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Social Determinants of Health Inequalities—A Global Perspective Study

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Abstract

Health inequalities persist among all countries in the world. These health inequalities are usually explained by health behaviors and social conditions in which people work and live. This paper aims to investigate the relative contribution of the social determinants to health inequalities in low-income, middle-income and high-income countries. Data from these three groups of countries was obtained from the UN and World Bank platforms. The VARSEL combinatorial technique was used to measure health inequalities through its proxy variable life expectancy at birth and the contribution of social determinants across the three groups of countries. The magnitude of the impact of social determinants on health inequalities varied considerably between countries. While poverty issues and unemployment were found to contribute to the explanation of life expectancy inequalities in low-income countries, educational and unemployment determinants emerged as the leading causes of life expectancy inequalities across middle-income countries and immigration together with the working conditions were mostly contributing determinants for high-income countries. The observed effects of different social determinants on health inequalities across the world point out that tackling health inequality should be a task that goes beyond focusing on a single social determinant.

Keywords: health, health inequalities, social determinants, VARSEL combinatorial approach

1. Introduction

Long-lasting health inequalities present a challenge for researchers and policy agendas. The field of health inequalities looks at a wide range of social and health issues (Kelly-Irving et al., 2022). The observed disparities in a wide range of health measures, arising from social and economic characteristics, are therefore an obvious reminder of the unequal nature of the societies (Kelly-Irving et al., 2022); making the social justice debate a primary issue within public health (Holguín-Zuluaga, et al., 2022). Reducing health inequalities is also seen as a social justice issue and a means of opening up other opportunities, especially for the most disadvantaged (Epstein et al., 2009). A lot of research is conducted and it is documented the various ways in which social, economic, political, and cultural circumstances influence health (Kontodimopoulos, 2022). Thus, the resulting evidence emphasized the need for political action and interventions around the world. Very often, public health researchers use social determinants of health to study numerous health-related inequalities (Gunamany, 2022). Different governments, with different capacities, enacted

policies and reforms to address health inequality and its social determinants. Despite substantial attention to socioeconomic health inequalities, striking health disparities still exist within and between nations today (Omotoso & Koch, 2018). It is considered that the action on the social determinants of health is imperative not only to improve health but such improvement point out that society has proceeded in a direction of satisfying human needs (Marmot, 2005).

Health inequalities can be defined as differences in health status between individuals or groups, as measured, for instance, by life expectancy, mortality or disease that result from avoidable social, economic and environmental differences (ICF, 2017). Therefore, health inequalities must be seen as patterns in health outcomes that emerge from other patterns of the human condition and lie within this social environment (Jayasinghe, 2015). Further, health inequalities are defined by Kondo (2022) as "gaps in health status between the groups, which are created by differences in the community or socioeconomic status". Kondo (2022) points out that the social researchers in epidemiology put forward as hypothesis that societies with less inequality have relatively substantial levels of social cohesion compared to those with greater inequality and that people living in fairer societies with abundant social cohesion have better health status. The process of producing health inequalities is a complex pathway (Kondo, 2022) and it is affected firstly by the municipal/community settings. The municipal/community context includes urban and rural areas, population density, and the range of social cohesion or income inequalities. Thus, for those in unfavorable circumstances, external resources such as social support, which also affects health care, and the ability to survive, as an internal resource, become scanty. This situation can cause stress reactions, such as depression, and lead to unhealthy behavior and an unhealthy physical state or cognitive decline resulting from the biological effect of stress.

The main aim of this paper is to examine the relationship between social determinants of health inequality and health outcomes using the proxy indicator: life expectancy at birth. Therefore, the study is at the level of macro factors and does not allow the analysis of individual dynamics. Thus, this study provides a rigorous comparison of the predictive reliability of health inequalities with data for low-, middle-, and high-income countries. Hence, the research study provides an opportunity to comparatively investigate the contribution of social determinants in explaining health inequalities around the world. This contributes to debates about health inequality and the variation of social determinants more generally across the globe. The paper is organized as follows. Section 2 provides a theoretical basis for the social determinants of health and health inequalities. In Section 3, the relevant literature is reviewed. In Section 4, the data and method used, as well as relevant measures of social determinants of health, are presented. While Section 5 offers a description of the results with some interpretive hints. Section 6 provides a discussion of the main findings. Section 7 concludes the paper.

