



# The Association between Peace and Life Expectancy: An Empirical Study of the World Countries

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## Abstract

**Background:** Although theoretically peace affects health, few published evidence for such an association was empirically available. This study aimed to explore the association between peace and life expectancy (LE) among the world countries.

**Methods:** In an ecological study and using random effects regression model, we examined the association between peace and LE among world countries between 2007 and 2012. The LE at birth and global peace index (GPI: a score between 1 and 5, higher score means lower peace) were selected as outcome and main predictor variables, respectively. We adjusted their association for the gross national income (GNI) per capita and education index (EI). Data were obtained from the Institute for Economics and Peace (IEP) and UNDP (United Nations Development Programme (UNDP)). Numbers of included countries were 158 based on the available data.

**Results:** GPI had a negative, considerable, and statistically significant effect on LE (standardized coefficient -0.039; 95% CI: -0.058, -0.019). This association was also significant even after the adjustment for EI (-0.019; 95% CI: -0.035, -0.003), GNI (-0.035; 95% CI: -0.055, -0.015), and both EI and GNI (-0.017; 95% CI: -0.033, -0.001). The full model showed that around 0.61 of the variation of LE among countries may be explained by the GPI, EI and GNI per capita.

**Conclusion:** The contribution of peace as a global determinant of LE was empirically considerable even after the adjustment for the economic and education levels of countries. This implies that governments should make efforts to settle peace through implementing good governance based on interactions with both public and other countries.

**Keywords:** Peace, Life expectancy (LE) at birth, Economic, Education, Peace making

## Introduction

### *Peace and determinants of health*

World Health Organization (WHO) defines Health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Based on this definition,

health is a broad concept in which different aspects of a community including cultural, societal, economical, and political status affect it (1-3). In recent decades, studies have addressed and examined many known factors about the

socioeconomic determinants of health (4). Peace is one of these factors, which in line with other factors such as social justice, education, income, food, housing, etc are the backbones and the prerequisites for health in each community (5).

### *Effects of no peace on public health*

Political, social and economic insecurity and unrests (conflicts, civil wars, riots,...) have an impact on human health by the destructive effects of different weapons, the sanctions and pressures of economic, social and political systems. In this term, people address their health needs, the subsequent refuge, starvation, drought, and epidemics of such disruptions, and the diversion of economic resources to military ends (6-10). Economic insecurity and hardship might make changes in mortality patterns and have an increase in suicides (11-12). The financial and technical supports of donors and intervention of peace making in times of different unrests and insecurities can make operational consequences in the health sector (13).

Overall, peace and environmental stability within and between countries can provide a more conducive climate to health improvement. Countries with a peaceful space are most likely to provide fundamentals such as finance and health professionals for health development. Moreover, lack of peace can affect the implementation of health programs and initiatives. For instance, violent conflict leads to poverty, disease, and vulnerability for a community particularly among high-risk groups including women and children who are the primary target population of the Millennium Development Goals (MDGs) (14). It drains resources for basic services, then it can impede implementing MDGs, as well as discouraging international partners from providing adequate assistance. In addition, insecurity, political unrest, the threat of violence, war and conflict are considered as some important push factors for immigration and the brain drain of health workers especially in developing countries (15). As a result, the continuity of this phenomenon contributes to waste of investments

included in human resources and further underdevelopment.

### *Concepts of Peace*

Peace is a multifaced concept and somewhat difficult to measure and define (16-17). Different definitions of peace appear in the literature. The most common definition of peace as the literature review shows is the lack of violence or any types of conflicts. This aspect of peace is referred to "negative peace" as defined by Johan Galtung (18). Sub-Saharan African countries, which have high levels of conflict, have poor health indicators independent of poverty and HIV (19). Some forms of insecurity such as civil wars cause substantial long-term effects on the burden of death and disability particularly affecting women and children (6).

