peer violence, witnessing community violence, and exposure to collective violence. The total ACE score for an individual can vary between 0 and 13, with 0 meaning no childhood adverse experiences. The internal consistency value within this sample was $\alpha = 0.79$.

2.3.3. Revised adult attachment scale (R-AS)

The R-AS scale developed by Collins (1996) assesses variations in attachment styles among individuals. The scale is composed of three subsets: Close, Depend, and Anxiety; and each consists of 6 items on a Likert response format. The Close subset evaluates how at ease a person is with intimacy. The Depend subset examines the degree to which a person feels they can rely on others to be present when needed. Finally, the Anxiety subset measures how much a person is concerned about being spurned or unloved. Higher scores on the Close and Depend subsets indicate a more secure attachment, while higher scores on Anxiety have the opposite effect. The internal consistency values within this sample were as follows: $\alpha = 0.72$ for the Anxiety subset, $\alpha = 0.75$ for the Depend subset, and $\alpha = 0.69$ for the Close subset.

2.3.4. Closeness in the child-employee dyad

This variable refers to the perception the employee has about the relationship between the worker and the child in terms of closeness. It was measured using an item that was constructed by the authors of this study – "How close or attached to the children you work with are you?". A Likert format was employed, which includes the following answers: 5 = "Very close, we have a parent-child relationship", 4 = "Close, like the child is part of my family", 3 = "Sufficiently close", 2 = "More or less close", 1 = "I don't

feel close to the children I work with."

2.4. Data analysis

The following packages for the R software environment (R Core Team, 2020) were used: the Lavaan package (Rosseel, 2012) was used to perform the statistical analysis through SEM; the psych package (Revelle, 2020) was used to perform the descriptive analysis. Jasp software version 0.12.2 (Jasp, 2020) was employed to test common method bias.

As SEM deals with intangible concepts, latent variables were taken into account. To determine the latent variables of the model, the reference variable method was utilized. This method requires assigning a value of one to the unstandardized coefficient of each respective latent variable, providing a unit of measurement for each variable (Bollen, 1989). Burnout and STS were brought together to form the CF factor, and the Depend, Close, and Anxiety components were brought together to form the attachment factor. They can be seen in the graphical model in Figure 1 as ovals. The study variables were evaluated using a path model for latent variables. Within this model, there were linear connections between each variable: ACEs as an antecedent of attachment security and closeness in the child-employee dyad, which culminate in more or less CF and compassion satisfaction.

Studies that examine the connection between attitudes and behavior using a cross-sectional approach are at risk

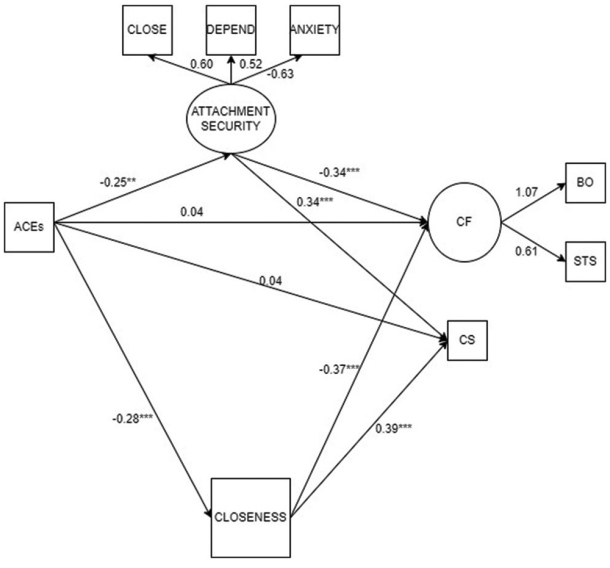

Figure 1. Structural equation modeling for mediation analysis of adverse childhood experiences as a driver of professional quality of life via attachment security and closeness in child-employee dyad.

of having their correlations enhanced due to the presence of common method variance (CMV) (Lindell & Whitney, 2001). The authors of this study chose Harman's Single-Factor Test as a technique to identify CMV and used Jasp software to implement this method. Because the percentage of variance explained by the factor is smaller than 50% (18.3%), it can be concluded that CMV does not affect the quality of this study.

3. Results

The descriptive analyses showed that 58% of foster parents perceived themselves as having a parent-child relationship with the child in their care, while 35% think of the child as being part of the family. 63% of specialists considered that they have a sufficiently close relationship with the children they work with. Only 4% of the specialists perceived themselves as not being close to the children they work with. Regarding the exposure to ACEs, 12% of child protection professionals reported no ACEs, 27% reported 1 ACE and 48% of the employees reported between 2 and 5 ACEs. Burnout was identified as being low for at least 70% of foster parents, social workers, and psychologists. Similarly, STS levels were considered low for most child protection employees. Approximately 83% of child protection professionals had a secure attachment.

Pearson correlations between the study variables are presented in Table 1. For example, there is a positive association between ACEs and burnout ($r = 0.31, p < 0.001$), and between ACEs and the severity of STS among child protection professionals ($r = 0.26, p < 0.001$), and a negative association between ACEs and CS ($r = -0.22$, $p < 0.01$). There are significant correlations between closeness and the components of the PQL.

According to Shi & Maydeu-Olivares (2020), the most frequently employed estimation method for fitting SEM models that involve continuous outcomes is the maximum likelihood (ML). The following fit indices were used to evaluate model fit: the root mean square error of approximation (*RMSEA* = 0.087 [90% CI: 0.055 – 0.120]); the comparative fit index (CFI: 0.951); the standardized root mean square residual (SRMR: 0.063). The full model can be seen in Figure 1. In accordance with Bowlby's attachment theory (1988), the present study found that ACEs had a significant inverse correlation with secure attachments ($\beta = -0.25$). This implies that individuals who experienced more ACEs were less likely to feel securely attached to others.

The mediation analysis of the effect of secure attachment and closeness on the relationship between ACEs and the PQL components was performed with SEM. The following direct and indirect effects were estimated: ACEs have

Table 1. Correlations between variables and internal consistency coefficients (n = 223)

	1	2	3	4	5	6	7	8
1 BO	(0.80)							
2 STS	0.66***	(0.73)						
3 CS	−0.76***	−0.42***	(0.88)					
4 ACEs	0.31***	0.26***	−0.22**	(0.79)				
5 CLOSE	−0.34***	−0.17**	0.35***	−0.10	(0.53)			
6 DEPEND	−0.24***	−0.26***	0.13*	−0.20**	0.24***	(0.44)		
7 ANXIETY	0.15*	0.17*	−0.13	0.12	−0.39***	−0.38***	(0.86)	
8 CLOSENESS	−0.43***	−0.20**	0.41***	−0.27***	0.15*	0.07	0.06	-
M	17.85	19.87	43.09	2.87	3.84	3.22	1.91	4.84
SD	5.66	5.29	5.40	2.31	0.63	0.62	0.85	1.04

Note: The values in the table represent Pearson's correlations (r). The internal consistency coefficients (Cronbach alpha α) are across the diagonal. CLOSE, DEPEND and ANXIETY are the dimensions of the attachment construct; ACEs: Adverse childhood experiences; CS: Compassion satisfaction measured with ProQOL; BO: Urnout measured with ProQOL; STS: Secondary traumatic stress measured with ProQOL; CLOSENESS: Closeness perceived by the employee in the child-employee dyad; *M*: Mean; *SD*: Standard deviation. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

a significant direct effect on the security of attachment (β = -0.25, p = 0.003), and on closeness in the child-employee dyad (β = −0.28, p = 0.000); attachment security has a negative direct effect on CF (β = −0.34, p = 0.000) and positive direct effect on CS (β = 0.34, p = 0.000); closeness has a negative direct effect on CF (β = −0.37, p = 0.000) and a positive direct effect on CS (β = 0.39, p = 0.000). The described effects are in accordance with what was proposed in the first hypothesis. However, the direct effect of ACEs on the components of PQL was not statistically significant (β = 0.04, p = 0.099 and β = 0.04, p = 0.099), contrary to the hypothesized effect. Although the direct effect of ACEs on CF and CS was not significant, the indirect effects of ACEs on the components of PQL are statistically significant and as follows: the effect of ACEs on CF via attachment security and closeness are positive (β = 0.09, p = 0.008 and β = 0.10, p = 0.000); the effect of ACEs on CS via attachment security and closeness are negative (β = −00.09, p =.010 and β = −0.11, p = 0.000). The described indirect effects were the anticipated ones in the second hypothesis.

4. Discussion

The purpose of the current study was to examine the role of attachment security and closeness in the child-employee dyad in linking ACEs and the components of ProQOL, in a sample of 223 child protection professionals.

First of all, the authors sought to explain the contribution of the ACEs of selected categories of employees in the child protection system on their ProQOL. Regarding exposure to ACEs, 88% of child protection professionals reported at least 1 ACE. Esaki & Larkin (2013) found comparable outcomes among a group of employees in a child-oriented organization, and Cooley *et al.* (2020) discovered analogous findings in a study involving 150 foster caregivers. The level of STS was low in the present sample of child protection professionals, and lower in comparison with the results reported by Hannah & Woolgar (2018), Baugerud *et al.* (2017), and Bolic (2019). All foster parents and specialists had at least a satisfactory level of compassion satisfaction. Senreich *et al.* (2020) declared in their study that approximately 60% of social workers had an increased level of compassion satisfaction. Burnout was identified as being low for at least 70% of child protection professionals. In the study performed by Baugerud *et al.* (2017), only 31% of child protection workers had a low level of burnout, with the rest of the employees having a moderate level of burnout. One potential explanation for the reported low levels of STS and burnout in the present study may be linked to the challenges that employees, particularly foster parents, face in recognizing and accessing the intricate emotions associated with the examined concepts. Another plausible reason could be the apprehension of potential repercussions if the confidentiality clause were to be violated, despite the authors explicitly stating otherwise.

Although the authors identified associations between ACEs, burnout, STS, and compassion satisfaction, the direct effect of ACEs on the components of ProQOL was not statistically significant. Hiles Howard *et al.* (2015) showed that burnout and compassion satisfaction were significantly predicted by the total number of ACEs in their study on a sample of 192 child welfare providers serving children in foster care. Similarly, with the current results, STS was not predicted by the total number of

ACEs. The present investigation found a correlation between ACEs and compassion satisfaction, indicating that early life challenges may have an adverse impact on workers' capacity to experience gratification from assisting those in need. The direction of the relationship is similar to the one declared by Steen *et al.*, 2021, even though they didn't find an association between ACEs and compassion satisfaction in their sample (n = 3,566) of social workers.

Second of all, the mediating role of attachment security and closeness in the child-employee dyad in the relationship between ACEs and the ProQOL was examined. This study examined mediators since having or not having negative childhood experiences among social workers cannot determine if an individual will face more or less challenges in achieving success compared to others (Hiles Howard *et al.*, 2015). Thus, the indirect effect of ACEs on the ProQOL can be explained through attachment security and closeness in the child-employee dyad. In this study, the more secure the attachment of the employees, the better it can protect against developing burnout and STS, in connection with the adverse experiences one had in their childhood, and can facilitate the development of compassion satisfaction. Similarly, being close to the children they work with represents a protective factor against developing burnout and STS, and a compassion satisfaction enabler, in connection with the adverse experiences the employees had in their childhood. Regarding attachment theory, the findings of this research support the belief that the caliber of childhood bonds affects the style of attachment in adulthood across one's entire life (Bowlby, 1988). The role of attachment security as a mediator was also tested in a study performed by Munoz *et al.* (2021). The results showed that ACEs negatively influenced attachment styles that lead to lower hope among a sample of adults. Bifulco *et al.* (2006) and Dimitrova *et al.* (2010) have both examined how attachment plays a part in the correlation between childhood hardships and psychological health. Dimitrova *et al.* (2010) additionally discovered that maintaining a relationship with attachment figures as an adult appears to help numb any lingering effects of sexual abuse during adolescence on one's mental well-being.

This study has clear limitations. To begin with, the suggested mediation model underwent testing utilizing cross-sectional data. Although evaluating a model founded on beforehand theory is deemed the most effective approach for assessing linear relationships with the use of cross-sectional data, it is crucial to note that findings from such assessments should only be taken as a tentative indication (Munoz *et al.*, 2021). Upon examining the current results, it is evident that a longitudinal format would further reinforce the connections between the variables.

The second limitation refers to the sample size. Less than half of the respondents who began the survey finalized it. Some possible reasons for this situation could be connected: (1) The limited access to the targeted population, where the information about the study and the necessary questionnaires were sent by the Child Protection Services Bureaus to their employees; (2) the respondents were not provided with incentives; and (3) regarding foster parents, the authors believe that not having the exercise of completing questionnaires and having small children in their care could be some of the reasons for the high number of unfinished surveys. Not engaging directly with the foster parents raises another limitation regarding perceived confidentiality. The authors now consider that more authentic information can be collected in the future through interviews with foster parents.

5. Conclusions

This study is the first to propose the mediating potential of attachment security and closeness towards another person in the relationship between personal ACEs and the components of ProQOL in a sample of child protection professionals. Furthermore, it is the first study to test this mediation model with a structural equation model. The authors emphasize that the effect of ACEs on the ProQOL of child protection professionals, such as foster parents, psychologists, and social workers, can be better explained through the indirect effect of attachment security and closeness in the child-employee dyad. Moreover, this research highlights that greater attachment security of employees and feeling close to the children in foster care can represent protective factors for employees who experienced adverse events in their childhood. Furthermore, this can positively reflect on the ProQOL outcomes, by developing compassion satisfaction, the positive emotional response that results from helping others, and being protected from burnout and STS.

Last, but not least, it is the first study that takes into consideration a more diverse population of child protection workers, more precisely consisting of foster parents and specialists – social workers and psychologists working in foster care. To the present day, studies have been conducted that investigated the presence of STS and vicariant traumatization among professionals in child welfare (Bolic, 2019), and studies that analyzed the development of CF and compassion satisfaction in foster parents (Bridger *et al.*, 2019; Hannah & Woolgar, 2018), without considering these employees as a single group of professionals.

To enhance the incorporation of trauma-informed approaches in child welfare, comprehending the means to safeguard child protection workers' emotional well-being while dealing with traumatized children is crucial. Their continuous vulnerabilization represents a threat to their ProQOL, the increase in turnover rates, children's placement stability, and to the potential limitation of delivering quality services to the children in need of substitute family and trauma support services. To maintain consistency in placements for children and retain employees, it is important for services to prioritize the welfare of child protection professionals. This includes acknowledging the risk of CF and threats to their ProQOL. Findings confirm the effect of employee attachment security and closeness towards children they work with on the ProQOL. Possible ways to implement these results could be to consider attachment-based approaches in supporting professionals, such as emotion-focused group therapy, and to promote closeness, sensitivity towards children's trauma, and empathy in the child-employee dyad as part of the organizational culture in the child welfare services. After performing a short review of the existing literature concerning effective interventions and support options for child welfare professionals dealing with trauma, no studies were identified. This could mean that more attention should be directed toward the research of effective tools for supporting child welfare employees who work with a vulnerable population. Additional investigation is necessary to examine the effectiveness of these measures and principles pertaining to organizational culture, as well as the overall welfare of child protection specialists who are in direct contact with children who have experienced trauma.

Acknowledgments

None.

Funding

None.

Conflict of interest

The authors declare they have no competing interests.

Author contributions

Conceptualization: Flavia Teculeasa, Florinda G
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Formal analysis and Investigation: Flavia Teculeasa
Supervision: Florinda Golu
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Writing – Review & Editing: Florinda Golu

Ethics approval and consent to participate

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University of Bucharest (23.04.2020/ No. 22). Participants enrolled in the study via an online survey created with Survey AnyPlace software. Before completing the questionnaire, each participant was presented with a consent information screen informing participants of the purpose of the study and its voluntary nature. Moving on to the next page and completing the questionnaire represented their consent to participate in the study.

Consent for publication

No identifying information of the participants appear in writing, only data representing answers to the questionnaires.

Availability of data

We generated a private link for our data in the Figshare repository: https://figshare.com/s/6d618f92f90b11425613

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ACCSCIENCE PUBLISHING

International Journal of Population Studies

RESEARCH ARTICLE

Personality traits in homosexual men with different sex roles in Iran

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Abstract

Studies on homosexual men reveal a secondary self-label, the sex role, which can affect many dimensions of their lives. Based on their roles in anal intercourse, homosexual men adopt self-label or sex role as top, bottom, and versatile. Unwelcoming social space, along with the legal and religious constraints in Islamic communities on homosexuality has made information about their personality traits scarce. Therefore, this study assessed the personality traits of homosexual men with different sex roles and compared them to each other and heterosexual men. In an ex post facto study, 197 Iranian homosexual men (30 tops, 36 bottoms, and 131 versatile) and 49 Iranian heterosexual men were included using purposive and snowball samplings to complete a short 71-item Minnesota Multiphasic Personality Inventory-2 (MMPI-2). The results showed top group obtaining highest mean score among the groups for scales of validity (F) and hypochondriasis (Hs), while bottom group obtaining highest mean scores for scales correction (K), depression (D), hysteria (Hy), paranoia (Pa), psychasthenia (Pt), and hypomania (Ma). These results suggested that bottoms encounter more difficulties in forming relationships and concealing their sexual identity. Depression, hopelessness, and a sense of failure in attracting support and affection from others are more prominent among bottoms.

Keywords: Gender identity; Homosexuality; Islamic population; Personality traits; Sex roles

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Citation: Shakib, S. M. P., Rezaei, S. & Naseh, A. (2023). Personality traits in homosexual men with different sex roles in Iran. *International Journal of Population Studies*, 9(2): 49-60.
https://doi.org/10.36922/ijps.0390

Received: April 3, 2023

Accepted: June 7, 2023

Published Online: July 13, 2023

1. Introduction

Despite considerable scientific progress made by Iranian researchers in different areas of psychology, homosexuality, and its related issues continue to be considered taboo, which can be attributed to an unaccepting social atmosphere and religious and legal constraints, leading to limited access to accurate and non-distorted information within this Muslim country. Consequently, Iranian psychologists and psychotherapists face challenges in effectively treating homosexual clients and accurately diagnosing their psychological problems. On the other hand, the situation is compounded by the presence of biases, presumptions, and individual and social prejudices of psychotherapists. These factors, combined with legal and religious issues, further exacerbate the difficulties of homosexual clients seeking psychological support (Shakib, 2021).