2. Theoretical Background

In the latest decades, social determinants of health received substantial attention as a core concept in the field of population and public health (Islam, 2019). The social determinants of health are defined as the conditions or circumstances in which people are born, grow, live, work, and age (Islam, 2019). These conditions are shaped by political, social, and economic factors. Accordingly, the main concept of social determinants of health refers to both the determinants of health and the determinants of health inequalities (Islam 2019). Social determinants of health are all those conditions, occurrences, characteristics or other known structures that directly or indirectly affect the life course, the health of individuals, inequalities and inequities in health (Holguín-Zuluaga, et al., 2022). More recent literature employs the term social determinants of health inequalities to be an indication of contexts, social structures, social norms, and their determinants (Jayasinghe, 2015). Widely speaking, social determinants of health contribute to understanding the causes of problems by recognizing them in the context of different political, social, economic, and cultural conditions. Social determinants are considered key drivers of health (Flavel et al. 2022). Social determinants of health inequalities have context, structural mechanisms and socio-economic positions of individuals (Jayasinghe, 2015). Context includes social systems (education system, labor market), culture (racism and social classes) and political systems (state structure, redistributive policies). Context should be seen as a dynamic concept, with a historical past, present and future pathway. Structural mechanisms are rooted in the institutions and processes in the

context that generate stratifications in society according to socioeconomic position, income or wealth, educational attainment and access, occupation, gender, race/ethnicity, and other dimensions. Accordingly, context, structural components and the resulting socio-economic position of individuals are specified as social determinants of health inequalities (ICF, 2017). In the following, some of the mainstream theories relevant to the study of social determinants of health and health inequalities are briefly explained.

The basic idea of the *political economy of health* is that a "society's separation of health and diseases—including its social inequalities in health—is produced by the structure, the values and priorities of its political and economic systems" (Gunamany, 2022, p. 205). According to this theory, health, race, gender, and class stratification are directly impacted by the structures of society. This means that the existing political and economic systems, priorities, policies and programs should be engaged for the analysis of the change in population distribution and health inequalities and diseases. This theory points out that the political and economic systems control the functioning of within and across regions and countries, as well as the institutions and individuals who are in charge of them.

The *eco-social theory of disease distribution* attempts to explain the distribution of disease including nearly all aspects of the disease by asserting that people manifest, biologically, their lived experience in a society and environmental context, thus creating population patterns of health and disease (Gunamany, 2022). This theory also posits that the epidemiological profiles of societies are shaped by the ways of living planned by their current and changing social arrangements of power, property, and the production and reproduction of both social and biological life, which includes humans, other species, and the biophysical world in which we live.

An *economic model* based on the relationship between income and health was developed, where the effect on the health of a given change in income (or percentage change in income) may not be the same for all social groups. This model generally shows the conditions under which policies directed at improving health behavior, proportional income growth, or income redistribution can affect population health and income-related inequalities in health (Epstein et al., 2009). This model also provides a conceptual framework underpinning some empirical studies looking at income-related inequalities in health. Thus, for each individual in a population, (eq.1), health H_j is influenced by the income l_j and by other factors E_j (Epstein et al., 2009).

$$H_j = (l_j, E_j) \quad j = \text{members of the population A, B.} \tag{1}$$

Thus, these other factors can be intermediate determinants of health, for instance, showing lifestyle. Person A may respond to changes in income with healthy lifestyle changes, while person B may adopt some elements of a less healthy lifestyle given the same change in income. Of course, lifestyle is not the only intermediate determinant of health, other factors may be work situations, housing, social networks and social support, access to education and leisure activities, etc., which are more or less influenced by income. This economic model does not include factors such as genetics that impact health but are not related to income. Furthermore, *Microeconomic theory* (Epstein et al., 2009) argues that personal decisions about health behavior may lead to inadequate levels of prevention, from a societal perspective, if, among other reasons: there is inadequate information for citizens; there are external factors (e.g. passive smoking, alcohol abuse linked to crime); there are artificially low prices for unhealthy products or individuals are liable to irrational behavior or poor self-control. From an economic perspective, policies that limit personal autonomy need to weigh these welfare losses against public health and other interests.