What makes this concept more complicated is what constitutes a lack of violence? The answer to this question refers to "positive peace" which takes account for a culture of efforts promoting education for peace and sustainable development based on respect for human rights, gender equality, democratic participation, forbearing solidarity, open communication, and international security (20). So, peace contains internal and external factors ranging from a nation's level of military expenditure to its relations with neighboring countries and the level of respect for human rights.

In our study, we supposed the positive aspect of peace as a notion which goes beyond the lack of violence and conflict. For this reason, we employed the Global Peace Index (GPI) as an index for peace obtained from global reports, which includes a composite measure of peace those encompass whatever reflects the incidence or absence of peace (21).

Theoretically, it is supposed that the more a society is peaceful, the more the society can be healthy. It should be noted that empirically little evidence has been established based on the association between peace, political violence, conflicts, and health after the adjustment for other correlated factors such as educational and economic levels (2). So, the present study aimed to examine any

empirical evidence to support the association between global peace and life expectancy (LE) at birth levels among world countries during a time period from 2007 to 2012.

## **Materials and Methods**

### ***Study's variables***

In an ecological study, we explored the association between global peace and the overall health status of countries adjusted for some other correlated factors, which were the level of education and economy. Although there are different outcome measures for health, different studies conducted at macro level (22-24) used life expectancy (LE) at birth and mortality rate as indicators of the health output. For this reason, we employed the LE at birth as an outcome variable of health status in each country. In addition, global peace index (GPI), education index (EI), and gross national index (GNI) per capita (PPP \$) were used as other predictor variables which might be associated with better health in each country. All variables were considered as continuous.

These indicators were selected for two reasons. First, they had less missing values and were reported from most of the countries in the six regions of the world more or less regularly. At the second place, it was required to control some potential confounders which might affect our conclusion. Therefore, we entered two variables namely economic and education status of the country in addition to targeted variables i.e. GPI and LE at birth.

### ***Data source and data collection***

We considered peace as an expanded concept that exceeds the absence of war and conflict and takes into account providing factors for peace building. For this reason, we were required to have access to a measure of peace that could encompass multivariable concept of peace status in countries. So, we searched all the relevant web-based pages and international databases like United Nations (UN), World Health Organization (WHO), Joint United Nations Programme on HIV/AIDS (UNAIDS),

United Nations Development Programme (UNDP), United Nations Children's Fund (UNICEF), United Nations Educational, Scientific and Cultural Organization (UNESCO), and international organizations and institutions for peace to find a relevant indicator of peace status in each country. The process was prolonged for three months from June 2013 to August 2013. The keywords used for these databases included: unrest, conflict, war, insecurity, political instability, war-related violence, peace, transparency, human right, democracy, and measure or indicator or index. We discovered the only comprehensively available and expedient indicator as named GPI. This index was a composite of indicators that reflected the incidence or absence of peace, and contained both quantitative data and qualitative scores from a range of trusted sources. It quantified three broad themes in each country: the level of safety and security in society; the extent of domestic or international conflict; and the degree of militarization based on a 1-5 scale. This index was produced by the Institute for Economics and Peace (IEP) for most countries across the world on a basis of international participation. Furthermore, the index was first produced in 2007 and it is annually reported by IEP. In our study, we employed the available indicator between the years of 2007 to 2012.

Whereas, it was supposed that some conditions in each country might affect the health, we then reviewed the formal publications and reports of WHO and UNDP for a suitable health outcome indicator and health-related indicators within the study period for the world countries in six regions which were accessible to have a value for peace status. Considering the availability and coverage of data and previous studies, LE at birth as a main outcome variable, GNI per capita and EI as independent variables, which might distort our conclusions, were calculated or obtained from the UNDP office source. The data were gathered between September 2013 to November 2013.

We tried to extract the required data for the variables of the study for different countries from international databases as possible. Only in case of EI, the data was not available for some years with-

in our time period. So, we backwardly calculated EI using the data of the HDI formula in UNDP reports. Whereas some countries had no value for GPI, we excluded the countries in our study. So, the final dataset for analysis was comprised of 158 countries in the six regions of the world.

