

# Healthy Life Expectancy at Birth: A Comparison Study between Developed, Developing and Undeveloped Countries

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**Abstract.** Life expectancy has always been taken into research since it is directly related to human being extension. Many governmental organization and non-governmental foundation have studied the life expectancy in the countries and could be able to find some vital aspects which are factors to long the period of people life span. Studies found out that as long as there are good health care facilities, economic condition, high financial resource, security as nowadays becomes a serious problem and political status, the longer life may individual have it. In this study, we consider three different groups of countries for instance Developed Countries (France, Germany and The United Kingdom), Developing Countries (China, Malaysia and Brazil) and Undeveloped Countries (Ethiopia, Uganda and Haiti). Descriptive statistics and inferential statistics have carried out to compare the life expectancy between the group of countries.

**Keywords:** Life Expectancy, Developed, Developing and Undeveloped Countries, Descriptive Statistics, Kruskal-Wallis H and Mann-Whitney U

## 1. Introduction

In recent years, life expectancy has become a popular topic around the world since it is directly related to the human being. It is evident that during the 20th century longevity has increased rapidly with about %50 at most of the countries. (1); (2). It could be said that based on some real theories, it was recorded only to 48 years from the beginning of human civilization until the end of the 19th century. (2). Thus, this upward trend of life expectancy has drawn attentions to focus. In 20 centuries, this worldwide disparity is reduced

and likewise today the life expectancy is upcoming up to 70 to 75 years and correspondingly today no country of the world having low life expectancy than the countries of high life expectancy in 1800 (3).

At this study, we are going to compare the life expectancy between developed, developing and undeveloped countries. Kruskal-Wallis H and Mann-Whitney U test are used to find out the difference of the means for the classified countries. Gender was also considered, and it is another object of this study to examine the life expectancy between male and female per country.

Life is an extensive word in nature. It is relatively challenging to apprehend the importance of life. In science, life may be explained as “the possession of self-sustaining biological processes”. In other words, (4) referenced life as

“life is the name of self- sustaining biological process which include homeostasis (ability of cells to maintain its physiological functions), organization (linkage between the functions of all parts of the body), metabolism, growth, development, adaptation, response to stimuli, and reproduction. It means that life is the name of such quality, which makes a person able to survive in the society”

Life expectancy that states to the number of years, it is calculated based on the statistical tools to show an expected duration life to a person. It is of course related to geographical background of the area (5).

### Mathematical Calculation of life expectancy

According to (5) mathematically life expectancy may be calculated as

Life expectancies =  $ex$

(e) Stand expected number of years remaining

(x) Stand for a person's present age

For example, life expectancy =  $(ex)$ . Expected number of years remaining (e) = (25) While present age of a person (x) = 35. So, the total number of present +expected remaining years  $(25+35=60)$  so life expectancy  $(ex)$  60.

### Developed, Developing and undeveloped Countries of the World

We have, here, listed the countries of the world into three different types. i.e. developed countries, developing countries and undeveloped countries. It is well known that economic status plays a very important role to have a healthy life and it can clearly be seen that in Developed countries that gross domestic products (GDP) and Gross National Product (total value of a nation's goods and services (GNP), per capita income, industrialization, standard and style of living, etc (6). similarly developed countries provide free health facilities and security to its citizen while all those countries which lacking these facilities are known as developing countries and undeveloped countries. Further listed of

few differences which show that why life expectancy is high among the developed, low in developing countries and almost not existed in undeveloped countries of the world (7). The differences are:

1. Developed countries having high income as compared to developing countries
2. Developed countries having high literacy rate while in developing countries it is low
3. Developed countries have good health facilities while developing countries it is lacking
4. Developed countries support the industrial aspects of the countries while developing countries getting supports from industrial aspects of the country
5. In developed countries standard of life is high as compared to developing countries

## 2. Factors Effecting Life Expectancy

### 2.1. Financial income as factors effecting life expectancy

It is obvious that income has a very strong impact on the health status which ends up with long life expectancy. Thus, having sufficient financial resources of income is a result of a better quality of life (8). It facilitates the accessible resources of very good quality of food and medicine when it is needed.

### 2.2. High literacy rate as factors effecting life expectancy

Another valuable and important factor which affects life expectancy is Education, it is a fundamental term to endorse health as well as the life expectancy of the people. Similar to high income, high level of education is also attributable to have high level of life expectancy with comparing to low education and income (9).