Studies have shown that many homosexual men identify themselves based on their role during anal intercourse. This self-identification, that is, "sexual self-label"

or "sex role" (Hart *et al.,* 2003; Moskowitz & Hart, 2011), is categorized into three groups. Men who prefer to be exclusively receptive during anal intercourse self-identify as "bottoms," while exclusively insertive self-identify as "tops." The third group consists of those without preferences, who self-identify as "versatile." It is worth noting that these sexual roles are highly correlated with sexual behavior during anal intercourse, with studies showing sexual self-identification to be typically a precise reflection of preference in anal intercourse (Carballo-Diéguez *et al.,* 2004; Gil, 2007; Moskowitz *et al.,* 2008). However, the proportion of men with each role is not proportionally equal among gays. Approximately, 20% of homosexual men are tops (insertive), while 26% are bottoms (receptive), and 54% are versatile (receptive or insertive) (Wegesin & Meyer-Bahlburg, 2000; Hart *et al.*, 2003).

The self-identification of sex roles in homosexual men is not merely a choice based on sexual behavior; it has a profound effect on their enduring personality traits. It is believed that since self-identification of sex role is considered a stable variable, it should be correlated with other stable psychiatric variables (Zheng *et al.,* 2012). In this regard, a strong relationship has been identified between sexual desires and personality traits (Bogaert *et al.,* 2018). Obviously, since personality is shaped based on biological and environmental factors, as well as interaction with society, sexual desire is an inseparable part of personal identity (Nay *et al.,* 2007). "Personality" is defined as a group of relatively constant intrapersonal and organized traits and mechanisms that has a considerable impact on how one deals with internal and physical issues, as well as their social environment (Larsen, 2009). Moreover, personality has a biological origin (McCrae & Costa, 2008).

A study ascertained a moderate relationship between the emerging mechanism of sex roles and personality traits (Orlofsky *et al.,* 1985). When discussing differences between homosexuality and other sexual orientations, the focus primarily lies on personality traits rather than cognitive skills. In fact, sexual orientation contributes more effectively to differences in personality traits compared to gender. For example, studies have shown that homosexual men exhibit higher levels of social anxiety, experiencing symptoms such as fear of negative evaluation and social turmoil more frequently than their heterosexual counterparts (Downey & Feldman, 1996; Pachankis & Goldfried, 2006; Safren & Pantalone, 2006). Moreover, homosexual men are more dissatisfied with their bodies and pay more attention to their physical appearance compared to their heterosexual counterparts (Yelland & Tiggemann, 2003; Morrison *et al.,* 2004; Levesque & Vichesky, 2006; Carper *et al.,* 2010). Matos *et al.* (2017) have found that homosexual men tend to have lower levels of psychological flexibility than their heterosexual counterparts. Furthermore, there exists a direct relationship between social adversities and symptoms of paranoia among sexual minorities (Qi *et al.*, 2020).

Rubinstein (2010) showed that homosexual men have a higher rate of narcissistic personality disorder and a lower rate of self-esteem than their heterosexual counterparts do. Moreover, tops are less likely to self-label as homosexual compared to their bottom and versatile counterparts. Therefore, tops are more likely to report internalized homophobia in comparison with versatile and bottom gays (Hart *et al.,* 2003). Liu *et al.* (2020) demonstrated that Chinese bottom and versatile homosexual men suffer more from depression and anxiety compared to their top counterparts.

There is scant information regarding the personality traits and psychopathology of homosexual men in Islamic countries. To address this gap and provide appropriate counseling and mental health services, it is necessary to examine factors that lead to incompatibility and inefficiency in their personal and social performance. Accordingly, the present study aims to provide a comparison between the personality traits of homosexual men with different sex roles and their heterosexual counterparts.

2. Materials and Methods

2.1. Sampling

The statistical population included heterosexual and homosexual Iranian men residing in Rasht and Tehran, Iran, between 2019 and 2020. These two cities were selected based on the researchers' ease of access for collecting data in person. Before commencing the study, the researchers attended several private gay parties and established connections with some of the participants. The researchers then sought their opinions regarding conducting a study on issues concerning homosexual men and potential solutions. The idea was met with friendly and welcoming reactions. With the help of gay friends, the researchers signed up for Hornet, a gay dating application, and joined gay groups on Telegram and Instagram.

However, due to various sociocultural-judicial restrictions on homosexuality, as well as the history of sexual predators, they had faced, many individuals expressed a lack of trust and were unwilling to participate in the study, whether virtually or in person. Accordingly, the researchers developed an online questionnaire using Google Forms, which allowed for anonymous responses. The link to the questionnaire was shared with

the participants in two different methods. First, through snowball sampling, where the link was delivered to the Telegram and WhatsApp accounts of homosexual men whom the researchers had come to know during the above-mentioned private parties, and they were asked to share the link with their other gay friends. The second method was purposive sampling, where the researchers personally sent the link to the subjects after studying their profiles on social networks (without adding any kind of filters such as age), performing initial interviews, and obtaining their informed consent. Worth noting that the researcher's accounts on Hornet and Telegram apps were suspended 3 times due to negative reports from the members, which had roots in their distrust and fears. These suspensions had removed by sending an email to relevant authorities and explaining the purpose of sending the questionnaire. Furthermore, heterosexual samples were selected using convenience sampling.

Due to fear of security issues, only 332 out of 1,377 questionnaires were completed. The inclusion criteria included being physiologically self-identified male, self-identification as heterosexual or homosexual (based on self-reports), and informed consent. The exclusion criteria included bisexuality, being transgender, being a woman, and being younger than 21 years old (all as self-reported). In total, 246 subjects (49 heterosexual and 197 homosexual men [30 tops, 36 bottoms, and 131 versatile]) were approved as participants.

2.2. Measurements

2.2.1. Sociodemographics

The "Personal Information Page" was used for collecting data on the demographical and sexual orientation of the participants. The demographic data included gender (male, female, and transsexual), educational levels (middle school or less, high school, associate degree, undergraduate, graduate, and Ph.D. degree), age, birth order (firstborn, middle, lastborn, and only child), relationship status (in a relationship, not in a relationship, and in an open relationship), marital status (single, married, and divorced), and private email addresses for receiving the general results of research.

2.2.2. Sexual orientation and sex role

Three simple questions were used to determine the sexual orientation and sex role. The first question inquired about sexual orientation, with response options including heterosexual, homosexual, and bisexual. To obtain more precise information, the second question asked participants to rate their sexual attractions on a 7-point Kinsey Scale, ranging from "only attracted to the opposite sex" to "only attracted to the same sex." Participants with a score of 0 and 1 were classified as heterosexuals, while those with a score of 5 and 6 were classified as homosexuals, and any score in between was considered indicative of bisexuals. The third question requested participants to select their preferred sex roles, with choices including "top" (insertive), "bottom" (receptive), and versatile (both receptive and insertive) for homosexual individuals, while heterosexual individuals were provided with the option of selecting "none of them."

2.2.3. MMPI

The MMPI, introduced by Hathaway & McKinley in 1940, earned acclaim for its accurate diagnosis of psychological problems in test subjects and became the most popular clinical personality assessment procedure. The original MMPI test included 567 items. The MMPI used in this study was the validated Persian translation of a shorter version of the improved MMPI-2 (71 items) (Nezami *et al.,* 2008). Test-taker were required to respond with "true" or "false" to the 71 items on the MMPI-2. The MMPI-2 used in this study consisted of eight clinical scales: Hypochondriasis (Hs), depression (D), hysteria (Hy), psychopathic deviate (Pd), paranoia (Pa), psychasthenia (Pt), schizophrenia (Sc), and hypomania (Ma). These scales utilized specific items, such as "my sleep is fitful and disrupted (Hs, D, Hy)" and "I find it hard to keep my mind on a task or job (D, Hy, Pd, Pt, and Sc)" to assess various psychological conditions. Three validity scales were included: Lie, Infrequency, and Correction, which helped measure the test-taking attitude and determine whether the subject approached the test in a normal and honest manner (Nezami *et al.,* 2008). In Iran, the reliability coefficients for the subscales of the Persian version of MMPI-71 were reported as follows: Hypochondriasis, 0.87; depression, 0.86; hysteria, 0.80; psychopathic deviate, 0.90; paranoia, 0.89; psychasthenia, 0.77; schizophrenia, 0.91; hypomania, 0.86. The reliability coefficients for the full scale were 0 and 0.78 (Shafiei & Ghodusi, 2019). General findings on the Farsi Version of MMPI-71 indicated that it possesses suitable psychometric properties for clinical use and research activities in Iranian culture (Hosseinchari *et al.,* 2011).

2.3. Statistical analysis

Data analysis was conducted using SPSS-24. The multivariate analysis of covariance (MANCOVA) was used to compare different personality traits in three homosexual groups and one normal heterosexual group. Due to the significant difference in age between groups and its potential impact as a confounding variable, the age variable was controlled for in the MANCOVA. *Post hoc* tests, specifically Games-Howell and Hochberg's GT2, were used to examine the mean differences between the

four groups, taking into account the sample sizes of the subgroups and the homogeneity of variances.

3. Results

Data collected from 332 participants were analyzed. Table 1 shows the frequency distribution and percentage of sexual orientation regarding gender.

Females, transsexuals, and male bisexuals who self-reported were excluded based on the exclusion criteria. Among the 208 homosexual male participants, 3.3% were excluded due to being younger than 21 years old, and 1.9% were excluded as bisexuals based on their responses to the items related to romantic affairs. As a result, only 49 heterosexual men and 197 homosexual men were selected for the next level of examination. Among the 197 homosexual men, 30 (15.2%) identified as tops, 36 (18.3%) as bottoms, and 131 (66.5%) as versatile. Table 2 shows the frequency distribution of age and marital status by sexual orientation and sex role groups.

Initially, we compared heterosexual and homosexual men to determine if there were any significant differences between them. In addition, age was controlled by including it as a covariate in MANCOVA (Table 3).

Table 3 shows significant differences between heterosexual and homosexual men in terms of Infrequency, Correction, Hypochondriasis, Depression, Hysteria, and Paranoia scales ($p < 0.05$), with homosexual men achieving the highest mean scores. The effect size for the Hypochondria scale was found be the largest, suggesting that only 4% of the observed difference in statistical population can be attributed to this scale. In the following discussion, we further analyzed the data by breaking down homosexual men into three subgroups based on their sex roles and compared each subgroup with heterosexuals. The mean and standard deviation of the personality traits for each study group are presented in Table 4.

Levene's test was used to compare the homogeneity of variance among the MMPI dimensions. Based on the *F*-value obtained from this test, the variance of the following scales was not significant ($p > 0.05$): Lie (0.87), infrequency (2.07), hypochondriasis (1.85), depression (2.05), hysteria (0.01), paranoia (0.75), psychasthenia (1.17), schizophrenia (1.21), and hypomania (0.86). In other words, these groups had a homogeneous variance in these dimensions, whereas Levene's *F* was significant for correction (16.91) and psychopathic deviation (2.99). Allen & Bennett (2008) recommended that if one or more components of dependent variables did not meet the variance homogeneity assumption, it would be better to use a more stringent alpha or significance level, such as 0.001, instead of 0.05. Therefore, the significance level of the *F*-test was adjusted in line with Allen & Bennett's recommendation (2008).

Table 1. Frequency distribution and percentage of sexual orientation by the gender of participants (*n*=332)

Groups	Male		Female		Transgender	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Heterosexual	49	16.4	24	88.8	-	-
Homosexual	208	69.79	1	3.7	7	100
Bisexual	41	13.7	2	7.4	-	-

Table 2. Frequency distribution of groups' age and marital status by sexual orientation and role

Groups	Homosexual						Heterosexual	
	Top		Bottom		Versatile			
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Age								
21–30	13	43.3	27	75	83	63.4	15	30.6
31–40	10	33.3	8	22.2	41	31.3	13	26.5
41–50	7	23.3	1	2.8	5	3.8	20	40.8
51–60	-	-	-	-	2	1.5	1	2
Marital status								
Single	27	90	35	97.2	118	90.1	27	55.1
Married	2	6.7	1	2.8	9	6.9	19	38.8
Divorced	1	3.3	-	-	4	3.1	3	6.1

Table 3. Results of MANCOVA determining differences between heterosexuals and homosexual men on MMPI-2 scales after controlling the age

MMPI dimensions	Groups				*F**	*p*-value	Partial eta squared	Observed power
	Straight (*n*=49)		Homosexual (*n*=197)					
	Mean	SD	Mean	SD				
Lie (L)	1.036	0.184	1.387	0.088	2.852	0.093	0.012	0.391
Infrequency (F)	4.469	0.341	5.411	0.164	5.977	0.015	0.024	0.683
Correction (K)	14.253	0.073	14.485	0.035	7.871	0.005	0.031	0.798
Hypochondriasis (Hs)	9.658	0.153	10.014	0.074	4.223	0.041	0.017	0.535
Depression (D)	12.969	0.307	13.810	0.148	5.887	0.016	0.024	0.676
Hysteria (Hy)	20.530	0.163	20.985	0.079	6.077	0.014	0.024	0.690
Psychopathic deviate (Pd)	11.801	0.380	12.466	0.183	2.400	0.123	0.010	0.339
Paranoia (Pa)	8.202	0.255	8.985	0.123	7.395	0.007	0.030	0.773
Psychasthenia (Pt)	10.281	0.315	11.047	0.152	4.627	0.032	0.019	0.572
Schizophrenia (Sc)	12.245	0.401	12.914	0.193	2.177	0.141	0.009	0.312
Hypomania (Ma)	7.205	0.268	7.761	0.129	3.382	0.067	0.014	0.449

Note: *df=1

Table 4. Mean and standard deviation of personality traits based on MMPI-2

MMPI dimensions	Homosexual						Heterosexual	
	Top		Bottom		Versatile			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Lie (L)	1.23	1.16	1.41	1.13	1.39	1.27	1.08	1.20
Infrequency (F)	5.76	2.25	5.38	2.55	5.40	2.29	4.28	1.83
Correction (K)	14.40	0.49	14.58	0.50	14.48	0.50	14.24	0.43
Hypochondriasis (Hs)	10.23	1.07	9.94	1.24	10.02	1.12	9.55	0.73
Depression (D)	13.56	1.71	14.00	2.32	13.90	2.28	12.71	1.84
Hysteria (Hy)	21.03	1.09	21.20	1.34	21.01	1.19	20.38	0.93
Psychopathic deviate (Pd)	12.50	2.08	12.75	2.30	12.47	2.80	11.55	2.24
Paranoia (Pa)	9.33	1.78	9.44	1.59	8.82	1.71	8.08	1.64
Psychasthenia (Pt)	10.66	1.88	11.38	2.15	11.13	2.19	10.02	2.06
Schizophrenia (Sc)	13.30	2.49	13.36	2.69	12.80	2.81	11.95	2.49
Hypomania (Ma)	7.86	1.54	8.06	1.96	7.76	1.85	6.93	1.79

The Box's M test was used to examine the homogeneity of the variance-covariance matrix of the dependent variables. The findings showed that the *F*-value of the Box's M test for personality traits (247.83) was not statistically significant ($F = 1.1$, $p > 0.05$). The *post hoc* Hochberg's test was used to compare the means among groups with unequal sample sizes. Regarding the results of the Wilks' lambda multivariate analysis for personality traits, a significant difference was observed between the groups at 0.002 level (Wilks' lambda = 0.77, $F_{(33,684)} = 1.71$, $p < 0.05$). The finding indicates that there is a significant difference in personality traits between the groups. Table 5 presents MANCOVA results that determine the differences in the personality traits among the groups.

According to Table 5, *F*-value was significant ($p < 0.05$) for infrequency (3.63), hypochondria (3.40), hypomania (3.30), correction (4.01), depression (4.34), hysteria (4.25), paranoia (5.65), and psychasthenia (4.08). These findings indicate a significant difference between groups in these traits. On the contrary, *F*-value was not significant for Lie (0.91), psychopathic deviation (2.01), and schizophrenia (2.44), indicating no significant difference between groups in these traits. The effect size for infrequency (0.04), correction (0.04), hypochondria (0.04), depression (0.05), hysteria (0.05), paranoia (0.06), psychasthenia (0.04), and hypomania (0.03) indicates that the difference is at a moderate level in the society. It is worth noting

Table 5. MANCOVA results to determine differences in personality traits using MMPI-2 in homosexual men

MMPI dimensions	SS	df	MS	*F*	*p*-value	Partial eta squared	Observed power
Lie (L)	4.11	3	1.37	0.91	0.430	0.01	0.24
Infrequency (F)	57.22	3	19.07	3.63	0.010	0.04	0.79
Correction (K)	2.87	3	0.95	4.01	0.008	0.04	0.83
Hypochondriasis (Hs)	10.89	3	3.63	3.40	0.010	0.04	0.76
Depression (D)	56.52	3	18.75	4.34	0.005	0.05	0.86
Hysteria (Hy)	15.71	3	5.23	4.25	0.006	0.05	0.85
Psychopathic deviate (Pd)	39.63	3	13.21	2.01	0.110	0.02	0.51
Paranoia (Pa)	48.63	3	16.21	5.65	0.001	0.06	0.94
Psychasthenia (Pt)	55.52	3	18.50	4.08	0.007	0.04	0.84
Schizophrenia (Sc)	53.39	3	17.79	2.44	0.060	0.02	0.60
Hypomania (Ma)	33.01	3	11.00	3.30	0.020	0.03	0.74

that the effect size was considered small, moderate, and large at 0.01, 006, and 0.14, respectively (Cohen, 1988). Figures 1 and 2 illustrate the results of a pair-wise comparison of mean scores among these groups based on the validity scale and clinical scale.