### Data manipulation

The data for EI was not directly available for our studied countries and the prespecified period in UNDP reports. Whereas, it was defined as one of the three components of Human Development Index (HDI), we captured the sub-variables of HDI and then backwardly calculated EI using the data of the HDI formula in UNDP reports.

### Data Analysis

The longitudinal dataset included six measurements (2007-2012) on 158 countries. This dataset consisted of repeated observations of LE at birth as an outcome variable and three indexes GPI, EI, and GNI per capita (PPP \$) as predictors. Generalized estimating equations (GEEs) and the random effects model are two common methods of analysis that account for correlated and repeated observations. As concluded in Twisk's study (2004), for a continuous outcome variable, the GEE and random effect coefficients models are comparable and can be used exchangeable (25). As our dataset consisted of repeated observations of the world countries and similarly it might make inter-correlation between countries and the prespecified period, the regression model based on random effects coefficients was run when appropriate. The simple random effects model is as follows:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it}$$

Where  $Y_{it}$  is the dependent variable at time  $t$ ,  $X_{it}$  represents one independent variable at time  $t$ ,  $\beta$  is the coefficient for that independent variable,  $\alpha$  indicates intercept,  $u_{it}$  indicates between-entity error at time  $t$  and  $\varepsilon_{it}$  reflects within-entity error at time  $t$ .

The range of variations for the independent variables in our model were different, therefore it was not acceptable to compare the strength of their associations using regression coefficients. In order

to deal with this limitation, we estimated the standardized regression coefficients.

We tested the requirements for the run of the regression model and the potential interaction between subgroups (six regions). The life expectancy as an outcome variable and GPI as an independent variable were followed more or less, as normal distribution within the time period of 2007-2012. We also conducted sensitivity analysis to test the robustness of our findings. We excluded the data of those countries with the extreme score for GPI levels and analyzed our model again. This analysis made no change in the direction or significance of any reported results related to our main model.

The statistical software of Stata, version 12.0 (Stat Corp. LP, College Station, TX, USA), was used to analyze the data. The type of covariance structure used for our data analysis was exchangeable. The  $P$ -values less than 0.05 were considered as statistically significant.

## Results

### Global Peace Index

The scale for Iceland (1.357) and Norway (1.113) were categorized as the countries with most at peace for 2007 and 2012, respectively. In contrast, the scale for Iraq (3.437) and Somalia (3.392) attained least peace levels for 2007 and 2012, respectively.

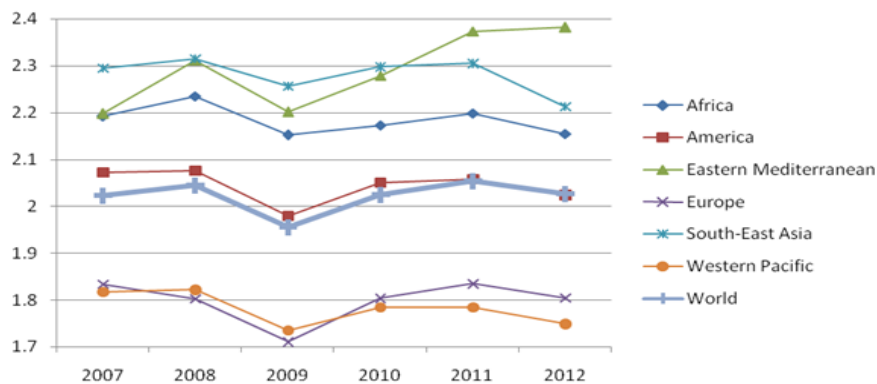
For 2007-2012 years, the Western Pacific and Europe regions were more peaceful than the other WHO regions with 1.79 and 1.80 scores, respectively. In addition, the Eastern Mediterranean and South-East Asia regions averagely were least peaceful with 2.29 and 2.28 as compared with other WHO regions for the same time period. Generally, the slope of this indicator for the world had a more or less constant trend and it was shown that the average score of GPI in all of the studied countries for both 2007 and 2012 years was 2.02 (Table 1). The peace levels for different WHO regions were unstable as Eastern Mediterranean and South-East Asia regions were estimated to have the most annual variations rate at 1.9%.