3. Literature Review

From the perspective of social determinants of health, inequalities in money, power and resources are dominant contributors to inequalities in health, disease as well as mortality (Kontodimopoulos, 2022). Some of the social determinants of health that are of great importance and influential in the literature are education, housing and/or environment, income and distribution of income, stress, early life, social exclusion, work, unemployment, social support, addiction, food and transportation (Islam, 2019). More recently in the literature, health systems, gender, sexual orientation, social safety net, culture or social norms, social capital, immigration, family and religion have also been identified as social determinants (Islam, 2019). As

stated by Chelak & Chakole (2023) examples of social determinants of health include occupation, job status, job security, income level, educational opportunities, job and workplace protection, inequality between men and women, and segregation based on ethnicity and race.

Research studies that provide causal confirmations based on systematic reviews of mostly observational studies (Kelly-Irving et al., 2022) are widely cited and contribute diverse evidence on causal relationships between socioeconomic factors and health outcomes. Since 2012–2014, improvements in life expectancy in many high-income countries, including England (previously known as an international leader in efforts to lessen health inequalities), have stopped, as a result of slow-moving improvements in the most disadvantaged groups (Kelly-Irving et al., 2022). The debate that social inequalities in health are not smaller in countries with more advanced welfare states (e.g. Scandinavian ones) originates from a 1997 paper that concluded that, despite strong commitments to egalitarian welfare policies, the Nordic countries had greater socioeconomic inequalities in health than other Western European countries (Kelly-Irving et al. 2022). One of the main issues in the reduction of the Nordic welfare model was the exclusion of new population groups — especially immigrants — from full welfare state support (Kelly-Irving et al., 2022). Migrants usually were entitled to benefits of a lower value compared to the social security benefits available to full citizens. This premise is important because, in studies of health inequalities, migrants are those usually situated in the lowest occupational and income groups. A recent review of the literature on migrant health and mortality found the opposite, interpreting this phenomenon of the 'healthy immigrant effect' in mortality as a result of the combination of the acculturation of host society beliefs, attitudes and behaviors with time spent in the host country (Ichou & Wallace, 2019). Studies established that a healthy immigrant effect operated in Canada as well; in general, immigrants are healthier than Canadian-born persons, but this effect tends to lessen over time (Gee et al., 2004).

Thus, given that life expectancy variation is a form of health inequality, many studies have shown that lower socioeconomic groups have the shortest life expectancy and the highest variation in age of death and that groups with longer life expectancy have the lowest life expectancy inequality (Gómez-Ugarte & García-Guerrero, 2023; Flavel et al., 2022; Quenel-Vallée & Jenkins, 2010; Balaj et al., 2017). Manual workers in the United States have been found to report poorer health than non-manual workers and their health declines faster. It was also found that, among British male civil servants aged 40 to 64, age-standardized mortality in the lowest classes (clerical and manual) was three times higher than in the highest class (administrative), (Quenel-Vallée & Jenkins, 2010). However, unemployment is emerging as a major cause of health disparities and rates of health deterioration, particularly mental health (e.g. Epstein et al., 2009). These authors show that workers who became unemployed were 2.9% less likely to report good health than the same workers who remained employed. It has also been found that the effects of employment change (e.g. privatization) are experienced differently by employees in different occupational categories and that the workplace may be an important setting in which to address health inequalities (Epstein et al., 2009). Europeans' unmet needs due to treatment costs are also over eight times more prevalent among people in the lowest income group than among people in the highest income group (ICF, 2017). Thus, the data showed that unmet health needs among unemployed EU citizens were consistently higher than unmet needs among employed EU citizens for the period 2008-2014.