The results from Hochberg's GT2 (Figure 1) indicate significant differences in mean scores between certain groups. Specifically, there was a significant difference in Infrequency between top homosexual men and heterosexual groups ($p = 0.03$), as well as between versatile homosexual men and heterosexual groups ($p = 0.02$). The top homosexual men had the highest mean score in this subscale. In addition, there was a significant difference in correction between bottom homosexual men and heterosexual groups ($p < 0.01$), as well as between versatile homosexual men and heterosexual groups ($p = 0.02$). The bottom homosexual men had the highest mean score in this subscale. Regarding the clinical subscales, hypochondria, depression, hysteria, paranoia, and psychasthenia showed significant differences (see Figure 2). The top homosexual men exhibited a significant difference from heterosexual groups ($p = 0.02$), and versatile homosexual men exhibited a significant difference from heterosexual groups ($p = 0.04$), respectively, in hypochondria, with the highest mean score among the top homosexual men. There was a significant difference in depression between bottom homosexual men and heterosexual groups ($p = 0.03$), as well as between versatile homosexual men and heterosexual groups ($p < 0.01$), with the highest mean score observed in the bottom homosexual men.

Significant differences were observed in hysteria between bottom homosexual men and heterosexual groups ($p = 0.053$), and between versatile homosexual men and heterosexual groups ($p = 0.005$). The bottom homosexual men had the highest mean score in this subscale. In

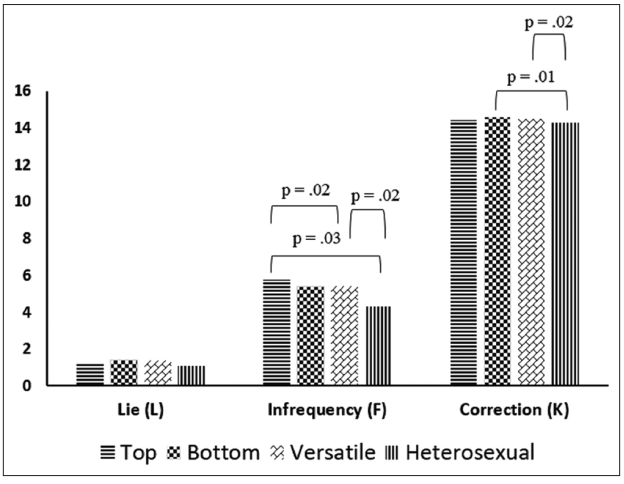

Figure 1. Pair-wise comparison of men with different sex roles in terms of the validity scales of MMPI-2 in Homosexual men, Iran.

paranoia, a significant difference was observed between top homosexual men and heterosexual groups ($p = 0.01$) and between bottom homosexual men and heterosexual groups ($p = 0.002$). The bottom homosexual men had the highest mean score in this subscale. In psychasthenia, a significant difference was observed between bottom homosexual men and heterosexual groups ($p = 0.02$) and between versatile homosexual men and heterosexual groups ($p = 0.01$). The bottom homosexual men had the highest mean score in this subscale. In hypomania, a significant difference was found between bottom homosexual men and heterosexual groups ($p = 0.04$) and between versatile homosexual men and heterosexual groups ($p = 0.004$). The bottom homosexual men had the highest mean score in this subscale.

4. Discussion

The results of the present study indicated that there were significant personality psychopathology differences between

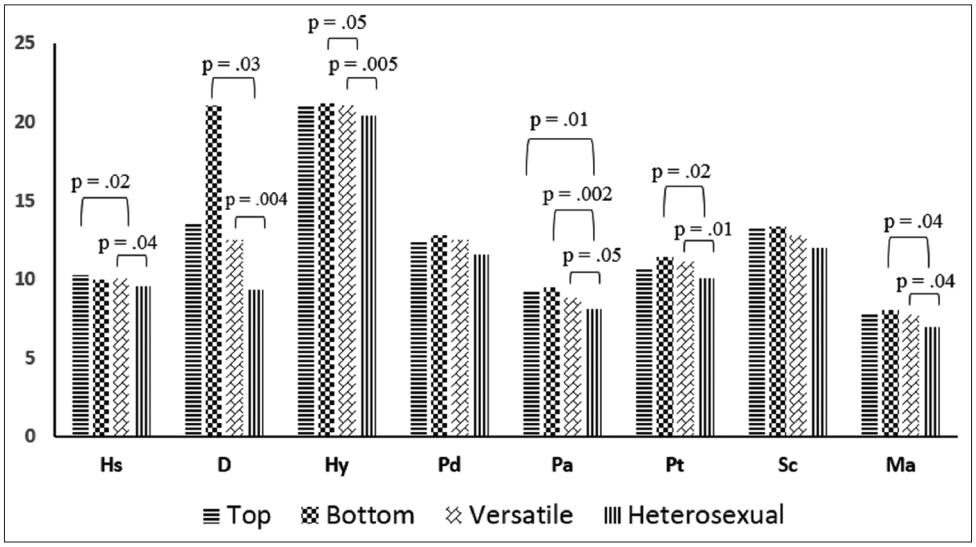

Figure 2. Pair-wise comparison of men with different sex roles in terms of the clinical scales of MMPI-2 in Homosexual men, Iran. Notes: Hypochondriasis (Hs), depression (D), hysteria (Hy), psychopathic deviate (Pd), paranoia (Pa), psychasthenia (Pt), schizophrenia (Sc), and hypomania (Ma).

Iranian homosexual men and their heterosexual counterparts. Homosexual men scored higher on various scales, including infrequency (F), correction (K), hysteria (Hs), depression (D), hypochondria (Hy), paranoia (Pa), and psychasthenia (Pt). Homosexual men had the highest mean across all scales. Furthermore, differences were observed between the bottom and versatile homosexual men compared to heterosexual men on correction (K). In addition, differences were found between the top and bottom homosexual men compared to heterosexual men on paranoia (Pa). It is worth noting that the bottom homosexual men had the highest mean score on correction (K), while the top homosexual men had the highest mean on paranoia (Pa).

Higher scores of top and versatile groups in infrequency (F) indicate confusion and low self-esteem in members of these groups. In other words, they evaluate themselves as less efficient than they actually are. They also suffer from high degrees of anger and anxiety. This result was consistent with the findings of Pachankis & Goldfried (2006), indicating that homosexual men had more social anxiety symptoms (e.g., fear of negative evaluation and social turmoil) than their heterosexual counterparts, particularly when they face male behavioral stereotypes.

According to Zheng *et al.* (2012), Swift-Gallant *et al.* (2018), and Besharat *et al.* (2016), homosexual men show more gender non-conformity in comparison with their heterosexual counterparts during childhood and adulthood, meaning that they exhibit more abnormal gender behaviors. This gender nonconformity is less noticeable in tops while being more visible in bottom and versatile gays. Eslen-Ziya & Koç (2016) ascertain that in a patriarchal and traditional community, homosexual men are condemned for and denied their feminine characteristics. This is because they internalize all masculinity criteria, originated from fully heteronormative rules, and identify themselves accordingly; rules by which men must be stronger, tougher, more successful, and more competitive.

Accordingly, higher scores of the tops group compared to the versatile group are because top homosexual men show their shame of being stigmatized for gender non-conformity through internalized homophobia and unwillingness to self-identify as homosexuals, to conform further to masculine gender norms in this patriarchal culture. At the same time, the more uncomfortable a homosexual men is with his orientation, the greater his level of anxiety in social interactions would be. On the contrary, since versatile gays show more conformity to feminine and masculine gender norms, they respond better to their community's demands (Hart *et al.,* 2003; Pachankis & Goldfried, 2006).

Higher scores of the bottoms and versatile groups in correction (K) indicate high resistance and control, along with unawareness and one-dimensionality of these men. Members of these two groups have several problems in social relationships and mutual interaction with each other. Heckhausen *et al.* (2010), Nussbaum & Dweck (2008), and Ungerleider & Ungerleider (2019) found that correction is the other side of the "blame" coin. That is, the person tries to claim, "It was not my fault; it was someone else's fault." This approach is often seen in communities with a system of criticism and punishment.

Patriarchal culture, religious beliefs, and low knowledge about sexual issues and orientation in Iran can manifest in the form of psychological, physical, and sexual violations, particularly for the bottom and versatile homosexual men that have more gender non-conformity compared to heterosexual men. This results in a negative self-image and a strong sense of self-criticism, which in turn leads bottom and versatile homosexual men to adopt a correction approach to protect themselves against social violence. This is an approach that puts the person in a constant state of "readiness" to repel potential attacks even where there is no real danger. Therefore, the damaged ego perceives every opposition as a threat and immediately assumes a defensive posture. Therefore, the person fails to have normal group interaction.

High scores of tops and versatile groups in hypochondria (Hs) indicate considerable, and sometimes even strange, physical concerns, along with anxiety disorders. Members of these two groups use physical pain to attract attention and control the environment. This finding is consistent with the findings of Morrison *et al.* (2004) and Levesque & Vichesky (2006), who claimed that homosexual men are more prone to physical dissatisfaction and pay more attention to their physical appearance than their heterosexual counterparts do. It is also consistent with the findings of Yelland & Tiggemann (2003) and Carper *et al.* (2010) who showed that homosexual men have greater dissatisfaction with their physical fitness compared to their heterosexual counterparts.

In societies with a patriarchal culture, the male gender is manifested by two rules: (i) A man must be attracted to the opposite sex and (ii) a man must be homophobic (Lehne, 1989; Eslen-Ziya & Koç, 2016). In these societies, homosexual men are perceived as more feminine and are accused of being "less of a man." To compensate for this social view, homosexual men internalize homophobic behaviors, such as negative feelings toward their feminine side and that of other homosexual men, to create a safe haven for their masculinity. At its extreme, this behavior leads the person to reject his own sexual orientation (Blashill & Powlishta, 2009; Herek & McLemore, 2013).

Given a higher mean score of tops in hypochondriasis (Hs) scale, they are less likely to identify themselves as homosexuals and report greater internalized homophobia. Since there is a relationship between internalized homophobia with negative body image and low self-esteem (Rowen & Malcolm, 2003; Hart *et al.,* 2003), it can be said that tops are more likely to conform to masculine gender norms and thus become alienated from their body compared to other groups.

Higher scores of bottom and versatile groups in depression indicate that these groups are generally dissatisfied with life and lack hope for the future. Members of these two groups often have low self-esteem and a sense of guilt and humiliation. This finding is consistent with the findings of Liu *et al.* (2020) that suggest that bottom and versatile homosexual men suffer from a greater degree of depression and anxiety compared to their top counterparts. According to Eslen-Ziya & Koç (2016), the perception of masculinity in homosexual men of patriarchal cultures has a root in traditional gender roles. Therefore, tops in these countries self-identify as heterosexual (Tapınç, 1992; Labi, 2007), whereas bottom and versatile homosexual men are considered full of inherent femininity (Murray, 2000; Fernàndez-Alemany & Murray, 2003).

In countries like Iran, bottom and versatile homosexual men, who have more gender nonconformity than their top counterparts, are more prone to different types of physical and psychological violence (Swift-Gallant *et al.,* 2018) because receptiveness is considered an insult and a heinous act in Iran. In such an atmosphere, bottoms are doomed to come under constant criticism and humiliation. These excessive criticisms make the bottom and versatile homosexual men not only feel worthless but also blame themselves for what they are, leading them to fail to have an influence on their surrounding environment and cause major disappointments. On the other hand, social reluctance in responding to their demands (i.e., emotional support) plays a major role as a sociopsychological factor in the development of depression symptoms, making bottom and versatile homosexual men vulnerable to depressive disorders.

High scores of bottom and versatile groups in hysteria (Hy) indicate that they typically display bodily symptoms in response to anxiety. On the other hand, they have a narcissistic personality disorder and adopt indirect and inappropriate attention-seeking methods. Goenjian *et al.* (2000) reported that excessive attention-seeking behavior is not a personality disorder but a response to damages inflicted by neglect these men experienced in the development and growth process. Moreover, Dawson (1985) believed that attention-seeking behaviors are rooted in developmental delay due to rejection by parents and peers. These issues can be rooted in the gender non-conformity of bottom and versatile homosexual men in Iranian society with the dominance of patriarchy, where men are judged against traditional criteria for masculinity and violators are punished. In this culture, their demands for emotional support from their families and communities are rejected because of violating desired norms, disrupting their internal regulation.

High scores of tops and bottoms in paranoia (Pa) indicate that they are sensitive to mistreatment and criticism from others. They have a strong bias toward their beliefs, making

them inflexible to others' opinions. They can be suspicious, anxious, and sad people, consistent with the findings of Qi *et al.* (2020) that there is a correlation between social mistreatment and paranoid symptoms among sexual minorities. On the other hand, Matos *et al.* (2017) showed that homosexual men have less psychological flexibility than their heterosexual counterparts, which worsens their internalized shame and depression. Needham & Austin (2010) also added that inflexibility and excessive sensitivity to criticism in these two groups are due to the internalization of shame experiences, that is, being criticized, threatened, and rejected. These events have a deeper influence on homosexual men than their heterosexual counterparts and can worsen their depression and sense of worthlessness (Gilbert & Gerlsma, 1999).

It is worth noting that a large part of the pessimism among Iranian tops and bottoms is attributed to their constant vigilance to protect themselves from potential dangers they may face in a patriarchal and religious society, where homosexuality is considered a perversion. According to Lingiardi & Nardelli (2014), this is rooted in "perceived stigma," that is, intense awareness and fear of being labeled as homosexual. The person's awareness and sensitivity to the surrounding environment increase with a greater perception of social rejection.

High scores of bottom and versatile homosexual men in psychasthenia (Pt) indicate an inability to make effective decisions and understand the situation, as well as being perfectionists. They often aim for a high level of performance, and their subsequent failure to achieve this challenging goal leads to a sense of guilt. These people are very worried about being accepted and try hard to become famous. These findings are consistent with Pachankis & Hatzenbuehler (2013), who suggests that homosexual men are more concerned about achievements and issues rooted in their self-worth and self-esteem compared to their heterosexual counterparts.

Ashby & Rice (2002) stated that maladaptive perfectionism has a negative relationship with self-esteem. Van der Kaap-Deeder *et al.* (2016) also noted that people with lower self-esteem tend to seek self-worth by achieving special goals more than others. Crocker and Wolfe (2001) believed that social environment contributes largely to behaviors that result in self-worth, while this value can be given by others or achieved through one's success in certain areas of life. In the sociocultural conditions in Iran, since an important part of the sexual identity of bottom and versatile homosexual men is not accepted by their communities and families, members of these two groups tend to seek more achievements in areas such as education, appearance, and competition to prove self-worth. This superiority is a substitute for those areas that are not accepted by society. However, such behavior — focusing only on success and social status — leads to more loneliness and stress.

Higher scores of bottoms in hypomania (Ma) indicate that members of this group have an exaggerated self-evaluation and overestimate their importance. As a result, they are usually unable to acknowledge their limitations. This finding is consistent with the findings of Gandhi *et al.* (2014), where homosexual men obtained higher scores in hypomania compared to their heterosexual counterparts. Given that setting a high-level standard is known as a sign of narcissistic personality disorder in Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, (DSM-5), our finding can be considered consistent with that of Rubinstein (2010), which showed that homosexual men have a higher level of narcissistic personality disorder and lower self-esteem than their heterosexual counterparts do. Behaviors such as grandiose fantasy and lack of empathy among bottoms can be interpreted as rising against homophobic norms and a reaction to years of unintentional internalization of demands in a homophobic society. Therefore, narcissism in bottoms is best to be considered an approach for better conformity with the norms rather than a mental problem because such behaviors act as a shield, protecting them from problems while providing them with opportunities for finding sexual partners and surviving through conformity with norms (Rubinstein, 2010).

The most important strength of this study is the collection of psychopathological data on homosexuals in an Islamic country. Nevertheless, there are some limitations that need to be acknowledged. First, the study employed non-random sampling, necessitating to interpretation these results cautiously. Cultural and religious restrictions in relation to sexual minorities make it difficult to collect samples randomly. Second, the use of an online questionnaire was a practical approach to ensure the safety of the participants, given their intense fear of being identified and punished. However, this may have led to a biased sample, as those who responded to the questionnaire may have had special personal strengths such as higher education and socioeconomic status compared to those who did not participate. Thirdly, the reliance on online surveys in platforms Hornet and Telegram introduces the possibility of false self-reporting regarding sexual orientation and identity, which might have distorted the results. This may apply to those who self-identify as tops and full tops. A trial study was conducted first to identify non-fake profiles to increase the accuracy of results. Using the internet and dating applications for

targeted sampling may have limited access to members of this sexual minority. Due to different reasons, such as age or lack of Internet access, the researchers could not have accessed a large number of homosexual men.

5. Conclusion

In general, the results suggested that tops are more likely to have better self-expression than the two other groups. They also have a greater degree of physical dissatisfaction and show more adverse behaviors compared to other homosexual groups. Bottoms have more problems in entering relationships and hiding their identity. Depression, hopelessness, and failure in attracting support and affection from others are more prominent among bottoms. The prevalence of pessimism and sensitivity to ethical and religious norms was higher among bottom and top groups. Moreover, senses of skepticism, worthlessness, and lack of control over other groups were stronger in bottoms.

Acknowledgments

This paper was extracted from a certified master's thesis presented by Seyed Mohsen Pourmohseni Shakib at the University of Guilan (No. 136292, January 12, 2021). The authors would like to thank all the participants who helped us in this research.

Funding

None.

Conflict of interest

The author declares no conflicts of interest.

Author contributions

Conceptualization: Sajjad Rezaei
Data curation: Seyed Mohsen Pourmohseni Shakib
Formal analysis: All authors
Methodology: Sajjad Rezaei
Supervision: Sajjad Rezaei
Writing – original draft: All authors
Writing – review & editing: All authors

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and/or National Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval for the study was obtained from the Council of postgraduate courses at the University of Guilan (No. 136292, January 12, 2021) and the Local Research Ethics Committees (Approval ID: 44467987). Informed consent was obtained from the participants.