Figure 1 shows the variations for GPI in the pre-specified time per six WHO regions. The average

and median of GPI for six years of the world countries were 2.02 and 1.99, respectively.

**Table 1:** Mean of predictors and outcome variables classified by WHO regions and the world countries for 2007-2012. Numbers with brackets are standard deviation

Variable	Yr	Africa	America	Eastern Mediterranean	Europe	South-East Asia	Western Pacific	World
<b>Region</b>								
<b>Global Peace Index</b>	2007	2.19(0.07)	2.07(0.06)	2.2(0.12)	1.83(0.07)	2.29(0.13)	1.82(0.9)	2.02(0.04)
	2008	2.24(0.06)	2.08(0.06)	2.31(0.13)	1.8(0.06)	2.32(0.14)	1.82(0.09)	2.04(0.04)
	2009	2.15(0.07)	1.98(0.06)	2.2(0.14)	1.71(0.06)	2.26(0.13)	1.74(0.1)	1.96(0.04)
	2010	2.17(0.06)	2.05(0.06)	2.28(0.15)	1.8(0.07)	2.3(0.13)	1.79(0.11)	2.02(0.04)
	2011	2.2(0.05)	2.06(0.06)	2.37(0.14)	1.83(0.06)	2.31(0.14)	1.79(0.11)	2.05(0.04)
	2012	2.15(0.05)	2.02(0.06)	2.38(0.13)	1.81(0.06)	2.21(0.14)	1.75(0.1)	2.03(0.04)
	<i>total</i>		<b>2.18(0.02)</b>	<b>2.04(0.02)</b>	<b>2.29(0.05)</b>	<b>1.8(0.03)</b>	<b>2.28(0.05)</b>	<b>1.78(0.04)</b>
<b>Life expectancy at birth</b>	2007	53.64(1.04)	73.2(0.88)	68.62(1.86)	75.16(0.71)	68.01(1.25)	73.49(2.07)	67.98(0.84)
	2008	54.17(1.03)	73.44(0.87)	68.83(1.85)	75.37(0.71)	68.3(1.22)	73.79(2.04)	68.28(0.83)
	2009	54.67(1.02)	73.68(0.86)	69.06(1.84)	75.57(0.71)	68.58(1.19)	74.06(2.02)	68.58(0.82)
	2010	55.16(1.01)	73.89(0.85)	69.3(1.82)	75.78(0.7)	68.9(1.16)	74.33(2.0)	68.88(0.81)
	2011	55.6(0.99)	74.1(0.84)	69.54(1.81)	75.97(0.7)	69.19(1.13)	74.57(1.97)	69.15(0.8)
	2012	56.01(0.99)	74.31(0.83)	69.78(1.79)	76.16(0.69)	69.51(1.1)	74.8(0.95)	69.42(0.79)
	<i>total</i>		<b>54.88(0.41)</b>	<b>73.77(0.34)</b>	<b>69.19(0.73)</b>	<b>75.67(0.29)</b>	<b>68.75(0.46)</b>	<b>74.17(0.8)</b>
<b>Education Index</b>	2007	0.41(0.02)	0.68(0.03)	0.53(0.04)	0.82(0.01)	0.49(0.05)	0.72(0.05)	0.63(0.02)
	2008	0.42(0.02)	0.7(0.02)	0.54(0.04)	0.83(0.01)	0.49(0.05)	0.73(0.05)	0.64(0.02)
	2009	0.43(0.02)	0.69(0.03)	0.55(0.04)	0.83(0.01)	0.5(0.05)	0.71(0.06)	0.64(0.02)
	2010	0.43(0.02)	0.69(0.03)	0.55(0.04)	0.83(0.01)	0.48(0.05)	0.72(0.06)	0.64(0.02)
	2011	0.43(0.02)	0.69(0.03)	0.55(0.04)	0.83(0.01)	0.48(0.05)	0.72(0.06)	0.64(0.02)
	2012	0.44(0.02)	0.69(0.03)	0.55(0.04)	0.83(0.01)	0.48(0.05)	0.72(0.06)	0.64(0.02)
	<i>total</i>		<b>0.43(0.01)</b>	<b>0.69(0.01)</b>	<b>0.55(0.01)</b>	<b>0.83(0.00)</b>	<b>0.49(0.02)</b>	<b>0.72(0.02)</b>
<b>GNI per capita per 1000 \$(ppp\$)</b>	2007	2.87(0.6)	10.35(2.01)	16.44(4.76)	20.23(1.96)	3.03(0.7)	16.8(4.44)	12.52(1.15)
	2008	3.03(0.66)	10.59(1.99)	16.07(4.55)	20.17(1.86)	3.11(0.7)	17.1(4.51)	12.56(1.12)
	2009	3.16(0.74)	10.29(1.89)	15.28(4.24)	19.12(1.73)	3.22(0.68)	16.74(4.34)	12.09(1.06)
	2010	3.12(0.68)	10.64(1.93)	15.52(4.39)	19.51(1.78)	3.44(0.73)	17.5(4.58)	12.37(1.09)
	2011	3.21(0.71)	10.94(1.95)	15.69(4.79)	19.8(1.78)	3.59(0.74)	18.02(4.69)	12.61(1.13)
	2012	3.3(0.73)	11.17(1.97)	16.33(4.88)	19.85(1.77)	3.79(0.79)	18.37(4.72)	12.81(1.13)
	<i>total</i>		<b>3.12(0.28)</b>	<b>10.66(0.79)</b>	<b>15.89(1.84)</b>	<b>19.78(1.73)</b>	<b>3.36(0.28)</b>	<b>17.42(1.8)</b>