### 2.3. Standard Health Facilities

Staying in life for a longer period is based on having satisfied conditions such as, health facilities, opportunity employment and good financial resources. These are, thus, not only related to life standard, but also are attributable to live for longer. It means there is a significant relationship between life standard and life expectancy.

### 2.4. Daily Circumstances as factors effecting life expectancy

At the level of global point of view, it is highlighted that peace also promotes life expectancy as well. In those countries where lack of peace is existed, always lead people to low level live (10). With reference to (11), factors like cultural, societal, economical, security and political status have great impact on one's health, and eventually countries of high level those factors always lead to high life expectancy comparing to other countries like developing and undeveloped.

## 3. Methods

### 3.1. Source of Data

This data set includes data of life expectancy at birth. The study sample consisted of 3 countries per group (developed countries (France, Germany and The United Kingdom), developing countries (China, Malaysia and Brazil) and undeveloped countries (Ethiopia, Uganda and Haiti) from 1960 to 2011. The raw data for this study is available on nation master website. One can find the data from ([www.natiomaster.com](http://www.natiomaster.com))

### 3.2. Data Analysis

According to, (12), researchers can examine relationships between two variables by comparing the mean of the dependent variable between two or more groups within the independent variable. Using the suggestion of (12), the was divided into three groups based on their place in the independent variable (countries). We then compared the means of the three groups on the dependent variable (life expectancy).

The data analysis process of this study included two stages. The first stages included a descriptive analysis to describe the distribution of the data. The second stage included hypothesis testing with test comparison.

### 3.3. Descriptive Statistics

At this stage, one can observe the nature of distribution of the data. Table 1 shows the summary of the descriptive statistics.

Table 1 shows that the basic statistical analysis for life expectancy at birth as whole and for each gender separately. It is clearly seen that in the developed country life expectancy is much larger than developing and undeveloped countries, with mean value 75.162 years from birth, while this number is about ten years

**Table 1.** Descriptive (Means  $\pm$  SD) for Life Expectancy at Birth for all Subjects

	Whole Subjects	Male	Female
Developed Countries	75.162 $\pm$ 4.639	71.961 $\pm$ 3.455	78.363 $\pm$ 3.259
France	75.689 $\pm$ 5.18	71.886 $\pm$ 3.572	79.492 $\pm$ 3.456
Germany	74.524 $\pm$ 4.576	71.507 $\pm$ 3.505	77.541 $\pm$ 3.382
UK	75.273 $\pm$ 4.064	72.489 $\pm$ 3.277	78.057 $\pm$ 2.61
Developing Countries	66.822 $\pm$ 6.666	64.775 $\pm$ 6.187	68.869 $\pm$ 6.516
China	66.553 $\pm$ 8.032	65.151 $\pm$ 7.942	67.955 $\pm$ 7.952
Malaysia	68.997 $\pm$ 4.553	67.345 $\pm$ 3.784	70.649 $\pm$ 4.69
Brazil	64.916 $\pm$ 6.358	61.83 $\pm$ 4.821	68.002 $\pm$ 6.244
Undeveloped Countries	49.9 $\pm$ 5.623	48.556 $\pm$ 5.47	51.244 $\pm$ 5.468
Ethiopia	47.73 $\pm$ 6.351	46.364 $\pm$ 6.335	49.096 $\pm$ 6.126
Uganda	49.2 $\pm$ 3.27	48.016 $\pm$ 3.228	50.385 $\pm$ 2.884
Haiti	52.77 $\pm$ 5.559	51.288 $\pm$ 5.252	54.252 $\pm$ 5.51

smaller for developing countries with mean value 66.822 years and for undeveloped countries is 49.9 years at birth. It is also true for male and female figures as well. However, life expectancy for female gender is quite larger than male at all level of countries with about 10% for developing countries, 6% for developed and undeveloped countries. It tells us that males are more likely to die earlier than female since they face dangerous situation compared to females. This discussion can also apply to countries.

Figure 1 and 2 illustrates the distribution of the dependent variable (life expectancy) for both gender male and female. Again, here it simply tells us that people at developed countries live for longer period than developing and undeveloped countries, in addition to that the box with specifies developed countries