Consent for publication

The authors affirm that research participants provided informed consent for publication of their information anonymously and confidentially.

Availability of data

Data are available on request from the authors.

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RESEARCH ARTICLE

The older, the wiser and also the less innovative? An empirical analysis of the relationship between population aging and innovativeness

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Abstract

Entrepreneurship is generally considered the engine of growth, given its role in introducing innovations into the economic system. Developed countries have already become a victim of rapid aging of their populations, while the similar trend has just started in developing countries. The previous literature has suggested that aging and nascent entrepreneurship are negatively related. This study investigated the relationship between aging and innovation using dynamic panel techniques. We found that the level of innovation activities represented by the number of patent applications is negatively related to aging. This association remains even after other demographic and institutional confounders are taken into account. We also found that education and flexibility of business regulations are positively related to innovation.

Keywords: Innovation; Population aging; Patents; Dynamic panel methods

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Citation: Ruiu, G., Breschi, M. & Fornasin, A. (2023). The older, the wiser and also the less innovative? An empirical analysis of the relationship between population aging and innovativeness. *International Journal of Population Studies,* 9(2): 61-74. https://doi.org/10.36922/ijps.0429

Received: April 12, 2023

Accepted: August 12, 2023

Published Online: September 18, 2023

1. Introduction

The economic literature has highlighted the strong connection between entrepreneurship, innovation and economic growth. Schumpeter (1934) was the first scholar singling out these associations and pointing out that entrepreneurs are vital to economic development because they translate inventions and scientific discoveries into economic innovations in the forms of new services, products, production processes, and management approaches. According to Schumpeter, the inventor may differ from the innovator. The former is the creator of ideas and inventions, while the innovator recognizes the potential for exploiting the invention for an economic purpose. Schumpeter remarked that both roles are essential for economic development, as the innovations generated by inventors and exploited by innovators contribute to economic growth and progress. In addition, new firms contribute to the economy by introducing new goods or more efficient production methods, displacing underperforming firms, thereby reallocating resources for better use. This phenomenon is known as the process of creative destruction. Numerous empirical studies have supported the role of entrepreneurship in economic growth (Scarpetta *et al.*, 2002; van Praag & Versloot, 2007; Acs *et al.*, 2008; Bosma *et al.*, 2018).

For instance, van Praag and Versloot (2007) reviewed 12 years of high-quality empirical research into the economic value of entrepreneurship, confirming that young

and small firms contribute heavily to employment creation as well as to high-quality innovations (measured by the number of patent citations). They concluded that there is little doubt that entry of individuals into self-employment/business ownership and of independent firms into the market are impetus to economic development in developed economies.

Given the importance of entrepreneurs in the economic system, it is crucial to further understand whether the rapid aging of populations in many developing countries and the large share of elderly individuals, which is a typical hallmark of developed economies, will affect their innovative capacity. The potential impact of aging on entrepreneurship is not a new concept in demography. More than 70 years ago, Sauvy (1948) observed that: "In countries suffering from ageing, the spirit of enterprise, and hence the willingness to accept risks, without which capitalism cannot function, gradually declines and is replaced by a new feeling: the desire for security" (p.118).

The French demographer's perspective on aging and risk tolerance has received extensive support on the empirical ground (Löckenhoff & Carstensen, 2007; Mata *et al.*, 2011; Mata *et al.*, 2016; Rolison *et al.*, 2014). As we will discuss later, empirical evidence at the individual level show that the likelihood of becoming an entrepreneur decreases after age 50. Furthermore, at the country level, Lamotte & Colovic (2013) have shown that older countries are also characterized by less nascent entrepreneurship.

Population aging is caused by a declining fertility rate, which reduces the proportion of young people, and an increasing life expectancy, which results in a larger share of elderly individuals (Goldstein, 2009). Many demographic models are based on the assumption of stationarity, which postulates a population with zero growth rate and a stable age structure. However, fertility rates in many developed countries have consistently remained below replacement levels, making stationarity more of a theoretical concept than an accurate description of the population process. Immigration can have temporary rejuvenating effects under certain conditions (Schmertmann, 1992; Alho, 2008), but in the long run, it would still contribute to an older age structure in the host country compared to that in country without migrants, as suggested by the literature in general (see Goldstein 2009, for a review). While aging can be construed as a success in terms of reducing mortality rates, particularly among infants, and as a consequence of improved living standards and health-care systems, it also presents various challenges.

The previous research has predominantly focused on the effects of aging on the labor force, the welfare system, and the increasing need for long-term care while neglecting the link between entrepreneurship and innovativeness (Liang *et al.*, 2018). Thus, this study aimed to empirically assess the effect of population aging on countries' innovativeness. To this end, in the first part of the next section, we will discuss well-known economic models of technological progress, clarifying the role of entrepreneurship and how institutions may shape innovation activities within a country. In the second part of the second section, we will explore the link between aging and entrepreneurship, setting the stage for our research questions. Moving on to the third section, we will present our data and method. In the fourth section, we will show our results which are then discussed in the fifth section. Finally, in the last section, we will provide some concluding remarks and considerations.

1.1. The drivers of innovation

1.1.1. Entrepreneurship, institutional factors and the innovation process

Based on the well-known exogenous growth model proposed by Solow (1956), economic growth is influenced by the growth rate of innovations, which are considered exogenous factors. Nevertheless, the contemporary economic growth is determined using endogenous growth models, including the one developed by Romer (1986). In Romer's model, population growth can contribute to per capita income growth because a larger population working in the research and development (R&D) sector can accelerate technological change. However, it is essential to note that Romer's model neglects the role of the entrepreneur. This omission aligns with Baumol's famous statement about theoretical growth models: "The theoretical firm is entrepreneur-less – the Prince of Denmark has been expunged from the discussion of Hamlet" (Baumol, 1968, p. 66). Treating the entrepreneur as a central figure in theoretical economic models is a concept by Aghion & Howitt (1992; 1997); Howitt & Aghion (1998). In these models, the entrepreneur is portrayed as a profit-seeking individual who competes with others to create innovations that provide competitive advantages.

Human capital and entrepreneurship are vital elements for economic progress. However, institutions also play a crucial role in the innovation process. This has been emphasized by Baumol (1990), who highlights that entrepreneurial activity is categorized as productive and unproductive entrepreneurships, and the direction of entrepreneurial efforts depends on the quality of prevailing economic, political, and legal institutions. This institutional framework determines the relative rewards of investing entrepreneurial efforts in productive market activities (e.g., R&D) versus unproductive ones such as political lobbying and lawsuits. Good institutions characterized by

secure property rights, a fair and balanced judicial system, contract enforcement, and effective constitutional limits on the government's ability to transfer wealth through taxation and regulation encourage productive entrepreneurship and foster economic development (Acemoglu & Johnson, 2005). Furubotn & Richter (2005) have also extensively explored how institutions, including laws, property rights, social norms, and governance systems, can either facilitate or hinder economic development.

Figure 1 provides a schematic representation of the innovation process. The core of the process (depicted in the yellow area) revolves around the firm and its entrepreneurial drive to innovate, which influences investment in R&D and other innovation-related activities. Thus, the firm is ultimately responsible for introducing innovation into the economy. The blue area in Figure 1 encompasses institutional and structural factors such as legal, economic, financial, and educational elements, which establish the rules and range of opportunities for innovation. At the same level, scientific knowledge cumulated in a society is a fundamental component in the innovation process, as remarked by Schumpeter and later on proven by both exogenous and endogenous growth models.

The transfer factors (represented in the green area) include all the elements that facilitate the flow of information and skills from the scientific environment to the firm level. This concept is borrowed from the second edition of the OSLO Manual, jointly proposed by OECD & EUROSTAT (1997), for collecting data on innovation. For instance, this dimension includes university dissemination activities, collaborations between research institutions and firms, workforce mobility from the research sector to the private sector, and cultural values like trust that can promote information sharing and collaboration.

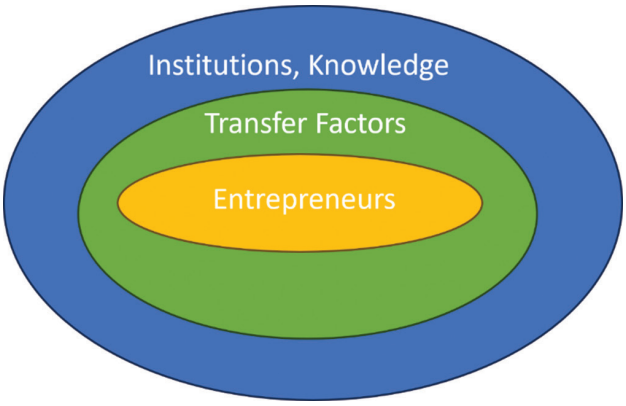

Figure 1. A representation of the factors that lead to innovation
Note: The authors' reworking of a scheme originally proposed in OECD and Eurostat (1997).

1.1.2. Aging, entrepreneurship, and innovation

Parker (2009) emphasizes that the U-reverse-shaped relationship between age and the probability of becoming an entrepreneur is one of the most robust findings in the empirical literature about entrepreneurship. Specifically, numerous studies have shown that the probability of starting a business tends to increase with age up to a threshold point (between 35 and 44 years of age) and then decreases thereafter (among others, Kautonen *et al.*, 2014; Levesque & Minniti, 2006; 2011). More recently, Zhang & Acs (2018) suggested that the shape of this relationship varies depending on the type of entrepreneur. They found that the probability of being a full-time entrepreneur tends to decrease with age, while the opposite trend was observed for part-time entrepreneurs. In addition, they confirmed the U-reverse-shaped relationship for incorporated entrepreneurs but not for unincorporated ones. Interestingly, they also found that the propensity of novice entrepreneurs compared to non-novice entrepreneurs follows a U-shaped age pattern, with a dip around the age of 60.

To avoid confusion, we need to specify that the age distribution of entrepreneurs is not generally skewed toward young ages. On the contrary, as highlighted in a report jointly released by the OECD and the European Commission in 2019, individuals over 50 make up more than 48% of self-employed people. Hence, it is nascent entrepreneurship but not entrepreneurship as a whole to be menaced by population aging. Our paper also attempted to investigate if this will affect the innovative capabilities of societies.

Recently, Liang *et al.* (2018) proposed a model highlighting the importance of the skills acquired through on-the-job training, the perception of the business opportunity, and the risk tolerance involved in deciding to start a business. In an older society, older individuals typically occupy leadership positions in firms, which reduce the opportunities for young workers to acquire business skills early in their careers. This implies that younger individuals, even if highly skilled, have a lower expectation of becoming entrepreneurs. Azoulay *et al.* (2020) also showed that the fastest-growing firms are founded by middle-aged entrepreneurs rather than younger individuals.

Using data from the Global Entrepreneurship Monitor on nascent entrepreneurship, Ruiu & Breschi (2019) found that while individuals over the age of 50 are less likely to become entrepreneurs, if they decide to do so, they are more likely than their younger counterparts to introduce radical and innovative products or services. However, older nascent entrepreneurs are not very likely

to bring in technological advancements in production. The authors argue that older individuals face more barriers to becoming entrepreneurs compared to younger individuals, such as having more economic resources, the risk of losing more in case of failure, less time to collect the rewards of an uncertain activity, and less time to recover their economic situation in the case of business failure. Consequently, when an older individual decides to become an entrepreneur, their entrepreneurial project should be worth the risk, aligning with Liang *et al.*'s perspective on the role of experience in business perception. At the same time, older individuals seem less comfortable with new technologies (Fernàndez-Lòpez *et al.,* 2022).

Indeed, the previous research has consistently found that older individuals tend to have negative attitudes toward new technological devices and innovations. Studies by Vorrink *et al.* (2017), Ellis & Allaire (1999) and Tacken *et al.* (2005) have demonstrated a negative association between age and the use of various technological devices, including computers, smartphones, tablets, and other digital tools. Furthermore, Ragnedda *et al.* (2020) have shown a strong relationship between age and the digital divide, indicating that older individuals are more likely to face challenges in accessing and utilizing digital technologies effectively.

Angelini (2021) developed a theoretical model that supports the notion that additional aging within a workforce hampers the adoption of innovative technologies and diminishes productivity. As young employees, who typically have a comparative advantage in utilizing modern technologies, become scarce, older individuals can further impede the adoption and integration of innovative technologies within organizations, potentially affecting the overall productivity. These findings collectively suggest that older individuals are less comfortable and familiar with new technologies, affecting their ability to engage in entrepreneurial activities that heavily rely on technological innovation.

In summary, older entrepreneurs, due to their accumulated market experience, may possess a heightened ability to identify untapped opportunities for introducing new products and services. Moreover, they are likely to have a deeper understanding of the needs and preferences of an aging population, enabling them to capitalize on the prospects presented by the "silver economy." The silver economy refers to "the economic opportunities arising from the public and consumer expenditure related to aging population and the specific needs of the population over 50 and it comprises a large part of the general consumer economy, but with considerable differences in spending priorities and patterns" (Pauhofova & Dovalova, 2015, p. 191). According to Drucker (1985), an entrepreneur should be able to recognize the opportunity to innovate in face of the environmental changes. Among the catalysts for such changes, Drucker emphasizes the potential for leveraging emerging needs resulting from demographic shifts. However, it is worth noting that older entrepreneurs may encounter challenges in keeping up with rapid technological advancements. Therefore, it is challenging to predict the specific effect that population aging will have on the innovativeness of a country.

In addition, population aging is associated with various demographic phenomena, such as increased life expectancy, decreased natural growth rate, and limited support from migration to offset potential negative natural balances. These factors, when combined, may contribute to depopulation. Based on Romer's model, population growth is closely linked to the rate of innovation, making it crucial to analyze the impact of aging in conjunction with other demographic forces that contribute to the growing proportion of elderly individuals.

With this, we formulated two research questions (RQ), which are given below as follows:

- *RQ1:* Considering the natural growth rate of the population, the increase in life expectancy and the migratory balance, does aging still impact the innovation rates?

Furthermore, in light of the discussion in the first part of the second section, where the importance of institutional settings in determining innovation rates was remarked, and considering that developed countries typically have both a higher proportion of older populations and more efficient institutional frameworks, we aim also to answer to the following question:

- *RQ2:* Considering the heterogeneity in institutional settings, are countries characterized by an old population less innovative than the younger ones?

The findings in response to these research questions highlight the importance of both demographic factors and institutional environments in shaping a country's innovation capacity.

2. Data and methods

2.1. Data

The data panel used in this study comprises data from various official sources. The number of patent applications by residents is obtained from The World Bank Data, while the demographic data are sourced from the Population Division of the United Nations. The quality of the legal system and business regulation is measured using indicators from the Fraser Institute. Educational attainment

data were derived from the Barro-Lee dataset. The dataset covered 38 countries over the 1985 – 2019 period. The data were divided into non-overlapping 5-year intervals to ensure comparability between the data provided by the United Nations (grouped by 5-year intervals) and the annual data on patent applications per resident provided by the World Bank. Table 1 provides the definition and the source of each variable used in the subsequent analyses. Patent applications per 1000 inhabitants will be used as the variable to gauge each country's level of innovation effort in this study. Smith (2005) has discussed the pros and cons of using this variable as a proxy of innovation. The most evident limitation of using this variable is that patents mainly reflect technological innovations rather than commercial ones. However, as mentioned in the previous section, given the potential threat of population aging to technological progress, this variable allows for a precise examination of the relationship between population aging and technological progress is crucial driver of economic development.

The countries included in the analysis were selected based on data availability to ensure the longest possible observational period. These countries (and regions) include: Austria, Bangladesh, Belgium, Bulgaria, Brazil, Canada, Chile, China, Hong Kong (China), Costa Rica, Denmark, Finland, France, Germany, Greece, Guatemala, India, Iceland, Israel, Japan, Republic of Korea, Malaysia, Mexico, Netherlands, New Zealand,

Table 1. Description and source of the variables used in the analysis

Variable name	Extended name	Definition	Source
PAT	Patents per inhabitants	Number of patents applications (by residents in the country) per 1,000 inhabitants. Averaged by 5 years intervals.	Numerator: World Bank: https://data.worldbank.org/indicator/IP.PAT.RESD Denominator: United Nations Population Division: https://population.un.org/wpp/
UNI	Tertiary education	Percentage of the population aged 25 – 64 that has completed tertiary education	Barro-Lee Estimates of Educational Attainment for the Population Aged 25–64 from 1950 to 2015 Source: Barro and Le (2013)
SPRP	Security and Property Rights protection Index	This index ranges from 0 to 10, where 0 corresponds to "no judicial independence," "no trusted legal framework exists," "no protection of intellectual property," and "no integrity of the legal system," while 10 corresponds to "high judicial independence," "trusted legal framework exists," "protection of intellectual property," and "integrity of the legal system."	Economic Freedom Index proposed by the Fraser Institute: https://www.fraserinstitute.org/economic-freedom/approach Source: Gwartney *et al.* (2019)
BUS	Business regulation index	This index is designed to identify the extent to which regulations and bureaucratic procedures restrain entry and reduce competition. It ranges from 0 to 10 where 10 indicates the maximum level of flexibility in the regulation of business activities.	Economic Freedom Index proposed by the Fraser Institute: https://www.fraserinstitute.org/economic-freedom/approach
LEXP	Life expectancy at birth	It captures how long, on average, a newborn can expect to live, if current death rates do not change	United Nations Population Division: https://population.un.org/wpp/
NAT	Population natural increase rate	Difference between the crude birth rate and the crude death rate.	United Nations Population Division: https://population.un.org/wpp/
NMR	Net migration rate	(Migratory balance×1,000)/Total population	United Nations Population Division: https://population.un.org/wpp/
OVER	Over 65	Percentage of the population aged 65 and over in the total population	United Nations Population Division: https://population.un.org/wpp/
HIGH	High income	Dummy=1 when the country is classified as a high income country by the World Bank	Source: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups
TRADE	Trademark application per 1,000 inhabitants	Number of trademark applications (by residents in the country) per 1,000 inhabitants. Averaged by 5-year intervals.	Numerator: World Bank: https://data.worldbank.org/indicator/IP.TMK.RESD Denominator: United Nations Population Division: https://population.un.org/wpp/

Norway, the Philippines, Poland, Portugal, Romania, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, and United States. While the choice of countries may have been somewhat constrained by data availability, the dataset was considered sufficiently heterogeneous in terms of institutional settings and demographic conditions. The heterogeneity in data was crucial for examining the relationship between population aging and innovation across different contexts. By including countries with diverse institutional frameworks and demographic characteristics, the analysis could capture a wide range of factors that may influence the innovativeness of nations. This heterogeneity strengthens the robustness of the analysis and enables more nuanced insights into the relationship under investigation.