**Fig. 1:** Mean of global peace index\* classified by WHO regions for 2007-2012

\* Global peace index shows the level of peace at each country on a 1-5 scale (1=most peace to 5=least peace level)

*Education index (EI)*

On the basis of UNDP data, Niger had the least EI for both 2007 and 2012 at 0.15 and 0.17, respectively. Also findings showed that the highest coefficients for 2007 and 2012 years were related to Norway (0.991) and New Zealand (0.997), respectively. The European region had the highest EI (0.81) as compared with other WHO regions. While, the African region was estimated to have the lowest index (0.42) as followed by the South-East Asia region with 0.46 (Table 1).

### Gross national income (GNI)

The Democratic Republic of the Congo for both 2007 and 2012 had the least GNI per capita with 273 and 319 PPP \$, while Qatar as was estimated to have the highest GNI per capita with 73341 and 87478 PPP \$ for 2007 and 2012, respectively. Meanwhile, Euro region remained markedly with the highest GNI among WHO regions with 19788.4 averagely, while Afro with 3116.6 had the lowest mean for this index (Table 1).

### Life expectancy (LE) at birth index

The mean of LE at birth for the world during 2007-2012 based on the UNDP data was 68.7.

The slope of the LE at birth for all of the WHO regions had a slight increasing trend (Fig. 2). Japan attained the most LE at birth rate for both 2007 and 2012 years with 82.7 and 83.6, respectively. In contrast, the Lesotho (45.4) and Sierra Leone (48.1) countries had the least LE at birth rate for 2007 and 2012 years, respectively. The highest mean of LE at birth rate was related to the European region with 75.67, while the African region had the lowest mean for this index with 54.88 (Table 1).