In a sample of selected European countries, Pacáková & Jindrová (2019) used the following social determinants of health: poverty rate (relative threshold), living in working households, disposable income (US dollar at PPP rates); and unemployment rate (% of the labor force aged 15+). The results of the literature review revealed that participation in or exclusion from the labor market has an important impact on life chances, risks of poverty and well-being that can affect or determine people's health throughout life (ICF, 2017). The results of the literature review also indicated that low-paid and temporary employment was less likely to be accompanied by employment benefits, for instance, health insurance (ICF, 2017). In such a situation, it may require them to pay in advance for health services where employment-related insurance is required or universal health care is not offered. Income is specifically associated with different health outcomes in different

populations and surroundings. Income buys access to health care; buys food, housing and other necessities. Nevertheless, whether the relationship is causal and/or mutual, substantial evidence indicates that income predicts health and well-being (Brady et al., 2023). It is commonly accepted that societies with unequal income distribution have poorer health outcomes (Kontodimopoulos, 2022). Therefore, reducing the income inequality of disadvantaged people can improve the health of poor individuals, help reduce health inequalities and increase the average health of the population. Nevertheless, a significant body of literature criticizes studies that report a link between income inequality and health since they are unsuccessful in controlling for factors associated with the income distribution and health status (Kontodimopoulos, 2022). Thus, according to Marmot (2005), income provides an insufficient explanation for differences in mortality between countries or between subgroups within countries. Therefore, according to him, it is widely known that among high-income countries there is little association between gross national product (GNP) per capita and life expectancy.

4. Measures, Data, and Methods

Measuring and monitoring health inequality is vital to achieving health equity — a central devotion of the World Health Organization (WHO) and a major goal of the 2030 Agenda for Sustainable Development (WHO, 2024; UN, 2024; Schlotheuber & Hosseinpoor, 2022). Core health indicators represent a set of standard health indicators that are prioritized for global and national health monitoring (Schlotheuber & Hosseinpoor, 2022), for example; health facilities density; access to medicines, under-five mortality rate; and life expectancy. Each indicator has a defined unit of measurement (such as number, rate, proportion or percentage) and an optimal level to be achieved or maintained through public health actions (Schlotheuber & Hosseinpoor, 2022). The optimal level is clearly defined for the favorable indicators, that is, the goal is to achieve the maximum level, such as the highest possible life expectancy; while for adverse indicators, and the goal is to obtain a minimum level, such as a zero under-five mortality rate.

The packet of parameters in health outcomes may include life expectancy at birth, child vaccination rate at 5 years, infant mortality rate, maternal mortality rates, and the rate of malnutrition among children (Jayasinghe, 2015). All socioeconomic determinants combined or independently, affect the health status of the population evidenced by indicators of total mortality or life expectancy (Prędkiewicz et al., 2022). Therefore, population health can be assessed by measuring average mortality levels. For this reason, life expectancy is one of the most commonly used indicators (Gómez-Ugarte & García-Guerrero, 2023). Life expectancy inequality has received the most attention of all inequalities (Permanyer et al., 2023; Gómez-Ugarte & García-Guerrero, 2023). Longevity is a crude but very useful and easy-to-measure health outcome that is collected regularly around the world. While life expectancy has long attracted considerable attention in demography and other social sciences, there has recently been a surge of interest in looking beyond means and studying the levels, trends, and determinants of life expectancy inequality (Permanyer et al., 2023).

Data were gathered from the UN World Population Prospects database (https://population.un.org/wpp), (UN, 2022) and from World Bank's development indicators platform (https://data.worldbank.org/indicator), (World Bank, 2024), which represents the major collection of international statistics on global development. Therefore, the net migration rate data and life expectancy at birth data were retrieved from the UN source above, and the source for all other variables data is the World Bank. The data were analyzed for low-income (LICs), middle-income (MICs) and high-income countries (HICs) in the world. Figure 1 presents the trend of life expectancy at birth in LICs, MICs, and HICs during 1995-2021. Based on the literature review, the following research questions were formulated:

1) What is the relationship between social determinants and health inequalities? Which indicators of the social determinants affect health inequalities more profoundly?