2.2. Methods

To answer *RQ1* and *RQ2*, we estimated the following dynamic data panel model:

$$Pat_{it}=\rho Pat_{i,t-1}+\beta x_{it}+v_i+\varepsilon_{it} \quad \text{(I)}$$

Where

$$E(\varepsilon_{it}|x_{i,1985_{1989}},\ldots,x_{i,2015_{2019}},v_i)=0 \quad \text{(II)}$$

Pat_{it} is the number of patent applications per 1,000 inhabitants of country i at time t (t = 1985 – 1989,…, 2015 – 2019). Given that innovation is generally an incremental process, we allowed a certain degree of persistence by including a lag of the dependent variable in our empirical model. Rho is the coefficient associated to the lagged dependent variable. The explicative variables x_{it} are the share of population over the age of 65 (as our proxy of country aging), the life expectancy at birth, the natural growth rate of the population, the net migration rate, the share of population aged 25–64 who have had tertiary education, the security and property rights protection index, the flexibility in the business regulation index, and a dummy equal to one when the country is classified as a high-income country by the World Bank. Beta represents the vector of coefficients associated to our explicative variables. The v_i are the panel-level effects. By construction, we consider that the lag of the dependent variable is endogenous given that it will be correlated with v_i, making the most common estimators (for instance, ordinary least squares) inconsistent. The model can be consistently estimated through the Arellano-Bover/Blundell-Bond Generalized Method of Moments (GMM) system estimator (Arellano & Bover, 1995; Blundell & Bond, 1998), which is designed to deal with panels with few periods and larger cross-section units (our necessity to group data in 5-year intervals led us to have only seven periods). The method assumes that no autocorrelation exists in the idiosyncratic errors ε_{it} (this can be tested through the Arellano-Bond test).

We also performed an alternative estimation by implementing a two-step GMM system estimation with standard errors corrected to account for the small size of our sample. It should be noted that the two-step estimator is more efficient than the one-step GMM system. However, standard errors tend to be downward biased in small samples. To consider this, Windmeijer (2005) proposed a finite sample correction to estimate the variance in this linear dynamic model. Therefore, we applied Windmejer' s correction in the two-step system GMM estimator. We also estimated a model including the number of trademark applications per 1,000 inhabitants in the right-hand side of Equation I (labeled as one-step GMM'). This variable is included as a proxy of the level of creativity in the country (Williams & McGuire, 2010; Flikkema *et al.*, 2019). Given that its inclusion implies a reduction of the sample size due to missing observations for some years/countries, we decided not to include it in our baseline model. All the statistical analyses are carried out using STATA 17.

3. Results

Figure 2 shows the evolution of patent applications in 100,000 residents from 1985 to 2019 in our sample. It is essential to clarify that the scale used in Figure 2A–D differs from the dependent variable used in Equation I as it is meant for visual purposes. All analyses were indeed conducted using the number of patents per 1,000 residents. To allow readability, we divided the figure into four panels (low, low-medium, medium-high, and high innovative countries) based on the following criteria: 2019 patent applications for inhabitants (PAI) in country $i \leq$ the 2019 cross-country first quartile; the 2019 cross-country median < 2019 PAI in country $i \leq$ the 2019 cross-country median; the 2019 cross-country median < 2019 PAI in country $i \leq$ the 2019 cross-country third quartile; 2019 PAI in country $i >$ the 2019 cross-country third quartile.

It is interesting to note that one of the most innovative and, at the same time, the oldest country in the world, such as Japan, is experiencing a declining trend in the number of patent applications in the last 20 years. Only the Republic of Korea exhibits an increasing trend in the number of applications in the whole period under analysis.

Figure 3 shows the percentages of the population over the age of 65 in 2019 for each country under consideration. Note that all the countries that are currently in the highest quartile in the number of patents application are also, except for China and South Korea, characterized by a larger share of population over 65 and, at the same time, are experiencing a flattening or a decline in the number of submissions to the patent office. To explain this decline,

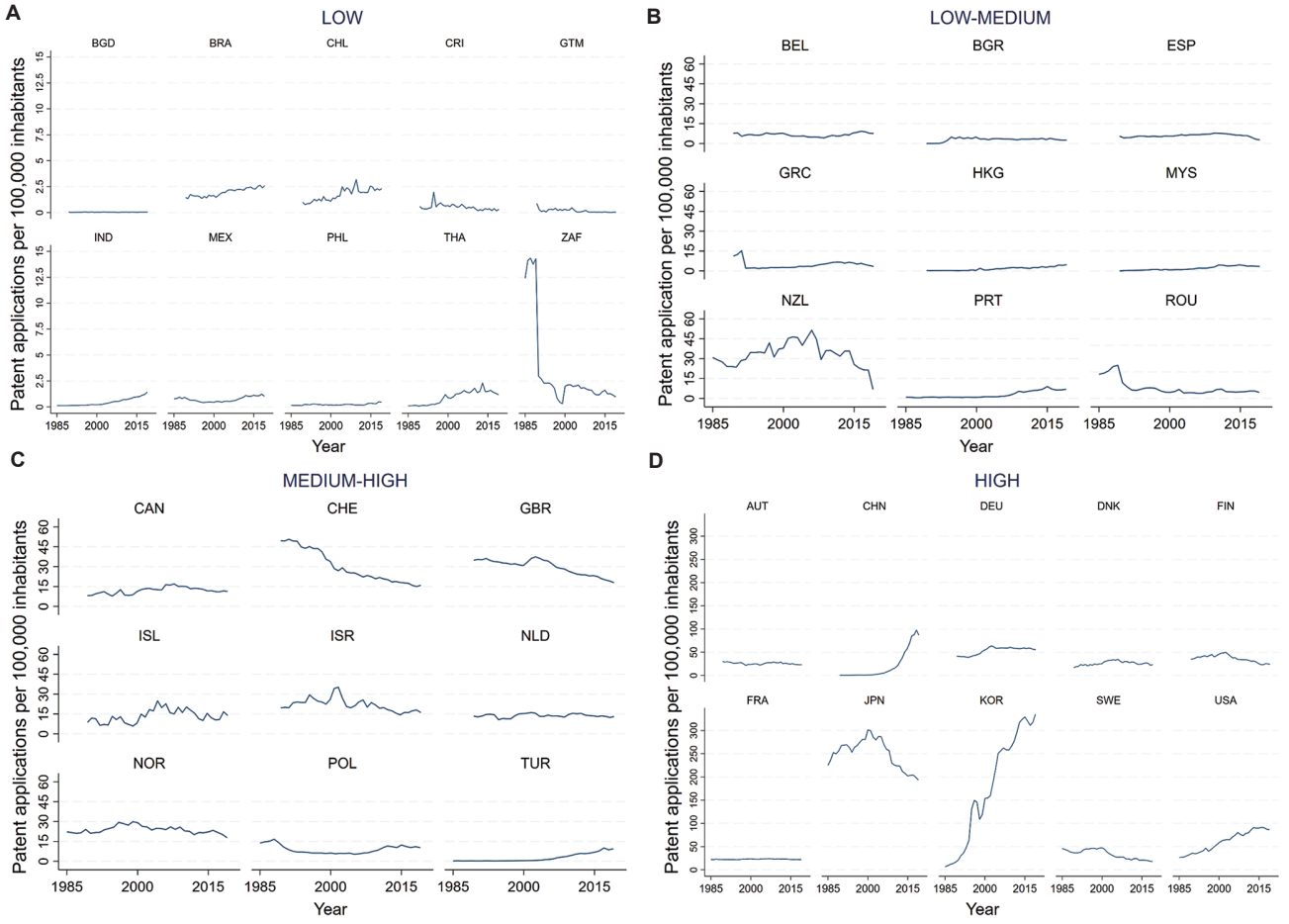

Figure 2. Patent applications per 100,000 residents by quartile, 1985 – 2019
Note: Country ISOCODES: AUT: Austria; BGD: Bangladesh; BEL: Belgium; BGR: Bulgaria; BRA: Brazil; CAN: Canada; CHL: Chile; CHN: China; HKG: Hong Kong; CRI: Costa Rica; DNK: Denmark; FIN: Finland; FRA: France; DEU: Germany; GRC: Greece; GTM: Guatemala; IND: India; ISL: Iceland; ISR: Israel; JPN: Japan; KOR: Republic of Korea; MYS: Malaysia; MEX: Mexico; NLD: Netherlands; NZL: New Zealand; NOR: Norway; PHL: the Philippines; POL: Poland; PRT: Portugal; ROU: Romania: ZAF: South Africa; ESP: Spain; SWE: Sweden; CHE: Switzerland; THA: Thailand; TUR: Turkey; GBR: United Kingdom; USA: United States. Low, medium, medium-high, and high refer to each quartile of the patent applications for inhabitants (PAI) in 2019.

Jones (2009) introduced the concept of the "burden of knowledge." In particular, Jones argued that the higher the level of knowledge that is reached, the more difficult it becomes to produce a newer one. This implies, for instance, that in the academic and/or the scientific ambit, researchers need to spend more time on the path to discoveries and innovations, and as a result, they are no longer young by the time they attain the first achievements; thus, the life cycle of a researcher is inevitably, by the natural course, reducing their overall scientific productivity (see also Schweitzer & Brendel, 2021). In our opinion, this is another reason, we need to explore the relationship between aging and innovativeness.

Table 2 shows the results of the estimation of Equation I. In particular, Columns 1, 2 and 3 report, respectively, the estimates derived from the one-step GMM estimator (with robust standard errors that take into account arbitrary forms of heteroskedasticity), the two-step estimator with robust standard errors, and the same model as in Column 1 but with the number of trademark applications incorporated for analysis. We also report the Arellano-Bond's test for all the models, whose null hypothesis is that autocorrelation in first-differenced errors is zero. Then, a rejection of the null hypothesis indicates that the model is misspecified.

4. Discussion

First of all, it should be remarked that the coefficient associated with the first lag of the dependent variable is positive, smaller than one (ensuring the dynamic stability of the model) and highly statistically significant. This result supports the notion that innovation is a path-dependent process, whereby a country's current efforts in innovation positively affect its future efforts.

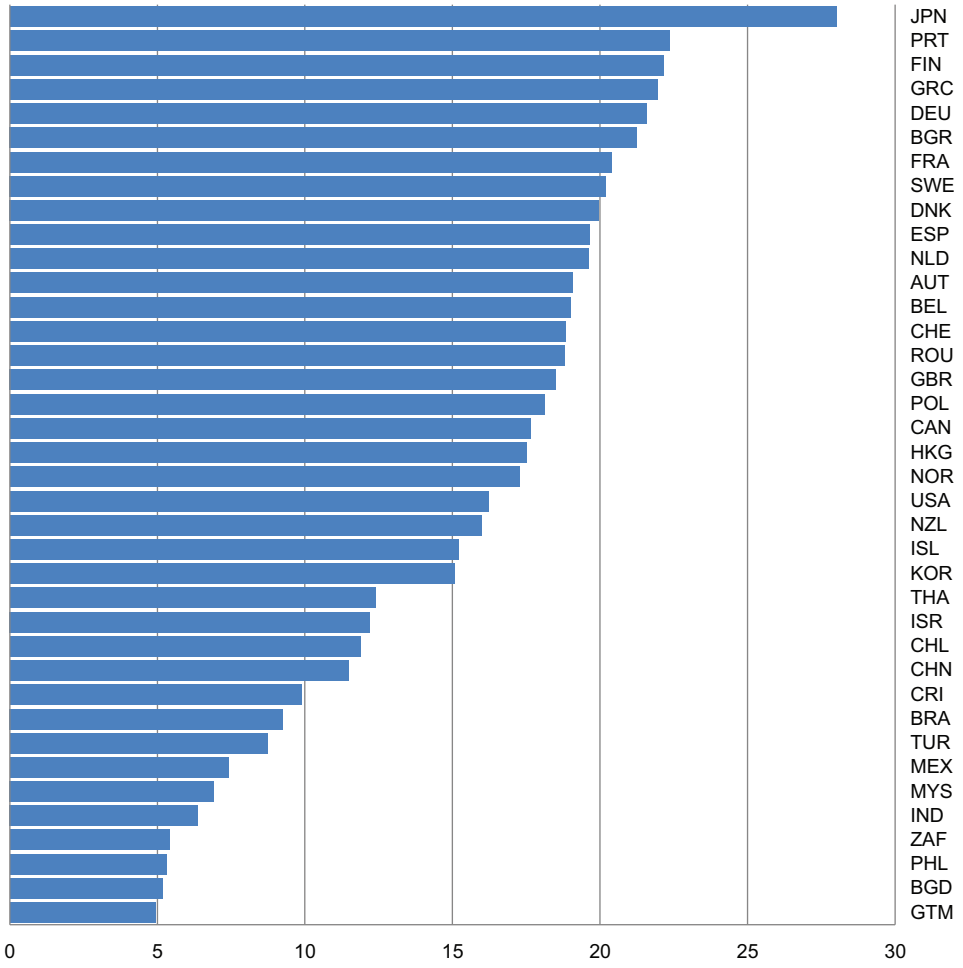

Figure 3. Percent share of population over the age of 65 for selected countries in 2019
Note: Country ISOCODES: AUT: Austria; BGD: Bangladesh; BEL: Belgium; BGR: Bulgaria; BRA: Brazil; CAN: Canada; CHL: Chile; CHN: China; HKG: Hong Kong; CRI: Costa Rica; DNK: Denmark; FIN: Finland; FRA: France; DEU: Germany; GRC: Greece; GTM: Guatemala; IND: India; ISL: Iceland; ISR: Israel; JPN: Japan; KOR: Republic of Korea; MYS: Malaysia; MEX: Mexico; NLD: Netherlands; NZL: New Zealand; NOR: Norway; PHL: the Philippines; POL: Poland; PRT: Portugal; ROU: Romania: ZAF: South Africa; ESP: Spain; SWE: Sweden; CHE: Switzerland; THA: Thailand; TUR: Turkey; GBR: United Kingdom; USA: United States.

An interesting result pertaining to the variable UNI indicates that a one-point percentage increase in the number of graduated people leads to a nine-unit rise in patent applications per 1,000 inhabitants. This result holds statistical significance across all model specifications and confirms the importance of highly skilled human capital in driving innovation. Regarding the institutional variables, only flexibility in business regulation exhibits a positive and significant correlation with the number of patent applications, at least in two out of three specifications. This suggests that lowering the rigidity of market regulations may incentivize more individuals to become entrepreneurs, thereby fostering innovation or, as per Baumol's perspective, channeling efforts away from unproductive entrepreneurship.

It is worth noting that there is a relatively strong correlation between the SRPR indicator and the indicator of business flexibility (r = 0.53). Given the relatively limited number of observations in our sample, the lack of significance of SRPR may be attributed to collinearity issues. Indeed, this seems confirmed by the fact that when an alternative model specification (not reported here) was employed, excluding the SRPR variable, the coefficient associated with BUS became statistically significant.

As shown in Figure 2, high-income countries are characterized by a higher number of patent applications. The coefficient associated with the variable TRADE suggests that for every additional 100 trademarks per 1,000 individuals, there is an expected increase of 12.6 patent

Table 2. A comparison of coefficients across different models

	(1)		(2)		(3)	
	One-step GMM		Two-Step GMM		One-step GMM'	
Lag.PAT	0.890***	(0.035)	0.892***	(0.063)	0.775***	(0.038)
OVER	-0.058***	(0.005)	-0.054***	(0.011)	-0.044***	(0.004)
NAT	-0.011***	(0.004)	-0.008*	(0.004)	-0.007**	(0.003)
NMR	-0.002	(0.003)	-0.002	(0.003)	-0.002	(0.003)
UNI	0.009***	(0.002)	0.009***	(0.002)	0.008***	(0.002)
SPRP	-0.006	(0.022)	-0.010	(0.026)	0.027	(0.021)
BUS	0.027**	(0.011)	0.024**	(0.012)	0.011	(0.011)
LEXP	0.008*	(0.004)	0.006	(0.007)	0.000	(0.004)
HIGH	0.647***	(0.106)	0.699*	(0.359)	0.940***	(0.103)
TRADE					0.126***	(0.030)
_cons	-0.439	(0.313)	-0.351	(0.593)	-0.371	(0.284)
N	228		228		219	
	Arellano Bond's test					
Order	z (sig)					
Model 1						
1	-.99349 (0.3205)					
2	.70122 (0.4832)					
3	-.84927 (0.3957)					
Model 2						
1	-.94232 (0.3460)					
2	.70087 (0.4834)					
3	-.80401 (0.4214)					
Model 3						
1	-1.0702 (0.2845)					
2	.63955 (0.5225)					
3	-.80996 (0.4180)					

Note: LAG.PAT: first lag of Patents per inhabitants; OVER: % of over 65 in the population; NAT: Population natural increase rate; NMR: Net migration rate; UNI: % of people with tertiary education; SPRP: Security and property rights protection Index; BUS: Business regulation index; LEXP: life expectancy at birth; HIGH: Dummy =1 if the Country is classified as high income country by the World Bank; TRADE: trademark applications per 1,000 inhabitants. GMM: Generalized Method of Moment. One-step GMM' indicates the inclusion of an additional variable of TRADE in the model. For each model, tests were performed for up to the third order of auto-correlation in the first differenced residuals. Heteroskedasticity Robust Standard errors in parentheses in all the columns; *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

applications per 1,000 inhabitants. Our results are thus coherent with Flikkema *et al.* (2019).