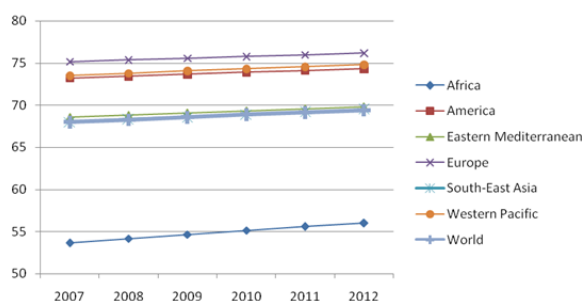
The results of univariate analysis showed that aggravating GPI may statistically have a significant influence on the decrease of EI, GNI per capita and HDI variables separately ( $P$ -value<0.05). Table 2 summarizes the information related to the relationship between GPI and the EI, GNI per capita and HDI.

We also analyzed the influence of EI and GNI per capita on the LE at birth. Both EI and GNI had a statistically positive influence on the LE at birth improvement ( $P$ -value<0.05). Figure 3 separately shows the influence severity coefficients of the studied variables on the LE at birth as an outcome variable. Numbers in arrows represent Z score.

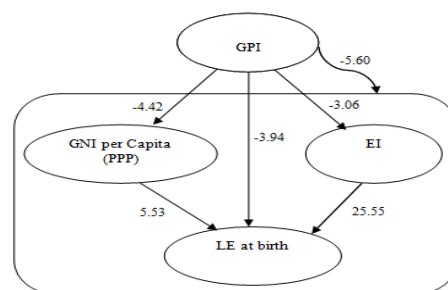
**Table 2:** the association global peace index with the education index, gross national income per capita and human development index by using univariate analysis

Variable	Standardized coefficient	Z-score	95% CI*	R <sup>2</sup>
EI	-0.031	-3.06	-0.051, -0.011**	0.26
GNI per capita (PPP \$)	-0.065	-4.42	-0.094, -0.036**	0.31
HDI	-0.045	-5.60	-0.061, -0.030**	0.31

\*Confidence interval/\*\* Indicates confidence interval at the 0.05 level



**Fig. 2:** Mean of life expectancy at birth by WHO regions for 2007-2012



**Fig. 3:** The diagram of univariate analysis Z-score related to global peace index, gross national income, education index and life expectancy

**Association between GPI and LE at birth for all countries**

We controlled for auto-correlation across the time period and used robust standard errors and clustered on the country. Table 3 presents the results of our estimate of the influence of peace on LE at birth. We controlled for the effects of GNI per capita as an economic wealth variable and also EI as a social development variable. Each row presents the results of a separate analysis including an standardized regression coefficient and associated Z-Score.

Based on univariate analysis, the average LE at birth decreased by approximately 0.039a year when one unit of GPI increased (as known less peaceful) in each country (95% CI: -0.058, -0.019). After adjusting the EI, GPI had a considerable influence on the LE at birth, however when GPI increased one unit about -0.019 LE at birth decreased (95% CI: -0.035, -0.003). Moreover, we

also adjusted the countries for GNI per capita and it was indicated that GPI significantly affected the LE at birth (regression coefficient: -0.035; 95% CI: -0.055, -0.015). We also run the final model including the control of GNI and EI together to examine the GPI influence on the LE at birth. In this case, we estimated that GPI statistically had a significant association equal to -0.017 on the life expectancy (95% CI: -0.033, -0.001). What is interesting is that the three independent variables together could significantly explain 61.0% of the variations in LE at birth as opposed to 25.0%, 60.0% and 42.0% for GPI alone, GPI and EI, and GPI and GNI per capita, respectively.

