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## Estimation of Mortality Rates and Causes of Death in Salahaldeen Province in 2018

### ABSTRACT

**Background** Mortality rate is one of the important means of assessment to any health system, and according to studies of causes of death, there is a high proportion of deaths happened due to causes that can be prevented. Since there is no previous study about mortality rates in Salahaldeen province, the current study is considered to be a guide for any future studies.

**Materials and Methods:** A cross-sectional study was carried out in Salahaldeen province to all death happened during 2018. The number of deaths included in the study was 3274. The analysis tool used (ANAcod v.2) was a special tool developed by WHO. The number of population considered was (1,595,235) according to Salahaldeen Statistics Directorate.

**Results:** The study showed that mortality rate in different groups, crude death rate, life expectancy and male/female ratio were resemble that of high economic communities, and disease burden showed that most deaths happened due to non-communicable diseases, with a clear role for injuries and accidents in middle age males .

**Conclusion:** the most common causes of death are related to non-communicable diseases especially in old ages. Preventive measures shows effective role in making mortality rate due to infectious diseases lower than other causes especially among children. Weak medical documentation of causes of death .

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## Introduction

Analysis of the causes of mortality is one of the most important means of assessing the health service provided to any community since such analysis presents the means and mechanisms to prevent the causes of death, and to avoid medical mistakes that may end with death. In this sense, the medical literature provides an appropriate designation called preventable mortality. Far from engaging in the philosophy of death and in order to avoid friction with side arguments about death and whether medicine can prevent it in reality, the term can be remedied in a less dramatic term called: "deaths from curable causes." (1)

Studies of cause-of-death analysis show that a high proportion of death-related diseases around the world are caused by wrong practices and behaviors that can be prevented, or well clarified to be avoided, such as smoking, obesity, alcohol, medical mistakes, sexually transmitted diseases, and infectious diseases. (1)

The importance of mortality analysis is a key factor in prioritizing the health system, and the most important pillar in the preparation of future programs and plans based on the knowledge of the most pressing health problems in a society and the most threatening to people's lives. (1)

For this purpose, this study provides a complete analysis of the deaths of Salahaldin governorate to help identify the most prominent health problems and what can be presented as a priority in the planning stage of the health system in the governorate.

Reasons for choosing the topic: The reasons for choosing the topic of death analysis in Salahaldin Governorate can be summarized in the following points:

- The subject has not been discussed in such a thoroughness in Iraq, as well as the province of Salahaldin, but there are sporadic studies of some of the contents of this research, but did not reach the amount of information provided by this research in quantitative and qualitative, which surrounds the full aspects of the subject and its vocabulary.

- The urgent need to plan for an integrated health system in Iraq, and in its provinces, requires the establishment of the baseline on which any plan stand, and this baseline is inevitably to know the existing health situation, assessment and analysis, and therefore the analysis of mortality is the first step of this assessment and the most important indicator.

- Availability of the raw material (registration of deaths) of the province, as one of the most accurate information available in the

Department of Health (Salahaldin), and availability of the means of analysis (Anacod tool), which make the required analysis easy.

Research Problem: The present study answers about:

- The presence of any difference in mortality rates and distribution by sex and age.
- The most important causes of death in Salahaldin province from the whole of Iraq and the world rates and numbers
- Discuss the most important possibilities that explain this difference, as well as the accuracy of the system of registration of deaths in the province and causes.

Previous studies: It can be said that the annual statistical report issued by the Iraqi Ministry of Health is the only source that collects all this amount of data related to various biostatistics in Iraq, including the statistics of mortality. The annual report provides tables and charts showing the crude mortality rate, infant mortality rate, and children under five, as well as some special deaths (eg. AIDS deaths).(6)

The annual report of the Iraqi Ministry of Health can be considered as a good reference for comparing the results, but the report does not cover all the important figures and results in the subject of deaths, and does not analyze these findings and reach

conclusions and recommendations through them.(6)

The study relied on the version of the annual statistical report for 2017 and 2010 as a relatively divergent reference in time to measure changes.

WHO reports on deaths in Iraq always conclude with an expression of uncertainty about the accuracy of information from Iraq because it does not really depend on government statistics, making the results highly unreliable.(2)

A number of websites provide comprehensive statistics for almost all countries of the world, but they do not differ significantly from WHO reports in terms of relying on United Nations estimates without actual field studies.(3) (4)

Several other studies have examined each of the results of this research separately, and will be compared with the results of the current study in situ.

Aim of the study: The purpose of this study is to determine the mortality rate, crude death rate, life expectancy, infant mortality rate, under-five mortality rate, male/female ratio, and disease burden in Salahaldin province.

## **Materials and Methods :**

A cross sectional study on deaths in Salahaldin province in 2018. Raw information related to deaths from 1st of Jan. to 31st of Dec. 2018 was provided by the Health and

Biostatistics Unit of Salahaldin Health Directorate, which -as part of its work- includes the causes of deaths and related information in statistical programs as a link in the series of civil registration of death certificate in the province.