Finally, we found that both the population aging and the natural increase rate negatively affect innovation. In particular, an increase of 1% point in the incidence of population over 65 is associated with a decrease of 58 patent applications per 1,000 inhabitants. Hence, our answer to *RQ2* seems to be positive, and the magnitude of the effect is relatively strong compared to other coefficients.

The negative coefficient associated with NAT may seem surprising given Romer's prediction about its effect. However, according to the framework proposed by Porter *et al.* (2002), economic development can be categorized into three stages: (i) factor-driven, (ii) efficiency-driven, and (iii) innovation-driven stages.

During the factor-driven stage, countries focus on non-agricultural self-employment, often consisting of small manufacturing and service firms. Countries in this stage compete in producing commodities or low-value-added products. Institutions' role becomes crucial to transit into the efficiency-driven stage. During this stage, countries must enhance production efficiency and educate the workforce to adapt to technological advancement. They also must develop financial institutions that support the birth of large firms capable of exploiting economies of scale. Finally, the innovation-driven stage is marked by an increase in knowledge-intensive activities. In this stage, the focus shifts from firms to agents possessing new knowledge (Acs *et al.*, 2008).

Since developed economies generally have fertility rates below the replacement rate, resulting in a negative or low natural increase rate, countries with the higher natural increase rates are more likely to be in phase 1 or 2 of economic development. This may explain why we observe a negative coefficient for the natural increase rate, as countries in earlier stages of development may prioritize production factors other than innovation.

Regarding the negative impact of aging, our results confirm the concern about its relationship with technological progress. Thus, not only aging produces a detrimental effect on nascent entrepreneurship, as shown by Lamotte & Colovic (2013), but it may also undermine the ability of countries to introduce technological innovations. This is also coherent with the findings reported at the individual level by Fernández-Lopez *et al.* (2022). In particular, they showed that senior entrepreneurs (intended as those over 50) are less likely to enter high-medium technological sectors than younger entrepreneurs. This paper complements their findings showing a link between aging and patenting activities.

Considering another demographic variable, a surprising finding is that the variable NMR is not significant from a statistical point of view. This contradicts common sense, according to which we may be tempted to believe the opposite. However, based on economic literature, the focus is not on the number of immigrants but rather on their quality in terms of human capital and the diversity they bring (Fairlie & Lofstrom, 2015; Li *et al.*, 2018; Burchardi *et al.*, 2020; Ozgen *et al.*, 2012). Burchardi *et al.* (2020) found that low-educated migrants do not significantly impact local innovation, while

medium-educated migrants have an effect about half as strong as the average migrants. Only high-educated migrants exhibit a positive and more significant impact on innovation compared to the average migrants. Due to the limitation in our data, we were unable to distinguish among the type of migrants, and given that part of our sample was composed of data from developing countries, our sample likely included data of a significant portion of low-skilled migrants, particularly in developing countries. This could explain why the variable NMR is not significant in our analysis, as low-skill migration may not contribute significantly to the innovation patterns we are examining.

Finally, our results suggested that other demographic forces do not drive the effect of aging; thus, our answer to *RQ1* is positive. In addition, the coefficient associated with aging is also characterized by the largest magnitude. Hence, not only the effect of aging survives to the inclusion of possible confounders, but it has a substantial impact on innovativeness.

The Arellano-Bond tests for all three models indicate that these are correctly specified.

5. Conclusions

In 2007, with regard to the ability to innovate, the CEO and founder of Facebook, Mark Zuckerberg, at Y Combinator Startup School event in Stanford, affirmed that "younger people are just smarter." Even though the same Zuckerberg represents a case of a very young innovator, the relationship between innovativeness and age is not as straightforward in literature as he postulated. In particular, older entrepreneurs may be less likely to introduce technological innovation, but this may not be true for product innovations (Ruiu & Breschi, 2019).

Almost all developed economies have experienced a robust aging process; the same process is also happening in the developing ones. On the one hand, this reflects essential improvements in living standards and the scientific conquests in health; on the other hand, the aging issue flags a potential concern for weakening economic development if the intensity of entrepreneurship booming dwindles, leading to less innovation activities. Adopting a macroeconomic point of view, this paper investigated the relationship between population aging and innovation activities as proxied by the number of patent applications. Our results obtained using data panel techniques seem to confirm this association that aging is negatively related to the number of patent applications. This relationship remains significant when we controlled for important contextual variables, such as the workforce's education level, business regulation flexibility, economic development level, and other possibly confounding demographic variables. Of particular relevance is the result associated with the net migration rate.

Immigration is often viewed as a temporary solution to address labor force shortages. However, according to demographic theory, immigration alone may not be sufficient to rejuvenate a population with fertility rates below replacement levels. Nevertheless, it is widely recognized that immigrants are generally highly entrepreneurial (OECD-EU, 2019; Parker, 2009; Dheer, 2018).

Consistent with the previous empirical findings (Burchardi *et al.*, 2020), our analysis suggested that the impact of immigrants on technological advancement depends on their level of human capital. When immigrants predominantly comprise low-skilled individuals, they are more likely to engage in entrepreneurship out of necessity rather than pursuing innovative ventures. Furthermore, the success of immigrant entrepreneurship may also be influenced by the support provided by local institutions (Dheer, 2018).

In summary, while immigration can contribute to entrepreneurship and economic growth, its impact on technological advancement depends on the composition of immigrants in terms of human capital and the level of support provided by local institutions. Low-skilled immigration may not significantly affect innovation, and immigrant entrepreneurs' success may vary depending on institutional support.

Fortunately, the effect of aging could be, in principle, counteracted by increasing the level of education and allowing for more flexibility in business regulations. In addition, even though aged entrepreneurship may imply lesser innovation in terms of technological advancement, this does not automatically mean that innovations stemming from the Silver Economy are not possible.

Overall, the key message that emerges from our analysis is that a policy in favor of mature-aged entrepreneurship is crucial for the growth of developed economies. On this line, the European Union and the OECD-EU (2021) have recognized the importance of senior entrepreneurship. They have emphasized the need to create an enabling environment that supports older individuals in starting and running their businesses, including access to finance, business support services, training and skills development, networking opportunities, and overcoming age-related barriers and stereotypes. European Union and OECD have also emphasized the importance of promoting intergenerational collaboration and knowledge exchange to leverage older entrepreneurs' experience, skills, and networks. In addition, they have highlighted the need to address specific challenges faced by senior entrepreneurs, such as limited access to capital, age discrimination, and inadequate tailored

support mechanisms. Therefore, paraphrasing Zuckerberg, if youngsters are smarter in the technological field, mature entrepreneurs may be "wiser" in judging new market opportunities thanks to their cumulated experience (see, among others, Ruiu & Breschi, 2019; Kitchell, 1997).

A limitation of our work stems from using patent applications as a proxy of innovation activities. Indeed, a patent does not necessarily represent a commercially exploited innovation, and the submitted applications can turn out to be unsuccessful. In any case, we believe that this variable is suited to capture the efforts exerted in a country to introduce technological innovations. As pointed out by the literature, the negative attitude of older people toward technology is one of the most severe challenges that aging populations should face soon. In addition, we did not consider other forms of innovation, such as social innovations, in the current analysis. However, we believe that even though these are important for development, this paper was oriented to explain the possible consequences of aging on technological progress. Therefore, offering reflections on other forms of innovation is out of the scope of this specific paper.

In conclusion, it is essential to advocate for a broader interdisciplinary dialogue among social scientists, and specifically, strengthen the collaboration between demographers, economists, sociologists, and business management scholars to maintain the innovativeness of an aging population. We believe that the challenges and opportunities a rapidly aging society presents require an integrated approach that transcends disciplinary boundaries. By bringing together expertise from various fields, researchers can gain a more comprehensive understanding of the complex dynamics and implications of population aging.

Acknowledgments

None.

Funding

None.

Conflict of interest

The authors declare they have no competing interests.

Author contributions

Conceptualization: Gabriele Ruiu, Marco Breschi, Alessio Fornasin
Formal analysis: Gabriele Ruiu
Methodology: Gabriele Ruiu
Writing – original draft: Gabriele Ruiu
Writing – review & editing: Gabriele Ruiu, Marco Breschi, Alessio Fornasin

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

All the data used in this paper are taken from several public sources. The final dataset is available from the Harvard Datavarse Repository at the following address: https://doi.org/10.7910/DVN/KYJFQL

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ACCSCIENCE PUBLISHING

International Journal of Population Studies

REPORT

Sustainable socioeconomic development service for suburban population: A case study in East Malaysia

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Abstract

Sustainable socioeconomic development service dimensions, determining the suburban residents' satisfaction from the residents' perspectives, have yet to be contextually identified for more effective policies and strategies to benefit the targeted households. This case-based empirical research paper aims to examine the relevant sustainable suburban socioeconomic service dimensions from the residents' perspectives. Interviews and questionnaire survey data were employed to identify the numerous dimensions and items in relevance. Batu Kawa suburban in Kuching (Sarawak, Borneo), Malaysia, was chosen based on its exemplary socioeconomic development and multi-ethnicity. The survey involved 283 respondents. The findings reveal that there were ten dimensions for the sustainable socioeconomic development service dimensions. The findings also indicate that the residents were generally satisfied, but there is still room for further improvement, especially in terms of public transport system, road traffic, safety and security, sport facilities, pollution, and job opportunities. The results suggested that there were differences between two geographical areas separated by the Sarawak River.

Keywords: Socioeconomic development service; Suburban; Sarawak

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Citation: Voon, B.H., Ing, P., Joseph, C., *et al.* (2023). Sustainable socioeconomic development service for suburban population: A case study in East Malaysia. *International Journal of Population Studies,* 9(2): 75-83. https://doi.org/10.36922/ijps.442

Received: January 10, 2023

Accepted: May 2, 2023

Published Online: May 22, 2023

1. Introduction

Sustainable socioeconomic development is crucial for mankind and it has received great attention from nations worldwide. The sustainable development goals (SDGs) of the United Nations have been the preferred key performance indicators for many governments and authorities at different levels for the community-desired development of sustainability (e.g., Voon *et al.*, 2021). Emerging economies, including Malaysia, have allocated increasing amounts of financial and non-financial resources for sustainability initiatives to serve and care for their citizens and households. Many organizations and individuals in the public and private sectors have been recognizing the needs and

opportunities of implementing sustainability practices in their operations to achieve the desired outcomes for better development service quality to the targeted stakeholders (e.g., Peter & Csaba, 2019). Understanding households' socioeconomic strategies for sustainability is essential to help them more effectively (Sachs *et al.*, 2021). Nevertheless, the voices of the residents, typically in the suburban areas, are given scant attention, and the needs and expectations of the suburb residents are often overlooked.

Therefore, this paper presents the empirical research which aimed to explore and thereafter measure socio-economic development services and residents' satisfaction. A suburb of Kuching City (Borneo), Batu Kawa, Sarawak, Malaysia, was selected for the intended investigation on the various sustainability initiatives for sustainable socioeconomic development and family happiness. The triple-bottom line measurement items of the natural, economics, and social dimensions of sustainability were included in the quantitative survey questionnaire.

1.1. Socioeconomic development and Batu Kawa in Borneo

Borneo is the world's third largest island and the largest island of Asia. It is a part of the Indonesian archipelago. Borneo is surrounded by the Java Sea to its south, the Celebes Sea on its east, and the South China Sea to its north. Borneo is the only island in the world that is shared by three different countries, namely: Indonesia (73%), Malaysia (26%), and Brunei (1%). The island of Borneo is rich in natural resources. Known metal deposits include gold, silver, copper, tin, aluminum (as bauxite), and iron ore. Most of the island is covered by tropical forests that produce tropical timber and other forest products. The coastal and offshore areas are underlain by deposits of coal, peat, oil, and natural gas. Sarawak, together with Sabah, is one of the states situated in Borneo. Kuching City (and her south-western periphery, Batu Kawa), one of the most dynamic cities in Borneo, is located in south-western Sarawak. Batu Kawa is exemplary for her fast and dynamic socioeconomic development as well as sustainability practices.

Batu Kawa, the periphery municipal area (Figure 1A), is administered under the Kuching South City Council and specifically managed by the Padawan Municipal Council. The original major Batu Kawa settlement areas (after the Datuk Chong Kiun Kong Bridge) consist of 10 major roads (*kolong*), with 10 primary schools and more than 5000 households, exceeding 10,000 population (in 2022). Batu Kawa, which mainly consists of Chinese Hakka and Malay residents, has undergone fast economic development after the bridge was built in the early 1990s. For the past 10 years, there have been many housing development projects in this suburb and there are many households with diverse ethnic cultures now. They are many Bidayuh and Iban families residing there. The occupations of Batu Kawa residents include construction workers, clerks, technicians, salesman, teachers, government servants, and others (Voon *et al.*, 2021). Many of them are businessmen in the retailing sub-sector. The old Batu Kawa Bazaar has 61 shops, 38 nearby the Bridge, and about 200 units of relatively new shop-houses at Sungai Moyan Junction and along the Pan Borneo Highway to Musi.

The quality of life of this suburban population has been generally improving. However, households in Batu Kawa have been facing numerous socioeconomic challenges such as relatively lower income, traffic jams, diminishing land ownerships, poorer logistics and basic amenities, and relatively lower family happiness, and the like.

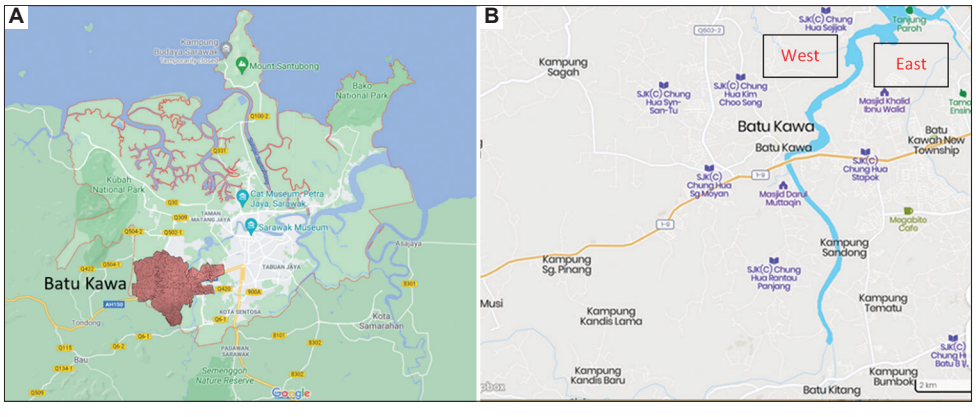

Figure 1. (A) Location of Batu Kawa in Sarawak. (B) Batu Kawa and the Sarawak River.
Note: In Figure 1b, the West bank of the Sarawak River refers to the old district (beyond the river and further away from Kuching City), whereas the East bank refers to the new district (nearer to the city).
Source: https://mapcarta.com/15816902 (Figure 1A), https://mapcarta.com/15816902 (Figure 1B).

Previous research has shown that households' adaptive attitudes, strategies, and initiatives are necessary factors in leveraging their quality of life (e.g., Dang *et al.*, 2020; Voon *et al.*, 2021). Hence, there is a need to understand socioeconomic service determinants that influence family happiness in this suburban for sustainability and also for other suburban communities and households to emulate for sustainable suburban development. The socioeconomic development for different parts of the suburban area (i.e., East bank and West bank, separated by the Sarawak River, see Figure 1B) needs to be understood and managed satisfactorily for sustainability.

At the household level, sustainable socioeconomic development is crucial for shared prosperity and family happiness, especially during disasters such as the COVID-19 pandemic (e.g., Sayyida *et al.*, 2021). Undoubtedly, many households are directly or indirectly emphasizing sustainability initiatives from a different perspective, especially in terms of environmental aspects. Nevertheless, more comprehensive understanding and implementation of sustainability (i.e., natural, economic, and social) are always lacking. A sustainable socioeconomic development ideally requires good geographical inclusion; urban, suburban, and rural. The rural development areas and B40 (Bottom 40%, lower income group) groups are commonly emphasized and helped (e.g., The 12th Malaysian Plan 2021–2025) and the suburban households may need to continuously self-help, adapt strategically, and work closely with the governments. What they do and how they do it are keys for understanding and develop sustainable socioeconomic services. The comprehensive social-economic and environmental service strategies for the different types of households with different cultural and economic backgrounds need to be well-understood and met accordingly for sustainability.

The socioeconomic development in suburban Batu Kawa depends very much on the consistent and continuous socioeconomic development services and financial allocations granted by the ruling state government, the federal government as well as support and involvement of the private sector, non-governmental organizations (NGOs), and local communities. Politically, the Batu Kawah Constituency N14, in the state government electorate, has experienced ups and downs in her socioeconomic development since the 1960s when Sarawak United People's Party (SUPP) was taking care of by the then rural Batu Kawa. The present representative for N14 is the Honorable Dato' Sri Dr. Sim Kui Hian, Deputy Premier of Sarawak, who is also the State Government's Minister of Public Health, Local Governments and Housing. Many tend to agree that this Batu Kawa suburb has been enjoying a rapid and dynamic socioeconomic development for the past few years. The "Better Batu Kawa" is promised, and many are optimistic about the future of Batu Kawa.