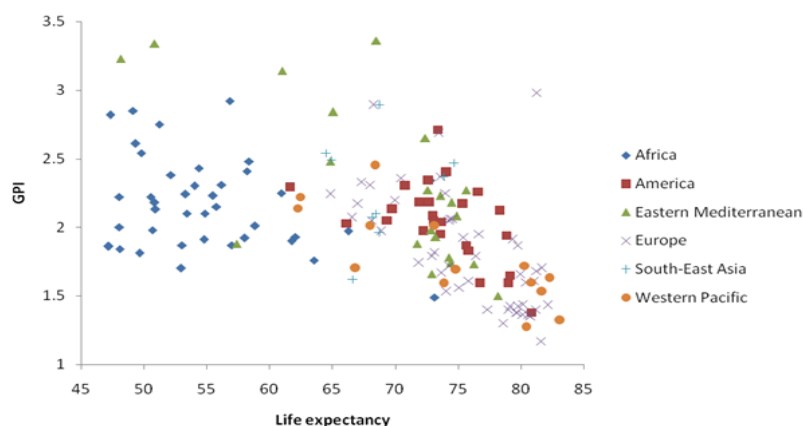
We tested to discover the interaction between GPI and six regions of the world, but we did not find any significant interaction ( $P$ -value= 0.25). So, by observing no significant interaction between GPI and the regions, we concluded that it was not required to analyze subgroups.

**Table 3:** Crude and adjusted association between global peace index and the life expectancy at birth in world countries

Variable	Standardized coefficient	Z-score	95% CI*	R <sup>2</sup>
Crude (GPI)	-0.039	-3.94	-0.058, -0.019**	0.25
GPI + Education	-0.019	-2.40	-0.035, -0.003**	0.60
GPI + GNI per capita in PPP	-0.035	-3.45	-0.055, -0.015**	0.42
GPI + Education + GNI per capita (PPP \$)	-0.017	-2.08	-0.033, -0.001**	0.61

\*Confidence interval

\*\* Indicates confidence interval at the 0.05 level



**Fig. 4:** Regression between global peace index and life expectancy at birth Indexes

## Discussion

In this study, we presumed the definition of peace as a comprehensive concept that goes beyond the war and conflict. On this basis, peaceful communities can be described as those representing very trivial levels of internal conflict with efficient, responsible and accountable governments, cohesive populations and good relations within the international community. Our study aimed to examine the association between peace and its severity as an independent variable and the LE at birth as an outcome variable adjusting education and economic levels among the world countries.

As mentioned earlier, different studies at macro level have been conducted. In this term, LE particularly at birth, and mortality rate particularly for infants and children, were considered as indicators of the health output. In this study, to select an indicator in order to be reported annually within the studied period and to have the least missing value, LE at birth was employed as a dependent variable. Furthermore, previous studies have shown that education and economy may affect health outcomes. For this reason, we selected these two variables to control the association between peace and LE at birth and guarantee a more precise estimation of our model. The GPI was found as the only comprehensive indicator to be consistent with our concept of peace which is a concept that goes beyond the lack of any wars or conflicts.

### *High-risk regions in terms of peace level*

During 2007-2012, we found that Eastern Mediterranean and South-East Asia regions were those with the least peace level and Africa was ranked as the next region. A considerable share of countries located at these regions experienced some forms of unrest such as internal and external wars or conflicts, political instability, and poor democracy, governance and legitimacy. A large share of countries located at these regions were categorized into low-to middle income countries which as stated by WHO (26), the ratio of the involvement in collective violence of these countries versus high-

income countries was ten to one. These instabilities destroy the infrastructures including human resources, facilities, and basic needs for each community. It also urges work forces to leave and weakens the management capacity, thus further undermines the competence of governance system to provide basic needs and equity (2,8).

We showed that a more peaceful space might increase LE at birth independent of economic and education levels. This makes a better common sense based on the literature which war and conflict has been framed as a public health problem (12). Therefore, low levels of peace may result into more mortality, injuries, psychological distress and social dissatisfaction (27). The movement towards peace in war-affected areas will often improve healthcare and health status of populations (28). Those countries, which are plunged in wars and conflicts, might lead to higher infant mortality rates, lower total life expectancy, and increased fertility rates compared with countries not experiencing violent conflict, independent of poverty and HIV rates (19).