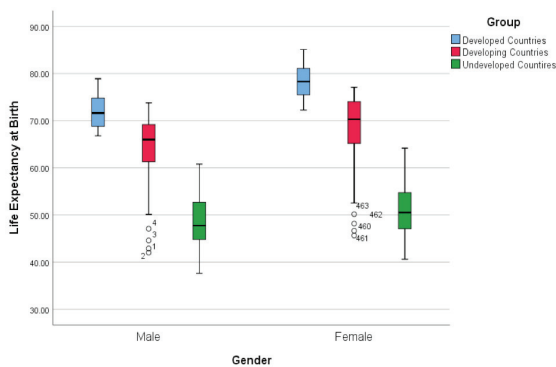


Figure 1. Box-plot chart of life expectancy for both Male and Female

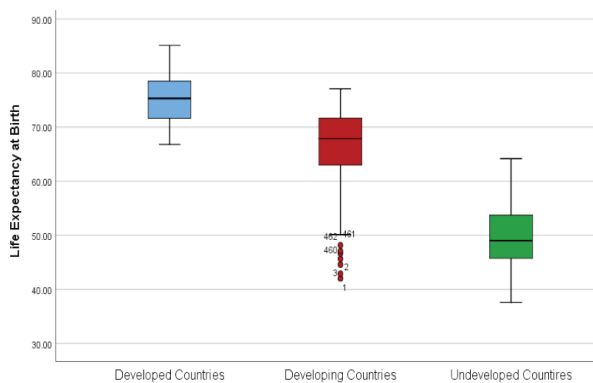


Figure 2. Box-Plot chart of life expectancy for the whole subjects

are higher than other boxes which is sign of longer living. We can also detect another important point which is normality distribution of the groups, since the upper tails and lower tails have different distance from the box, it leads to decide that the variables are not normally distributed.

Plus, Figure 3 and Figure 4 inform us that the life expectancy slightly increased for all of them.

we further examine for normality test using Shapiro-Wilk test. Table 2 provides the result of the test and implies that the variables are not normally distributed since the p-values are all less than 0.05. Hence, the null hypothesis says the variable is normally distributed is rejected.

Since the data does not support normality, then we must use a test to not assume normality in the data.

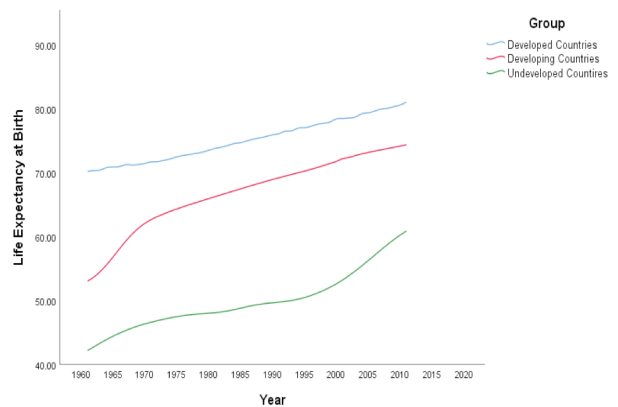


Figure 3. Line charts of Life Expectancy with regards to each group of countries

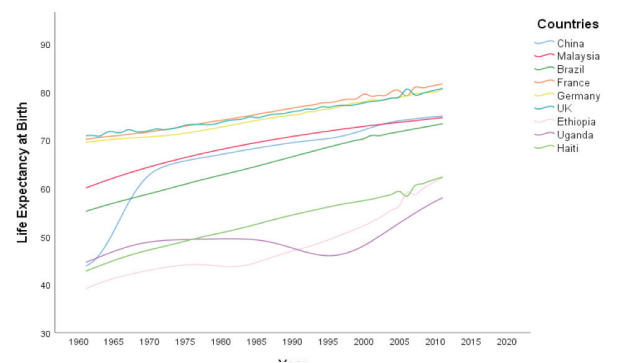


Figure 4. Line chart of Life Expectancy per countries

**Table 2.** Normality test of life expectancy at birth for the groups

Gender	Groups	Statistic	df	Sig.
Whole	Developed Countries	0.975	306	0.000
	Developing Countries	0.945	306	0.000
	Undeveloped Countries	0.976	306	0.000
Male	Developed Countries	0.942	153	0.000
	Developing Countries	0.924	153	0.000
	Undeveloped Countries	0.966	153	0.001
Female	Developed Countries	0.971	153	0.002
	Developing Countries	0.908	153	0.000
	Undeveloped Countries	0.959	153	0.000

Thus, instead of using ANOVA test which follow the normality assumption strongly, Kruskal-Wallis H test is computed to complete the comparison. First, we imply the comparison test for the data without considering gender discrimination as the Kruskal-Wallis H test result in Table 3 leads us to reach conclusion of having significant difference in life expectancy between group of countries,  $\chi^2 = 676.342$ ,  $p$ -value = 0.000, with a mean rank life expectancy value 720.08 for Developed countries, 492.82 for Developing

countries and 165.60 for Undeveloped countries. Nevertheless, this test is an *omnibus* test statistic cannot detect which particular groups are statistically significant from each other; it only tells us that at least two groups are different.