1.2. SDGs: Some issues for suburban

SDGs are blueprints emphasizing holistic and sustainable development of economic, social, and environmental aspects. The 2030 Agenda, drafted by the United Nation in 2013, contains 17 important SDGs, 169 targets, and 232 indicators (United Nations Statistics Division, 2017) aimed to transform the financial, economic, and political systems (Sustainable Goal Report, 2020) to alleviate poverty, ensure social participation as well as environmental protection (Aksoy & Arlı, 2020). The Sustainable Report 2020 argues that the effort to achieve sustainable goals is insufficient and uneven. For instance, the world has done better than before in reducing the number of children and youths out of school, reducing the incidence of many communicable diseases, improving the safely managed drinking water as well as women representation in leadership roles. However, the COVID-19 pandemic has disrupted the achievement of the SDG goals and even argued to turn back decades of progress (van Norren, 2020), particularly for the health-care system.

The more vulnerable groups, including older people, women, children, informal workers, persons with disabilities, indigenous people, migrants, and refugees, are at risk to be hit harder by the pandemic. People living in poverty who have already suffer from inadequate housing and limited access to basic infrastructures and services are becoming more vulnerable. One of the important issues is how the SDGs can address the ultimate aim of mankind to live a sustainable happy life (e.g., Aksoy & Arlı, 2020).

The SDG framework needs to be able to effectively address human-nature-well-being interrelationship (van Norren, 2020). The current SDG framework is criticized to represent individualism and is not biocentric enough to respect nature for nature's sake and to enable reciprocity with nature. The SDGs still focus on growth and the use of resources, and its framework also downplays the importance of private sector. There are other criticisms of SDGs such as the indicators chosen might influence the interpretation of its goals and limit its scope of and do not address structural causes of perpetuating poverty, power relations, and ecological inclusive development (Gupta & Vegelin, 2016).

Sørensen (2014) argued that life satisfaction was higher among rural dwellers than urban dwellers (in European Union [EU]). People living in the city tend to enjoy a higher sense of well-being in income, education, and occupational structure, and this is proven in a lower

economic development context (Berry & Okulicz-Kozaryn, 2009). The economic differentials tend to disappear when the economic development advances (Easterlin *et al.*, 2016). In other words, rural-urban differentials are remarkably consistent with regard to the level of economic development. In the study by Shucksmith *et al.* (2009), a higher subjective well-being was also found among rural dwellers in the richer countries, while lower subjective well-being was experienced among rural dwellers in the poorer countries of the EU. Sasaki (2018) found that the urban Japanese who recently move to rural area tend to report higher subjective well-being. Environmental conditions (e.g., friendly and trusted neighborhood) influence social well-being. It is hence clear that well-being and happiness for people living in urban or rural area could be different in the context of a developed versus developing nation. However, there is still little understanding at more micro-level such as a suburb within the rural or urban area. As suburb is defined in contrast to an inner city or downtown, the residents could be working either within or out of the suburb area. They are able to commute to their workplace daily. One example is the Batu Kawa suburb in Kuching Division (Sarawak). Before the Datuk Chong Kiun Kong Bridge was built, the residents staying after the river (West) experienced much inconvenience and the socioeconomic development was much slower.

2. Data and methods

A multiple-stage triangulation study, after obtaining the ethics approval from the researchers' funding university, was carried out to examine the residents' satisfaction of a sub-urban area (i.e., Batu Kawa) in Malaysia. Batu Kawa is a suburban area or district, administered under the Padawan Municipal Council in Kuching, Sarawak. In the first stage, personal and group interviews were carried out, aiming to identify the possible factors that contribute to residents' perceptions of happiness, challenges they faced while living in this suburban area as well as their recommendations to improve their happiness. The findings would be useful in developing the measurement items for a mass-scale quantitative questionnaire survey in the second stage of the study.

2.1. Phase 1: Qualitative (interviews and visits)

The qualitative phase of this research aimed to explore the dimensions of socioeconomic development services from the residents' perspectives. It involved two group interviews (in 2021) to explore the sustainable suburban socioeconomic satisfaction and family happiness. The interviewees were made up of 20 randomly selected representatives of the households who resided in the suburban. They were of different races (i.e., 12 Chinese, 4 Malays, 2 Ibans, and 2 Bidayuhs), age groups, and occupations. The interviews were conducted online through Google Meet and WhatsApp. The major questions used in the interviews were: Are you happy staying in Batu Kawa and why? What are the challenges or problems you are facing? Do you think you have a happy family and why do you say so? How can your family be happier? What can you do to make your family happier? The data collected from the qualitative interviews were content analyzed, and the socioeconomic service dimensions or items were identified. Besides, the researchers also went to the suburban areas to personally see, understand, and experience the socioeconomic development, and environment services rendered there. Several social economic aspects were identified: nature, education, cultural and social issues, health, security and safety, sport and recreation, transportation and logistics, infrastructure and amenities, economic, and sustainability.

2.2. Phase 2: Quantitative (questionnaire survey)

The inputs from literature review and qualitative research were used to design the research instrument for the quantitative research. The questionnaire was carefully designed. The respondents' demographic information socioeconomic service satisfaction and family happiness were obtained through online survey (i.e., Google Form) as well as through physical distribution and collection of printed questionnaires in the year 2022. The printed questionnaires were necessary especially for the less educated, the elderly, and IT-illiterate residents. A total of 283 usable questionnaires were analyzed. Among the characteristics of the respondents are: Females (50.7%); ages below 25 (12.6%), 26–35 (25%), 36–45 (16%), 46–55 (28%), and 56 and above (19%); Malays (24%), Chinese (41.7%), and Ibans and Bidayuhs (29.3%); occupations in public sector (24.2%), private sector (34.5%), self-employed (14.6%), unemployed, (17.8%), and student (9%). The data were randomly split into two samples (n_1 = 124, n_2 = 159) to gauge the reliability and consistency. The multi-item measures were found to be reliable (i.e., satisfactory internal consistency, Cronbach's alpha coefficient values more than 0.70 and item-to-total correlations more than 0.40). The results in Table 1 indicate that the residents are satisfied with the socioeconomic services provided in Batu Kawa. The numerous areas with relatively lower scores are road traffic, public transport system, safety and security, pollution, sport facilities, employment opportunities, income distribution, and digital economy development, as well as irrigation and drainage.

3. Key findings

The results in Table 1 indicate that the residents are satisfied with the socio-economic services provided in

Table 1. Socioeconomic development service dimensions and items (Batu Kawa, Sarawak)

Dimensions and items	n_1=124		n_2=159	
	Mean	SD	Mean	SD
Nature	**3.45**		**3.51**	
Natural environment	3.58	0.898	3.75	0.771
Natural resources	3.47	0.892	3.54	0.817
Natural beauty	3.57	0.899	3.62	0.833
Environmental-friendly development	3.46	1.014	3.41	0.880
Level of pollution (e.g., water, air, and sound)	3.16	1.071	3.24	0.944
Culture	**3.53**		**3.53**	
Historical conservation	3.34	0.900	3.42	0.905
Traditional knowledge documentation	3.35	0.882	3.39	0.956
Cultural diversification	3.77	0.883	3.68	0.896
Cultural conservation (e.g., dances, songs, and games)	3.45	0.894	3.51	0.982
Cultural promotion and development	3.48	0.886	3.41	0.911
Social harmony (e.g., people relations, and neighborhood)	3.80	0.813	3.77	0.846
Education	**3.65**		**3.63**	
Pre-school education facilities and development	3.80	0.868	3.71	0.859
Primary school education facilities and development	3.80	0.819	3.73	0.760
Secondary school education facilities and development	3.64	0.888	3.69	0.803
Higher education facilities and development	3.35	1.032	3.39	1.024
Health	**3.81**		**3.75**	
Number of health facilities (e.g., hospitals, clinics)	3.83	0.884	3.85	0.838
Quality of health facilities	3.79	0.880	3.77	0.888
Quality of health services	3.82	0.878	3.82	0.789
Cost of health services	3.80	0.799	3.57	0.877
Safety and security	**3.33**		**3.34**	
Safety (e.g., protection from accidents and mishaps)	3.36	1.005	3.40	0.942
Security (e.g., protection from deliberate threats or harms)	3.32	0.990	3.30	0.905
Feel safe at night	3.31	1.076	3.31	0.982
Sports and recreation	**3.21**		**3.36**	
Sports facilities	3.16	1.021	3.33	1.022
Recreational facilities	3.21	1.038	3.41	0.989
Sports activities	3.20	1.018	3.30	0.973
Recreational activities	3.25	1.025	3.38	0.940
Transportation and logistics	**3.05**		**3.13**	
Overall transportation service	3.18	1.025	3.30	0.997
Public transport system	2.94	1.089	3.08	1.076
Road traffic	2.75	1.121	2.86	1.161
Movement of goods and services	3.33	0.901	3.30	0.946
Infrastructural and amenities	**3.51**		**3.59**	
Overall infrastructural development	3.57	0.855	3.57	0.913
Variety of commercial premises (e.g., shops and markets)	3.86	0.767	3.96	0.809
Irrigation and drainage	3.21	1.040	3.15	1.008
Housing development	3.42	0.892	3.63	0.770
Waste management	3.26	1.004	3.35	0.965
Quality of water	3.63	0.886	3.59	0.889
Electric supply	3.81	0.778	3.89	0.745
Internet connectivity	3.34	1.021	3.56	0.987
Economic	**3.28**		**3.43**	
Overall economic development	3.60	0.740	3.65	0.722
Economic structure (type of economic sectors)	3.50	0.769	3.63	0.785
Cost of living	3.20	0.907	3.39	0.888
Employment opportunities	3.09	0.965	3.34	0.955
Income distribution	3.16	0.883	3.26	0.918
Digital economy development	3.14	0.857	3.32	0.985

(Cont'd..)

Table 1. (*Continued*)

Dimensions and items	n_1=124		n_2=159	
	Mean	SD	Mean	SD
Sustainability	**3.40**		**3.41**	
Quality of living	3.59	0.863	3.65	0.853
Social inclusion (inclusive development)	3.50	0.848	3.54	0.834
Green initiatives and practices	3.40	0.909	3.28	0.977
Risk and disaster management (e.g., flood and fire)	3.31	1.065	3.28	0.937
Sustainable development (nature, economic, and social)	3.34	0.900	3.43	0.825
Corruption and ethics	3.22	0.970	3.26	0.911
Socioeconomic service satisfaction index (1–5)	**3.40**		**3.48**	

Note: The bold values indicate the means for the dimensions and overall.

Batu Kawa. The numerous areas with relatively lower scores are road traffic, public transport system, safety and security, pollution, sport facilities, employment opportunities, income distribution, and digital economy development, as well as irrigation and drainages. Table 1 further shows that there were 10 dimensions of sustainable socioeconomic development services collected from the questionnaire survey of suburban Batu Kawa, Kuching City. The list of 50 items for socioeconomic development services was compiled from the qualitative research phase. These items were found to be reliable (item-to-total correlations of more than 0.50). The internal consistency for all the items was satisfactory. Besides, the dimensions of these items were having Cronbach's alpha values of more than 0.70. The split-samples (n = 124, n = 159) showed consistent results. The areas of concern (items with relatively lower mean values) for socioeconomic development service improvement are mainly the transport system, economics, safety and security, pollution, and sport facilities.

Gap analysis (the mean difference between importance and performance [I-P]) was performed to compare the gaps between the I-P of the 10 dimensions under study, namely, nature, culture, education, health, safety and security, sports and recreation, transport and logistics, infrastructure and amenities, economics, and sustainability (Table 2). The gaps addressed the difference between Batu Kawa residents' expectations and the perceptions of these dimensions.

The I-P gap analysis and mean scores comparison presented several interesting findings. First, all I-P gaps were found significantly different for all the 10 dimensions tested. In other words, the expectations of all the 10 dimensions were found to be significantly higher than their performance perceptions, highlighting the importance to address these 10 dimensions in the effort to improve the satisfaction level among Batu Kawa residents. The largest I-P gaps were found in the aspect of "safety and security," followed by "transport and logistics," "sports and recreation," and "economy."

Gur *et al.* (2020) examined the effect of housing and neighborhood satisfaction among Turkish people and argued that safety and location were critical factors influencing happiness perceptions. Communities that provide security, wealth, and common values tend to have higher happiness perception (Gür *et al.*, 2020). In the case of Batu Kawa, the local residents were found to be not very satisfied with their safety and security aspects (e.g., flooding issue and road safety).

In the context of "transport and logistics," the review of the past literature shows that travel and transport policy affect the perceptions of happiness (Choi *et al.*, 2013; Gim, 2020; Motoi & Yamaguchi, 2022). For instance, effective management of commuting time is an efficient method to improve happiness perceptions. A study found that the happiness levels among mainland Chinese were closely related to the time people spent on commuting (Yin *et al.*, 2019). Lower satisfaction is experienced when people have to endure longer commuting time. Nevertheless, higher endurance was found among people living in urban area and sensitivity toward commuting time increased among people in undeveloped area. People are more satisfied when they drive to work in this area where traffic congestion is not severe. Yin *et al.* (2019) also highlighted the importance of improving transportation and transit supply in improving satisfaction, particularly for cities with higher urbanization rates. The perceived transportation service is important, particularly the pedestrian environment. In the case of Batu Kawa, the local residents are expecting better public transport system and smoother road traffic flows.

The mean scores comparison for all the ten dimensions indicate dimensions such as "education" and "healthcare facilities" to have consistently highest mean scores in both I-P aspects. In other words, these dimensions are viewed as important in contributing to the evaluation of happiness and at the same time, residents of Batu Kawa are quite happy with the performance of "education" and "health-care" facilities. The finding of the present study

Table 2. Socioeconomic development service gaps (Batu Kawa, Sarawak)

Dimensions	Performance (1-5)				Importance (1-5)				Gaps	Gaps
	n_1=124		n_2=159		n_1=124		n_2=159		n_1	n_2
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.		
Nature	3.64	0.824	3.59	0.870	4.10	0.866	3.98	0.833	0.46*	0.39*
Culture	3.65	0.763	3.59	0.870	4.04	0.850	3.92	0.821	0.39*	0.33*
Education	3.74	0.791	3.69	0.767	4.25	0.849	4.11	0.896	0.51*	0.42*
Health	3.64	0.837	3.64	0.847	4.25	0.839	**4.17**	0.883	0.61*	0.53*
Safety and security	**3.32**	0.985	3.39	0.992	**4.27**	0.894	4.09	0.970	**0.95***	**0.70***
Sports and recreation	3.40	0.927	3.31	0.933	4.02	0.926	3.93	0.882	0.62*	0.62*
Transport and logistics	**3.33**	0.916	**3.29**	0.963	4.14	0.820	3.94	0.926	**0.81***	0.65*
Infrastructure and amenities	3.48	0.869	3.47	0.874	4.21	0.826	3.94	0.986	**0.73***	0.47*
Economy	3.51	0.914	3.52	0.805	**4.27**	0.816	3.97	0.947	**0.76***	0.45*
Sustainability	3.55	0.894	3.55	0.851	4.23	0.854	4.00	0.971	0.68*	0.45*

Note: Performance: 1=Very poor, 2=Poor, 3=Moderate, 4=Good, 5=Excellent; Importance: 1=Very unimportant, 2=Unimportant, 3=Neutral, 4=Important, 5=Very important; The gap is the mean difference between importance and performance (i.e., importance – performance); *All the gaps are significant at 5% level of significance. The bold values indicate the relatively wider gaps.

Table 3. Significance of the gaps and difference between two regions (by river), Malaysia, 2021

Dimensions	n_1=124		n_2=159		Before the river	After the river	t	Sig.
	Gaps	t	Gaps	t				
Nature	0.46*	6.470	0.39*	5.259	3.50	3.45	0.524	0.600
Culture	0.39*	5.651	0.33*	4.036	3.56	3.46	1.116	0.266
Education	0.51*	6.395	0.42*	5.291	3.70*	3.49	2.037	0.043
Health	0.61*	7.912	0.53*	6.718	3.89*	3.50	4.014	0.000
Safety and security	0.95*	8.897	0.70*	7.498	3.36	3.28	0.706	0.480
Sports and recreation	0.62*	6.748	0.62*	6.906	3.33	3.19	1.194	0.234
Transport and logistics	0.81*	7.848	0.65*	6.767	3.12	3.04	0.744	0.457
Infrastructure and amenities	0.73*	8.155	0.47*	5.333	3.65*	3.33	3.549	0.000
Economy	0.76*	8.814	0.45*	5.885	3.44*	3.19	2.736	0.007
Sustainability	0.68*	7.951	0.45*	5.877	3.44	3.30	1.438	0.152
Overall					3.48**	3.33	1.851	0.065

Note: *Significant at 5%; **Significant at 10%. The bold values indicate the relatively wider gaps.

is consistent with a study by Dang *et al.* (2020)'s that education and health-care facilities are critical factors influencing residents' life satisfaction and happiness perceptions. Nevertheless, the quality of education and facilities should be continuously emphasized. "Culture" is also important, rated as the second highest in its performance score.

Further investigation was done to understand the experience and expectations of the suburban population. The mean analysis was done between the residents staying before the river and after the river (if coming from the Kuching City). The residents staying before the river, nearer to the Kuching City, are generally more satisfied (significant at 10%) with the socioeconomic development service provided (Table 3). The differences are significant (level of significance of 5%) for "education," "health," "infrastructure, and basic amenities" as well as "economy" dimensions. The Sarawak River which divides Batu Kawa into two geographical parts, especially before the Datuk Chong Kiun Kong Bridge was built in the early 1990s, causes much inconvenience in logistical and human capital mobility hence the difference in socioeconomic development and the related service provision.

The suburban socioeconomic development ideally should be comprehensive and the geographical distribution

and mobility of the residents as well as their daily socioeconomic activities need to be well-understood for more effective and efficient socioeconomic development service provision and improvement purposes.