2) What is the strength of this relationship around the world? Do the social determinants stimulate health positively or negatively?

The above questions have been verified by estimating VARSEL data models. Further, the list of explanatory variables considered for this study is the following: unemployment rate (% of labor force aged 15+); GNI per capita, Atlas method (current US$); net migration rate per 1 000 populations; vulnerable employment as % of

total employment, poverty headcount ratio at $2.15 a day (2017 PPP) (% of population)[1], and School enrollment, secondary (gross), gender parity index (GPI).

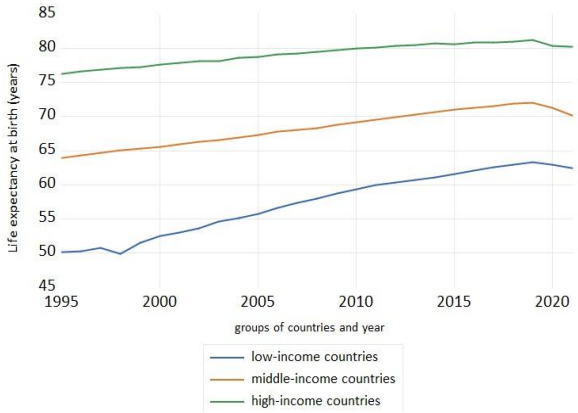

Figure 1. Life expectancy at birth in LICs, MICs, and HICs-1995-2021

Source: Author's design.

The recent boom in available data, combined with increased computing power, has led to increased acceptance of methods that allow the data itself to suggest the most appropriate combination of regressors to be used in estimation. Therefore, rather than specifying a specific model, these methods allow the researcher to provide a set of candidate variables for the model. VARSEL, i.e. Variable selection, or feature selection, is an important module of modern data analysis. Variable selection methods are implemented as a pre-estimation step before standard least squares regression is performed (IHS, 2022). Before estimation, a dependent variable must be specified along with a list of always included variables and a list of selection variables, from which the selection algorithm will choose the most appropriate one. After the variable selection process, the results of the final regression, i.e. the regression of the always included and selected variables on the dependent variable, will be reported. The *p*-values reported in the final regression output and all subsequent testing procedures do not take into account the regressions that were performed during the selection process.

There are several different methods of variable selection: Uni-directional, Stepwise, Swapwise, Combinatorial, Auto-Search/GETS and Lasso Selection. In our study, the combinatorial method was used. For a given number of added variables, the combinatorial method evaluates each possible combination of added variables and chooses the combination that leads to the largest R-squared in a regression using the added and always included variables as regressors (IHS, 2022). This method is more in-depth than the other methods, as the other methods do not compare every possible combination of variables and require additional computation. With a large number of potential added variables, the Combinatorial Approach can take a very long time to complete.

5. Results

This Section presents the estimated VARSEL models on life expectancy in LICs, MICs and HICs, separately. The analysis follows the models estimated with the combinatorial selection method with six added social variables to perform the combination that leads to the largest R-squared on the impact of life expectancy in an OLS regression. Three models contain yearly data between 1995 and 2021 on the life expectancy for LICs, MICs, and HICs, along with annual data for the six key social variables in the pre-estimation for the same groups of countries. As a result of the lack of data for the low-income countries, for this group of countries the period was little narrowed, i.e. 1995-2018. As a dependent proxy variable for health inequalities, the life expectancy at birth is used. There are a total of six search regressors: unemployment rate (UNEMPL); GNI per capita (GNI); net migration rate (NMR); vulnerable employment (VULNEREMPL); poverty ratio (POVERTY); and gender parity index (GPI). The three models also have an always-included constant. Table 1-3 presents the results of the combinatorial algorithm linking the percentage change in life expectancy to a range of search variables. The estimated coefficients and associated summary statistics of the combinatorial estimation together with the details of the selection process are shown in Table 1-3 separately for LICs, MICs, and HICs. The number of added variables was set to two variables; therefore, the combinatorial method selected the combination of two regressors that leads to the largest increase in R-squared in a regression for each group of the