The information of the population of the province has adopted the updates of the Directorate of Statistics of Salahaldin for 2018, although they are speculative figures depended on the calculation of the rate of population growth based on the last census conducted in Iraq.

Statistical analysis: The research was based on the death analysis tool (ANAcod) version 2 updated in October 2014 issued by the World Health Organization (WHO).(5) This tool is a relationship established in the program (Microsoft Excel) and extracts all the results related to mortality and distribution by age group, sex and causes according to protected equations. The use of this tool requires the introduction of ICD deaths for males and females, as well as the distribution of population by age group and sex, followed by the error correction phase and zeroing of prohibited diagnostic lists of deaths so that correct results can be achieved.

The study excluded 170 death certificates from deaths registered in the governorate because they do not

comply with the specifications of statistical analysis and could not be corrected. The included errors that caused the exclusion of this number of deaths were as following:

- Non-conformity of the registered symbol of death with the causes of death.

- The registered symbol of death does not match the age of the deceased.

- Non-conformity of the registered symbol of death with the sex of the deceased.

It should be noted that the deaths included in the study are deaths registered with official death certificates issued by the health institutions authorized in the Directorate of Health, but not all deaths in the province, as Iraqi law prohibits the registration of deaths in health institutions and grant them a death certificate. Instead, a special document called a “death argument” is issued by the personal status court in the region. In this argument cause of death may not always be mentioned despite the fact that it is mentioned in the law. And even when issued, it could not be considered scientific cause because it is not issued from a health institution and it is solely for the purpose of proving death .

The population distribution of the governorate was as follows <sup>(6)</sup>.

**Table (1): Salahaldin population distribution**

Age group (year)	Population	
	Male	Female
<b>Total</b>	805 809	789 426
<b>0</b>	32 741	31 449
<b>1-4</b>	98 222	94 346
<b>5-9</b>	117 575	109 709
<b>10-14</b>	103 296	95 377
<b>15-19</b>	91 910	87 637
<b>20-24</b>	80 395	72 410
<b>25-29</b>	57 986	59 393
<b>30-34</b>	50 412	50 876
<b>35-39</b>	43 195	44 640
<b>40-44</b>	40 060	40 989
<b>45-49</b>	26 345	28 574
<b>50-54</b>	16 014	20 328
<b>55-59</b>	17 817	19 991
<b>60-64</b>	11 678	13 567
<b>65-69</b>	8 375	8 575
<b>70-74</b>	4 151	4 387
<b>75-79</b>	2 097	2 685
<b>80+</b>	3 541	4 494

As shown in table (1), the population distribution by category in the province of Salahaldin appears in the form of a pyramid; its broad base includes the younger age groups, and then gradually decreases to older age groups.

## Results:

1. The number of deaths recorded in the death certificates for 2018 in Salahaldin governorate reached 3444 deaths. 170 deaths were excluded from the statistical analysis because they did not meet the requirements of the statistical analysis, making the total number of deaths covered by the statistical analysis 3274.

2. Number of deaths by age group:

**Table (1): Number of deaths by age groups**

Age group (year)	Number of deaths		Rate from the total deaths	
	Male	Female	Male	Female
<b>All ages</b>	<b>1 827</b>	<b>1 447</b>		
<b>0</b>	<b>76</b>	<b>73</b>	<b>4.2</b>	<b>5.0</b>
<b>1-4</b>	<b>35</b>	<b>36</b>	<b>1.9</b>	<b>2.5</b>
<b>5-9</b>	<b>41</b>	<b>40</b>	<b>2.2</b>	<b>2.8</b>
<b>10-14</b>	<b>57</b>	<b>31</b>	<b>3.1</b>	<b>2.1</b>
<b>15-19</b>	<b>66</b>	<b>26</b>	<b>3.6</b>	<b>1.8</b>
<b>20-24</b>	<b>65</b>	<b>28</b>	<b>3.6</b>	<b>1.9</b>
<b>25-29</b>	<b>71</b>	<b>19</b>	<b>3.9</b>	<b>1.3</b>
<b>30-34</b>	<b>63</b>	<b>19</b>	<b>3.4</b>	<b>1.3</b>
<b>35-39</b>	<b>53</b>	<b>29</b>	<b>2.9</b>	<b>2.0</b>
<b>40-44</b>	<b>77</b>	<b>38</b>	<b>4.2</b>	<b>2.6</b>
<b>45-49</b>	<b>97</b>	<b>57</b>	<b>5.3</b>	<b>3.9</b>
<b>50-54</b>	<b>124</b>	<b>77</b>	<b>6.8</b>	<b>5.3</b>
<b>55-59</b>	<b>94</b>	<b>79</b>	<b>5.1</b>	<b>5.5</b>
<b>60-64</b>	<b>187</b>	<b>123</b>	<b>10.2</b>	<b>8.5</b>
<b>65-69</b>	<b>156</b>	<b>145</b>	<b>8.5</b>	<b>10.0</b>
<b>70-74</b>	<b>189</b>	<b>154</b>	<b>10.3</b>	<b>10.6</b>
<b>75-79</b>	<b>132</b>	<b>139</b>	<b>7.2</b>	<b>9.6</b>
<b>80+</b>	<b>244</b>	<b>334</b>	<b>20.6</b>	<b>32.7</b>

Table (1) shows that the mortality of Salahaldin province in 2018 shows a gradual increase in the number of deaths from the youngest age groups upwards towards the older age groups with three points noted:

- The number of deaths in children under one year of age is higher than in other children and early adulthood.
- The number of deaths begins to increase almost linearly from the age of 40 years and above.
- Male deaths outnumber females in most age groups except for some groups such as children under one year of age and over 75 years of age, where female mortality is higher than males.