4. Concluding remarks

This empirical research employed both qualitative and quantitative techniques to achieve the intended research objectives. The socioeconomic development services for the suburban population were explored in the qualitative phase of the study and the dimensions identified for sustainable development were nature, education, cultural and social, health, security and safety, sport and recreation, transportation and logistics, infrastructure and amenities, economics, and sustainability. The suburban residents have undergone numerous socioeconomic challenges, such as relatively lower income, poorer access to quality health and education services, diminishing land ownerships, poorer logistics and basic amenities, relatively lower family happiness, and the like. The quality of life of this suburban population has been better and the possibility of sustaining it could be empirically examined and enhanced. Hence, it is recommended that the various socioeconomic service determinants of family happiness in this suburban area need to be consistently and continuously well-understood and monitored from time to time for sustainability. The sustainable socioeconomic development service is found to be multi-dimensional, and the interests of the suburban population need to be prioritized for better resident satisfaction and their happiness for consistently good quality of life. Nature, culture, education, health, safety and security, sports and recreation, transport and logistics, infrastructure and amenities, economy, and sustainability are the 10 dimensions found in this empirical research.

Acknowledgments

The research team would like to thank the Rector and Research Management Unit of Universiti Teknologi MARA Cawangan Sarawak for their kind supports and cooperation to make this research project a success.

Funding

This research is funded under the SDG Borneo Research Grant (Universiti Teknologi MARA). The reference number is 600-RMC/SDG-BORNEO 5/3 (011/2020).

Conflict of interest

The authors declare that there is no conflicts or competing interests with any institutes, organizations, or agencies that might influence the integrity of results or objective interpretation of their submitted works.

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Ethics approval and consent to participate

The research proposal and instrument (questionnaire) were approved by the Research Ethics Committee, Research Management Centre of Universiti Teknologi MARA.

Consent for publication

Not applicable.

Availability of data

Not applicable.

Further disclosure

Part of or the entire set of findings have been presented in conferences (*9th Asian Conference on Environment-Behaviour Studies,* Perdana Kota Bharu, Kelantan, Malaysia, July 28–29, 2021).

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REVIEW ARTICLE

Active aging and alternatives to age-based retirement

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(This article belongs to the *Special Issue: Active Ageing and Educational Gerontology*)

Abstract

For several decades, proposals have been made to redistribute social transfers (mainly pensions) and the time people spend on training and work (paid or otherwise) throughout the life course, in line with an analytical perspective that considers the life course as a whole, not just certain stages or transitions. One recent proposal, known as temporary leave (TL), would provide the opportunity to take temporary periods of voluntary paid exit from work over the life course, in exchange for a proportional delay in the age of retirement. This paper discusses the suitability of TL as a social policy for aging European societies.

Keywords: Caring; Life course; Lifelong learning; Retirement; Temporary leave; Work

1. Introduction

In recent decades, the change in demographic aging and life expectancy patterns, the blurring of boundaries between the life-course stages (education/training, work, and retirement), and the acceptance of egalitarian ideologies in today's European societies have all prompted the defense and development of proposals for redistributing the time spent in paid work throughout the adult life course (Eurofound, 2012, 2016). From a sociological perspective of aging, and bearing in mind the risk of social exclusion that can arise when a paid worker finally retires on the grounds of age, Guillemard (1992) argued that the retirement pension, the transfer designed to cover non-working time, should not necessarily be accumulated at the end of people's lives, but could be redistributed in different stages of the life course. The idea was first put forward by Riley (1979) in more general social and gerontological terms, as she proposed abolishing periods for education, work, and leisure differentiated on the grounds of age to give people the opportunity to combine the three aspects throughout the entire life course. However, these ideas have never been developed in specific or practical ways.

The life-course perspective, fundamental to this study, recognizes the centrality of work and the role of institutions in the definition of an age-based life course, which has led to a three-way division of life into the stages of education, work, and retirement (Henretta, 2003; Settersten, 2006; Guillemard, 2009), and the inherent inertia of these institutions has led to a structural lag which continues to the present day (Moen, 2016).

This paper aims to argue that new life-course policies are needed to replace age-based retirement, and it is structured as follows. Three sets of reasons why the traditional

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Citation: Alfageme, A. (2023). Active aging and alternatives to age-based retirement. *International Journal of Population Studies*, 9(2): 84-90.
https://doi.org/10.36922/ijps.482

Received: May 2, 2023

Accepted: July 5, 2022

Published Online: July 21, 2023

structure of the life course can be considered outdated are first discussed in this paper: it is ageist, androcentric, and does not facilitate lifelong learning. Last but not least, the suitability of temporary leave (TL) from work throughout the life course as an alternative to age-based retirement is discussed for illustrative purposes.

2. Retirement, ageism, and active aging

Ideally, retirement would coincide with old age or being older. However, the differentiation of this life stage is contentious. A fixed retirement age cannot be justified because it will always be an ageist simplification of reality. A recent systematic review of empirical research concluded that ageism is manifested in multiple aspects of life, such as in the hiring process, employability, and performance evaluation of older workers (Cebola *et al.*, 2021).

At this point, it seems pertinent to dismantle some of what are probably the most deeply rooted prejudices about older people's capacity and willingness to work. Working until an advanced age helps most people to maintain their levels of general well-being. This should come as no surprise to those who, without going into the retirement debate, advocate "active" aging. This concept needs to be properly understood since it involves creating a wider range of opportunities and facilities that do not exclude people who find themselves in situations of severe fragility or dependency (Walker, 2002; Walker & Maltby, 2012; Boudiny, 2013) and who, therefore, are quite understandably retired, or in the same way, those who are entitled to retire and simply prefer to do so and claim their pension.

On the other hand, the fact that retirement is perceived as a chosen option, as opposed to an obligatory course of action, has a profound influence on people's levels of psychological satisfaction (Radó & Boissonneault, 2020). Issues of gender also arise here, since this perception seems to have a greater effect on men than on women (Nordenmark & Stattin, 2009). However, the relationship between health and retirement is complex and bidirectional, and research in the field is inconclusive (Oksanen & Virtanen, 2012; Silver *et al.*, 2020). The research on older workers suggests that the relationships between attitudes and practices are complex, and identifies the need for employment policies that do not discriminate against older people, and that take account of individual capabilities and not age-based stereotypes (Brooke & Taylor, 2005; Loretto & White, 2006). One good example is the Age Barriers Project, involving various European countries, which showed that good practice is possible in the form of, for example, lifelong training and education policies (Walker, 2002). More recent studies also conclude that providing training to older workers is a fruitful human resource strategy for employers to stimulate job satisfaction among their older employees and facilitate longer working lives (Visser *et al.*, 2020). In this vein, several studies have concluded that if there is a real will to enable older people to continue working, real opportunities must be provided and more flexible work and retirement regulations and better working conditions must be agreed on (Hofäcker, 2015; Virtanen *et al.*, 2021; Sacco *et al.*, 2021; Böckerman & Ilmakunnas, 2020).

The more radical and perhaps clearer statement regarding the logical extension of anti-ageism policies would be, according to Walker (2002), "… the abolition of mandatory retirement ages (because age barrier retirement is age-discriminatory, and uniform pension ages make no sense in an era of diversity) and to have, instead, minimum pension ages. […] (a flexible decade of retirement is one possible model)." Walker also advocates a society for all ages through an active aging strategy focused on the life course as a whole.

3. The traditional androcentric structure of the life course

It must be taken into account that the traditional three-stage life course (education, work, and retirement) depends on the centrality of paid work, which, in turn, is based on the sexual division of labor in the broadest sense (paid or otherwise), instituted since the industrialization of societies. This sexual division of labor entails different basic life-course structures for men and women, which is therefore both ageist and sexist (Figure 1).

From both the material and symbolic points of view, the social organization of time and labor undervalues unpaid work, despite it being just as essential as paid work, and those who perform it, most of whom are women (Carrasco *et al.*, 2011). The proven relevance of gender and family circumstances in any analysis of relationships between retirement processes and psychological welfare (Kim & Moen, 2002; Coursolle *et al.*, 2010) is highly illustrative. Gender issues influence retirement processes, although the relationship is complex due to the way they interact with questions of social class, for instance (Radl, 2013). To understand this properly, it is important not to consider the transition to retirement exclusively in terms of typically male career paths (Loretto & Vickerstaff, 2015). For several years, now, there has been evidence of notable differences between women's and men's attitudes to employment and

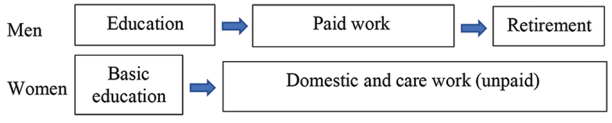

Figure 1. The basic structure of the traditional life course

retirement, differences that, in turn, are relevant when designing employment and pension policies (Ginn & Arber, 1996). In this line, according to one study, men's quality of life at advanced ages is more closely related to a previous regular employment path and late retirement, whereas, in the case of women, it is linked to more diverse employment and domestic work experiences (Wahrendorf, 2014).

The life course perspective is grounded on theoretical bases that usually address both gender policies and aging policies, a relatively infrequent concurrence. Indeed, the gender literature does not generally have in-depth knowledge of studies on aging, nor does it question, for example, the institution of retirement. Similarly, aging studies do not usually examine gender questions in previous life stages.

4. The growing need for lifelong education

In addition to caring for other people, education is another area of activity that is just as essential as paid employment; for them to be carried out effectively and in an egalitarian way, new policies are necessary, preferably designed from the life-course perspective. The need for such policies is better understood and justified if both these spheres of activity are taken into consideration.

As regards the field of education, there is no doubt that the level of formal education achieved in the early stages of life is decisive in most cases and has far-reaching implications for personal and social development opportunities, particularly in the labor market. Indeed, it is highly recommended that lifelong learning research takes into account inequalities in access to formal education among adults. As well as the extent of participation in education, the social profile of participants, and the inequalities generated in adult education are also of interest to academics and policymakers (Rubenson, 2018). The life-course perspective offers a realistic viewpoint that can guide egalitarian policies since it can be applied to identify individuals or groups disadvantaged for reasons related to the life stage in which their disadvantage arises (Crosnoe & Benner, 2016; McDaniel & Bernard, 2012). The individuals and families that most need an income from paid work are those who in practice have fewer opportunities to access formal learning throughout the life course; this, in turn, can be understood as part of the well-known tendency to accumulate advantages and disadvantages over the life course (Dannefer, 2018; Mortimer & Moen, 2016). In the area of education and training, this tendency has been documented in, for example, the United Kingdom (Bukodi, 2017), Catalonia (Miret & Vono, 2015), or more generally, in comparative studies of various Organization for Economic Co-operation and Development countries (Blossfeld *et al.*, 2014; Lee & Desjardins, 2019). These studies lend support to the demand for equality policies that ensure greater access to education and training for adults (in terms of resources, accessibility, and motivation) in more disadvantaged sectors of society (Kilpi-Jakonen *et al.*, 2015).

The complexity of adult lifelong learning participation is painstakingly examined by Boeren (2017), who points out the need to distinguish between the micro level (differences between adults), the meso level (education and training providers), and the macro level (country variation), with the understanding that these three levels are interrelated and that each one operates as a necessary, but insufficient, condition for adult participation in education. For example, the measures implemented by universities (such as distance education programs, access opportunities for adults, or university programs for older adults) are found at the meso level, whereas more general life-course policies, which affect the spheres of both education and care, correspond to the macro level.

The need for periods away from paid work to undertake other unpaid tasks has been recognized by the European Foundation for the Improvement of Living and Working Conditions (Eurofound), among others: in a context of structural change, in which the stages of education and retirement are becoming longer and the stages of paid work are shrinking, there is a growing recognition of the need to establish parallel periods of work and non-work, whether for family reasons, for training to prepare for a second or third career or other purposes; these changes, in turn, would involve prolonged employment activity at more advanced ages (Naegele *et al.*, 2003). In addition, and bearing in mind the current demographic trends, proposals have also been made to redistribute work throughout the life course, especially in later life; this would be feasible if part-time work was extended both before and after current official retirement ages and would also allow young adults to devote more time to conceiving and raising their children (Vaupel & Loichinger, 2006).

Based on these considerations, it seems clear that aging policies increasingly tend to merge with life-course policies. What Marshall (2001) said a few years ago still make sense today: "… there is a wealth of research knowledge – and also, increasingly, policy development – around issues such as education, the transition from education to initial employment, and problems of youth unemployment; and there is a large literature on retirement itself and on the transition from paid employment to full retirement. But rarely is it recognized that such age- or stage-specific phenomena are linked." At the same time, the gender perspective must be included in every case so

as to take into account situations and processes that are relevant, and often indispensable, for a better and broader understanding of social realities.

5. Temporary paid leave from work in exchange for delayed retirement (TL)

To illustrate new possibilities for developing policies focused on the life course as a whole, a more recent and concrete proposal (TL), that is also consistent with the idea of active aging, is brought up in this study. It consists of giving people the option to take temporary periods of voluntary paid exit from work throughout the life course, in exchange for a proportional delay in the age of retirement, once the person has worked for a certain number of years to accumulate social security contributions (8 – 10 years in paid work, for example, would entitle the worker to a maximum of 2 or 3 years of paid temporary exit). Rather than a "cut," this should be regarded as an alternative to early retirement, or to retirement when the person still enjoys good health and is capable of living a full life (Alfageme *et al.*, 2019). The more flexible and egalitarian character of this proposal would lead to a new life-course structure (Figure 2), in contrast to the traditional structure (Figure 1).

The disability-free life expectancy in most European countries is approximately 70 – 75 years of age (see website *EurOhex. Advanced research on European health expectancies*: http://www.ehemu.eu/). During this stage between retirement and old age, also known as the midcourse stage (Moen, 2006), most people are able to lead an active life in every sense including doing paid work. It seems very reasonable to anticipate working up to the age of 70 – 75 years old given the general state of health and capabilities of most European citizens around those ages.

Individual choices are conditioned by organizational culture and policies (Bobbitt-Zeher, 2011). In this vein, TL differs substantially from other social policy advances in the European Union aimed to improve work-life balance, such as paid maternity leave or benefits for families or carers. These policies provide direct recompense for the work they entail (caring for dependent people, mainly children), whereas TL is conceived as an employment right (symbolically still more closely associated with men), which, thus, facilitates more equal access to work and recognizes the existence of another, equally necessary, and type of work (unpaid domestic and care work).

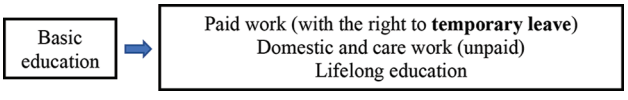

Figure 2. The basic structure of the emerging life course

The TL alternative can be defended as a social policy that focuses on the life course and that is appropriate for our times, on the one hand, because it accommodates the need for lifelong learning (Alfageme, 2014) and on the other, because it confers equal status on the need to do unpaid work, such as domestic or caring tasks, throughout the entire life course (García-Pastor & Viñado, 2013). In summary, TL would give those who have to work to survive (the vast majority of people) more freedom to organize essential aspects of their lives. In this vein, the idea of temporary exit as a partial or total alternative to retirement has been argued on philosophical and sociological grounds (Seguí-Cosme & Alfageme, 2008; Alfageme, 2009) and has been defended as a suitable alternative to tackle the processes of ageism and sexism (Alfageme *et al.*, 2012).

More recently, the TL proposal was evaluated using a variation of the Delphi method, involving a group of Spanish experts from the general social sciences and the sociology of aging in particular (Alfageme *et al.*, 2014). The most widespread opinion among these experts was that entitlement to periods of paid temporary exit from work throughout the life course would be especially justified for caring or training activities – as long as it was voluntarily – and that it should have a moderate effect on retirement. This latter point is particularly pertinent, given that a more radical TL proposal has been mooted based on three points: abolition of retirement, setting temporary exit periods corresponding to periods of paid work (2 or 3 years for every ten worked, for example) throughout the life course, and careful regulation taking into account permanent disability allowances (Alfageme *et al.*, 2012). This proposal, however, appears to be unfeasible due to the deep-rooted cultural and institutional hold that retirement has, even among experts in the sociology of aging who are undoubtedly aware of the arbitrariness of the retirement age and the risk of social exclusion brought on by forced retirement from paid work (Alfageme *et al.*, 2014). For this reason, it could be appropriate to consider a more moderate proposal of, for example, an approximate period of 5 years of temporary exit from work to be taken throughout the years of active employment, with a corresponding delay in retirement.

6. Conclusion

By way of conclusion, it is affirmed that the proposal for TL in exchange for delaying retirement can be considered interesting not so much for what it solves, but for what it opens up. Research should provide the basis for other alternatives or variations that will depend on the characteristics or peculiarities of different societies and welfare state models.

In short, the demise of the traditional three-stage life course (education, work, and retirement) is firmly advocated, and the need for new and truly transformative policies that must be able to challenge the problems of ageism and sexism is defended.

Acknowledgments

None.

Funding

None.

Conflict of interest

The author declares no conflicts of interest.

Author contributions

This is a single-authored paper.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Not applicable.

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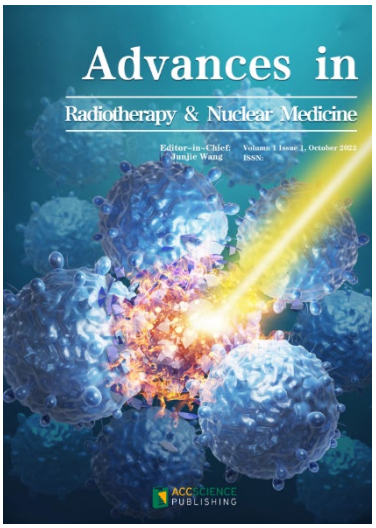

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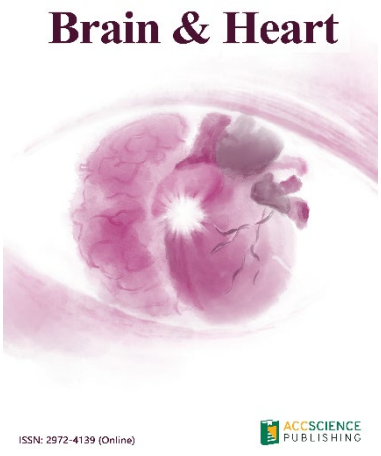

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