[1] Due to the absence of the data for this indicator only for the middle-income countries during 1997-2001, an estimation of the value of this indicator for this period was made by the author.

countries. The statistical significance was set at $p<0.05$. Some of the variables were logarithmically transformed to achieve a normal distribution. Thus, the OLS assumptions of normality, autocorrelation and homoscedasticity were confirmed with the Jarque-Bera test and Breusch-Godfrey Serial Correlation LM test, as well as, with the Breusch-Pagan-Godfrey Heteroskedasticity test, respectively. A possible multicollinearity was examined with the VIF (variance inflation factor), which was less than the recommended threshold of 5, implying the absence of even modest collinearity.

The unemployment effect appears to have a significant impact on the changing rate of life expectancy, with a positive impact in the LICs model and with negative impact in the MICs model. Additionally, percentage changes in life expectancy are negatively linked with the rise of poverty in LICs and positively with the gender parity index in the MICs model. Therefore, for the group of LICs, poverty and unemployment were the most influential social determinants, i.e. predictors of life expectancy by contributing 97% explanatory power to the model (Table 1). The lag effect of the gender parity index as an educational variable is very effective in increasing life expectancy in MICs and together with the negative impact of unemployment accounting for 98% of the variability in life expectancy in the MICs model (Table 2). Additionally, it was found a positive influence of the net migration rate on the life expectancy in HICs. Further, it also revealed an inverse relationship between changes in life expectancy and vulnerable employment for the HICs. Thus, in the HICs model, net migration rate and vulnerable employment were the two significant predictors and explained 92 % of the variability of life expectancy (Table 3). Interestingly, the application of the combinatorial method showed that GNI per capita has no significant impact on changes in life expectancy in any of the groups of countries.

Table 1. Combinatorial estimation results on life expectancy in LICs (low-income countries):

Dependent variable: log (Life expectancy at birth)				
Method: Variable selection				
Sample: 1995-2018				
Included observations: 24				
Number of always included regressors: 1				
Number of search regressors: 6				
Selection method: Combinatorial				
Stopping criterion: Number of search regressors: 2				
Low-income countries model				
Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	5.6404	0.1798	31.375	0.0000
Log(Poverty ratio)	-0.5243	0.0209	-25.057	0.0000
Log(Unemployment)	0.2943	0.0944	3.1166	0.0052
Summary statistics				
R-squared	0.9696	Mean dependent var	4.0332	
Adjusted R-squared	0.9668	S.D.dependent var	0.0777	
S.E.of regression	0.0142	Akaike info criterion	-5.5585	
Sum squared resid	0.0042	Schwarc criterion	-5.4112	
Log likelihood	69.702	Hannan-Quinn criter	-5.5194	
F-statistic	335.47	Durbin-Watson stat	0.9868	
Prob(F-statistic)	0.0000			
Selection summary				

Number of selected regressors: 2
Number of combinations compared: 15

Note: *p*-values and subsequent tests do not account for variable selection. Source: Author's calculations.

Table 2. Combinatorial estimation results on life expectancy in MICs (middle-income countries)

Dependent variable: log (Life expectancy at birth)				
Method: Variable selection				
Sample: 1995-2021				
Included observations: 27				
Number of always included regressors: 1				
Number of search regressors: 6				
Selection method: Combinatorial				
Stopping criterion: Number of search regressors: 2				
Middle-income countries model				
Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	4.3765	0.0206	212.74	0.0000
Log(Gender parity index(-2))	0.6336	0.0202	31.301	0.0000
Unemployment(-1)	-0.0193	0.0033	-5.7924	0.0000
Summary statistics				
R-squared	0.9784	Mean dependent var	4.2229	
Adjusted R-squared	0.9766	S.D.dependent var	0.0378	
S.E.of regression	0.0058	Akaike info criterion	-7.3602	
Sum squared resid	0.0008	Schwarc criterion	-7.2162	
Log likelihood	102.36	Hannan-Quinn criter.	-7.3174	
F-statistic	542.76	Durbin-Watson stat	1.1924	
Prob(F-statistic)	0.0000			
Selection summary				
Number of selected regressors: 2				
Number of combinations compared: 15				

Note: *p*-values and subsequent tests do not account for variable selection. Source: Author's calculations.