The current study delineated that wealth and the increase of GNI per capita might acknowledge to more longevity as supported by Davis and Kuritsky's study in which the level of poverty was a very important determinant of public health performance (19). There is a positive relationship between economic stability and health effects, however this relationship is not steady (11, 29-31). We also controlled the economic status of each country for less unbiased estimation to have an association between peace and LE at birth. After adjusting the economic status, the association remained significant. It can be noted that countries, which are faced with low peace situations, have more fragile economics and as a result this considerably affects the pace of long-term economic growth (32). This makes an additional impact of low peace on health owing to the distortion of health services resources and the economic infrastructure into defense goals. Furthermore, peaceful societies can make better investment and fiscal space for both public and health policy. As declared in literature, the development of a nation is arisen not only in terms of economic growth but it also in-



cludes other social aspects that mutually enforce economic achievements (33).

The education level of each country had an impact on LE at birth as compared with other studies (34-38). In our study, peace had a significant association with LE at birth even though after adjusting the education level. In addition, a more peaceful situation can affect health through creating potential opportunities for learning and educational development at each community. In Rwanda, education can play a part in the driving of conflict and building peace (39).

The two main conclusions from the results of the study are as follows. First, the peace level can increase LE at birth creating opportunities for educational development, economic stability and security. Second, if we ignore the relationship between education and economic welfare level for each country with LE at birth, peace can itself affect the LE at birth. Empirically peace in each community can improve the LE at birth protecting human rights, respecting the rule of law, and ensuring that people are free to participate in, and be heard on decisions that affect their lives. There is a strong correlation between life expectancy and democracy (23,40) even after controlling the initial level of human capital as well as political histories. Furthermore, this study acknowledges the notion that peace operates as a global determinant of implementing health promotion and healthy public policy in each community (41). Thus, the method of governing a society may affect the peace level in each community. For this reason, policy makers, politicians, and interest groups in both public and private institutions, which play a key role in making public policy, must address the circumstances whereby a policy to be established in an effective, transparent, and accountable manner (42), meet the security and sustainable development in a society through entrenched rules and laws, and enforce them.

This study had some limitations. First, in terms of data this should be mentioned that they were obtained from global reports, there are also some challenges regarding the quality of these data, the methodology used to calculate the indicators and there are many missing values for some countries

in consecutive years. However, we tried to select most valid databases to gather the studied indicators. At the second place, similar to any other ecological studies, our conclusion might be distorted because of the nature of grouping data (ecological fallacy). Secondly, we did not check the time lag between different variables to explore how fast peace might change the health status of a community, which mainly was because of limitations in the access to the required data over a long period of time. Thirdly, the known direct measurement of health is somewhat difficult. In our study, LE at birth was used as the health outcome measure; however, it cannot assess the quality of health, which is one of our limitations in this study. Finally yet importantly, despite a wide range of theoretical studies related to peace and peacemaking, we could not find any comprehensive, quantifiable and annually reported measures to show peace level at each country except the GPI as the only accessible indicator for measuring peace. This was developed by IEP.

Although this study concluded that there is a relationship between peace and LE at birth adjusting economic and education status, there methodologically is an overriding difficulty of interpreting them as causal effects. Further empirical studies must be conducted on quantifying peace concept and measures and its association with other health outcomes at macro level such as infant mortality, disability adjusted life year (DALY), maternal mortality, after adjusting some variables (food security, education, socioeconomic status, etc...). Moreover, it is worth knowing that more advanced methodologies like structural equation modeling (SEM) can be used to study peace and the potential mediators to see how they have an effect on population health.

## Conclusion

This study is considered as one of the first published studies which empirically highlights the association between peace, as conceived beyond the concept of merely war and conflict in community, and the life expectancy at birth as an outcome measure of the population health. Hence, the ef-

forts for peace making which incorporates good governance can play a central role in shaping better health. This study acknowledges the social determinants of health (SDH), which are emphasized on the great impact of structural and intermediary factors on health.

## Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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