For determining the exact difference, we use Mann-Whitney U. Table 4 shows that the existed differences are among all the groups since the  $p$ -values are all less than 0.05. In other words, we can say that the life span is statistically difference.

**Table 3.** Kruskal-Wallis H test for both gender

Group	N	Mean Rank	Kruskal-Wallis H	
			Statistics	P-value
Developed Countries	306	720.08	676.342	0.000
Developing Countries	306	492.82		
Undeveloped Countries	306	165.60		
Total	918			

**Table 4.** Mann-Whitney U test for multiple comparison between the group of countries

Groups	N	Life Expectancy at Birth		
		Mann-Whitney U	Exact P-Value	
Developed Countries	Developing Countries	306	13898	0.000
	Undeveloped Countries	306	0.000	0.000
Developing Countries	Developed Countries	306	13898	0.000
	Undeveloped Countries	306	3703	0.000
Undeveloped Countries	Developed Countries	306	0.000	0.000
	Developing Countries	306	3703	0.000

Likewise, the same procedure has been used with respect to male and female separately. Like the above part there is also a statistically significant difference between the group of countries as indicated in Table 5 where p-values are smaller than 0.05 at both gender.

Table 6 displays that the significant differences are occurred among all three groups of countries as the p-values are all less than 0.05.

We are also interested in implying the comparison test to identifying whether there is statistical

difference of life expectancy between males and females for each group of countries separately. Again, since we are comparing two groups only, so no need to use Kruskal-Wallis H test, only Mann-Whitney U test is used. Table 7 tells us that there is a statistically significant difference between male's life expectancy and females. It is worth reminding that females are expected to live longer than males at all groups of countries classified to Developed Countries, Developing Countries and Undeveloped Countries.

**Table 5.** Kruskal-Wallis H test for Male and Female separately

Gender	Group	N	Mean Rank	Kruskal-Wallis H	
				Statistics	P-value
Male	Developed Countries	153	360.542	338.521	0.000
	Developing Countries	153	246.484		
	Undeveloped Countries	153	82.974		
Female	Developed Countries	153	372.641	366.577	0.000
	Developing Countries	153	234.958		
	Undeveloped Countries	153	82.402		

**Table 6.** Multiple comparison Test for Male and Female

Groups	N	Life Expectancy at Birth			
		Mann-Whitney U	Exact P-Value		
Male	Developed Countries	Developing Countries	306	3436	0.000
		Undeveloped Countries	306	0.000	0.000
	Developing Countries	Developed Countries	306	3436	0.000
		Undeveloped Countries	306	914	0.000
	Undeveloped Countries	Developed Countries	306	0.000	0.000
		Developing Countries	306	914	0.000
Female	Developed Countries	Developing Countries	306	1585	0.000
		Undeveloped Countries	306	0.000	0.000
	Developing Countries	Developed Countries	306	1585	0.000
		Undeveloped Countries	306	814	0.000
	Undeveloped Countries	Developed Countries	306	0.000	0.000
		Developing Countries	306	826	0.000

**Table 7.** Mann-Whitney U test to compare Life Expectancy of Male and Female

Groups	Gender	N	Mean Rank	Life Expectancy at Birth	
				Mann-Whitney U	Exact P-Value
Developed Countries	Male	153	92.59	2385.000	0.000
	Female	153	214.41		
Developing Countries	Male	153	122.59	6975.500	0.000
	Female	153	184.41		
Undeveloped Countries	Male	153	132.35	8468.500	0.000
	Female	153	174.65		

#### 4. Conclusion

We have come to conclude that the life expectancy varies from one country to another or between group of countries. It is actually based on standard life that exist in some countries which we call it high life standard includes (health facilities, good economics, financial resources, political status and security). The more of these runs in a country the longer people may live. It was discussed that the mean value of life expectancy at birth for developed countries was much larger than that undeveloped countries with 71.961 and 48.556 years living respectively. While for developing countries, it was measured with 64.775. It is clear that the above factors play a key role in developed countries and less in developing countries. Another important result was that even in developed countries there was a slightly difference in life expectancy values among male and female. The data used shows female life longer than male by 10% in developed countries.

Furthermore, an inferential statistical method was conducted to locate the significant difference. Kruskal-Wallis H as well as Mann-Whitney U were computed since the data had violated the normality assumption, and the result lead us to conclude that the differences are statistically significant at level 0.05.

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