Table 3. Combinatorial estimation results on life expectancy in HICs (high- income countries)

Dependent variable: log (Life expectancy at birth)
Method: Variable selection
Sample: 1995-2021
Included observations: 27
Number of always included regressors: 1
Number of search regressors: 6
Selection method: Combinatorial
Stopping criterion: Number of search regressors: 2

High-income countries model				
Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	4.7326	0.0211	224.21	0.0000
Log(Net migration rate)	0.0095	0.0028	3.3535	0.0026
Log(Vulnerable employment(-1))	-0.1570	0.0090	-17.491	0.0000
Summary statistics				
R-squared	0.9276	Mean dependent var	4.3713	
Adjusted R-squared	0.9215	S.D.dependent var	0.0193	
S.E.of regression	0.0054	Akaike info criterion	-7.4940	
Sum squared resid	0.0007	Schwarc criterion	-7.3500	
Log likelihood	104.17	Hannan-Quinn criter.	-7.4512	
F-statistic	153.64	Durbin-Watson stat	1.3888	
Prob(F-statistic)	0.0000			
Selection summary				
Number of selected regressors: 2				
Number of combinations compared: 15				

Note: *p*-values and subsequent tests do not account for variable selection. Source: Author's calculations.

6. Discussion

In this research study, regression models prior based on the combinatorial variable selection method determined the contribution of various social determinants on the health inequalities whereby life expectancy at birth was used as a proxy-dependent variable. The relationship between the proxy variable of population health, i.e. life expectancy and well-studied social determinants of health such as income, poverty, unemployment, education, employment and immigration are analyzed at the country income level. Each of the three groups of countries in the study was based on the income level according to the group categorization of the World Bank: low-income (LICs), middle-income (MICs) and high-income countries (HICs). According to most recent World Bank thresholds, countries are grouped by GNI per capita as: low-income if GNI/capita ≤ USD1025, middle-income if GNI/capita is between USD1026–$12375, and as high-income if GNI/capita ≥ USD12376 (World Bank, 2024). The results of this study are consistent with studies that used similar predictor variables and showed a strong relationship between social determinants and health outcomes (Islam, 2019; Epstein et al., 2009; Pacáková & Jindrová, 2019).

Moreover, the results showed a different relationship between social determinants and health at different country income levels. Specifically, it was found that the relationship of life expectancy with immigration and working conditions (e.g. vulnerable employment) is significantly stronger in the HICs. Thus, our HICs findings are in coalition with a UK study that found an association between the degree of employment, which also affects salary, and the prevalence of a range of health outcomes (ICF, 2017). Supporting our findings from HICs is also another study that found that people in insecure employment were more likely to report poor mental health (ICF, 2017). In addition, poor mental health was also significantly higher among workers with low educational attainment, low-skilled workers, those who were previously unemployed, and immigrant workers. Our findings are in line also with the previous work of Assari (2018) suggesting that life expectancy gains depend on employment status. Regarding the positive relationship found between life expectancy and immigration in HICs, it is important to emphasize that the 'healthy immigrant effect' in mortality has been also documented for foreign-born Hispanics (including Mexicans) in the United States (Garcia et al., 2017); North Africans in France (Ichou & Wallace, 2019); Canadian immigrants in Canada (Gee et al., 2004).

Furthermore, the relationship of life expectancy

with poverty and unemployment was significantly stronger in LICs and MICs. The poverty headcount ratio defined as the percent of the population living on less than US$2.15 per day (2017 PPP) was also used in this study. Poverty was the strongest contributor to life expectancy in the LICs. Our research results confirm the other studies' findings that poverty and unemployment are negatively related to population health (Kontodimopoulos, 2022). The unemployment rate is a crucial indicator of the economy's ability to generate jobs for the workforce and to some extent reflects the socio-economic situation of a country, although a low unemployment rate can hide significant poverty (Kontodimopoulos, 2022). It is well known that poverty is bad for health and it is not difficult to understand how poverty in the form of dirty water and poor nutrition coupled with lack of quality medical care, could account for the shortened lives of people in LICs (Marmot, 2005).

This study also found an unexpected sign of the unemployment coefficient, i.e. positive relationship with life expectancy in LICs. The unemployment rate was a significant adverse predictor of life expectancy in MICs. As indicated in the literature, unemployment, especially long-term, has an effect on health status through reduced income, loss of occupational status, and reduced social interaction (Prędkiewicz et al., 2022). From the research results, unemployment does not negatively affect the population health in LICs. However, the explanation for this finding is that the unemployed can refrain from smoking, maintain a normal body weight, be more physically active and follow a better diet (Kontodimopoulos, 2022), all of which have a positive effect on health. Another explanation for the positive relationship found between unemployment and life expectancy in LICs may be the view of Kontodimopoulos (2022) that a low unemployment rate may hide significant poverty. Since the unemployment rate in LICs for the entire period from 1995-2021 is between 4-6%, very stable and lower than unemployment in MICs and HICs, in that case, there is no reason not to believe in the standpoint of Kontodimopoulos. Unemployment levels are more likely to affect those in a lower socio-economic position who face poverty and social exclusion as a result of lower levels of household income (ICF, 2017). In addition, long-term unemployment and inactivity are associated with a range of poor health outcomes, such as premature aging, poor mental health, negative health behaviors and low levels of self-rated health (ICF, 2017). In the case of MICs, the lag in the relationship indicates that unemployment from an earlier period has a substantial adverse impact on population health than the current situation.

Educational attainment was operationalized by the secondary (gross) school enrollment, gender parity index variable. Thus, it was found that educational attainment is important in recognizing a person's longevity prospects, and in this study, it emerged as a very strong social determinant of population health for the MICs. The explanation may be that in high-income countries most people finish primary and secondary school anyway, because of better living conditions, and health is unlikely to be affected. On the other hand, in low-income countries, it can be attributed to many people not being able to achieve educational attainment. Various studies have investigated trends in the relationship between educational attainment and mortality, all concluding that educational differences in mortality and life expectancy widen over the years (Luy et al., 2019; Hummer & Hernandez, 2013; Kaplan et al., 2014).

Gross domestic product (GDP) and gross national income (GNI) are two standard indices used to measure the economic scorecard of a country. One major difference between them is that GDP is the value produced within the borders of a country, while GNP is the value produced by all citizens (Kontodimopoulos, 2022). In our study, GNI/capita was chosen to reflect the national income of each country group. Some studies in rich countries have also shown no relationship between average income and measures of population health (Marmot, 2005). The findings of this study are also a bit surprising as income is not one of the important social determinants of population health neither for any group of countries.

7. Conclusion

This research study can be seen as a contribution at the global level to understanding how social determinants can affect population health. Indeed, our hope is to contribute to this discussion in the literature by providing the newest findings. The connection between social determinants of health and health outcomes varied among the LICs, MICs, and HICs. Poverty had a strong negative relationship with health

outcomes in LICs, and educational attainment was a key determinant of population health in MICs. The working conditions proved to be a decisive social determinant of population health in HICs. Based on the evidence from this study and other similar studies globally, researchers and policymakers could implement policies to act on the social determinants of health inequalities and formulate actions to intervene to improve population health. Of course, many similar research studies show that these postulations are important and can help policymakers in different countries to distribute appropriate resources to different social groups. But, when focusing even more on the perspective of social determinants of health, the main objective of policy-makers should be to minimize the accumulation of social disadvantages to promote better and more equitable population health outcomes.

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