3. Death rate per age group:

**Table (2):Death rate per age group**

Age group (year)	Death rate per age for each 100,000 population	
	Male	Female
<b>0-4</b>	<b>232</b>	<b>232</b>
<b>5-9</b>	<b>36</b>	<b>38</b>
<b>10-14</b>	<b>35</b>	<b>36</b>
<b>15-19</b>	<b>55</b>	<b>33</b>
<b>20-24</b>	<b>72</b>	<b>30</b>
<b>25-29</b>	<b>81</b>	<b>39</b>
<b>30-34</b>	<b>122</b>	<b>32</b>
<b>35-39</b>	<b>125</b>	<b>37</b>
<b>40-44</b>	<b>123</b>	<b>65</b>
<b>45-49</b>	<b>192</b>	<b>93</b>
<b>50-54</b>	<b>368</b>	<b>199</b>
<b>55-59</b>	<b>774</b>	<b>379</b>
<b>60-64</b>	<b>528</b>	<b>395</b>
<b>65-69</b>	<b>1 601</b>	<b>907</b>
<b>70-74</b>	<b>1 863</b>	<b>1 691</b>
<b>75-79</b>	<b>4 553</b>	<b>3 510</b>
<b>80+</b>	<b>6 295</b>	<b>5 177</b>

Table (2) shows the mortality rate in each age group for males and females per 100,000 population. The near-perfect mortality of females and males can be seen in young and older age groups, while male mortality rates are high in all middle age groups.

4. Crude death rate:

The current study showed that the overall crude death rate was (2.1) deaths per 1000 population. The crude death rate for males was 2.3 deaths per 1000 population, while the crude mortality rate for females was 1.8 deaths per 1000 population.

5. Life Expectancy:

The study showed that the average life expectancy in Salahaldin governorate for both sexes was (80 years), while the average life expectancy for males (78.3 years) and life expectancy for females (81.7 years).

6. Infant mortality rate:

The study showed that the infant mortality rate under the age of one year was (2.3) deaths per thousand live births.

7. Under-five mortality rate:

The study showed that the mortality rate of children under the age of five reached (3.8) deaths per thousand live births.

# 8. Male / Female Mortality Ratio

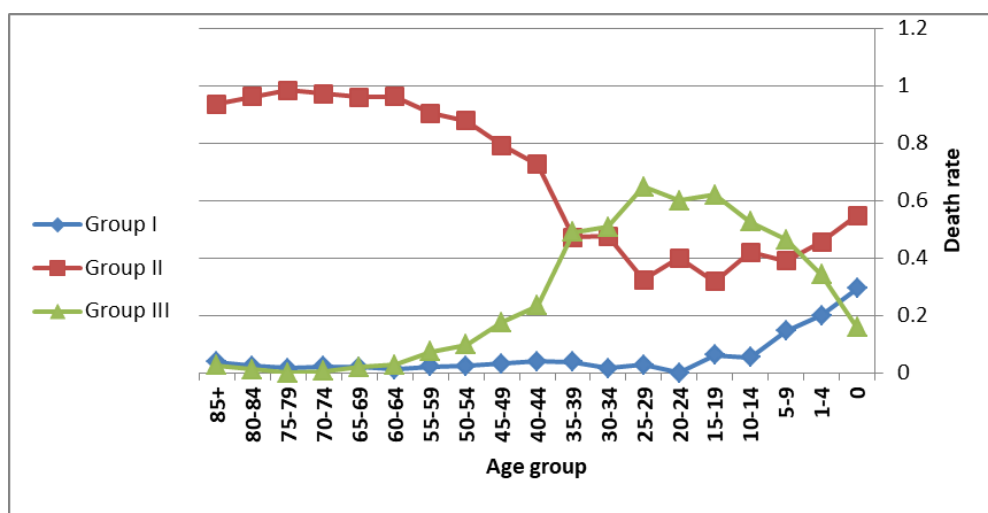
**Table (3): Male/ female ratio according to age group**

Age group (year)	Male/female
0-4	1:1
5-9	1:1
10-14	1.7:1
15-19	2.4:1
20-24	2.1:1
25-29	3.8:1
30-34	3.3:1
35-39	1.9:1
40-44	2.1:1
45-49	1.8:1
50-54	2:1
55-59	1.3:1
60-64	1.8:1
65-69	1.1:1
70-74	1.3:1
75-79	1.2:1
80+	0.9:1

Table (3) shows an increase in the male mortality rate to the female mortality rate in all age groups except for the last age group where the female mortality rate is higher than the female mortality rate.

# 9. Disease Burden:

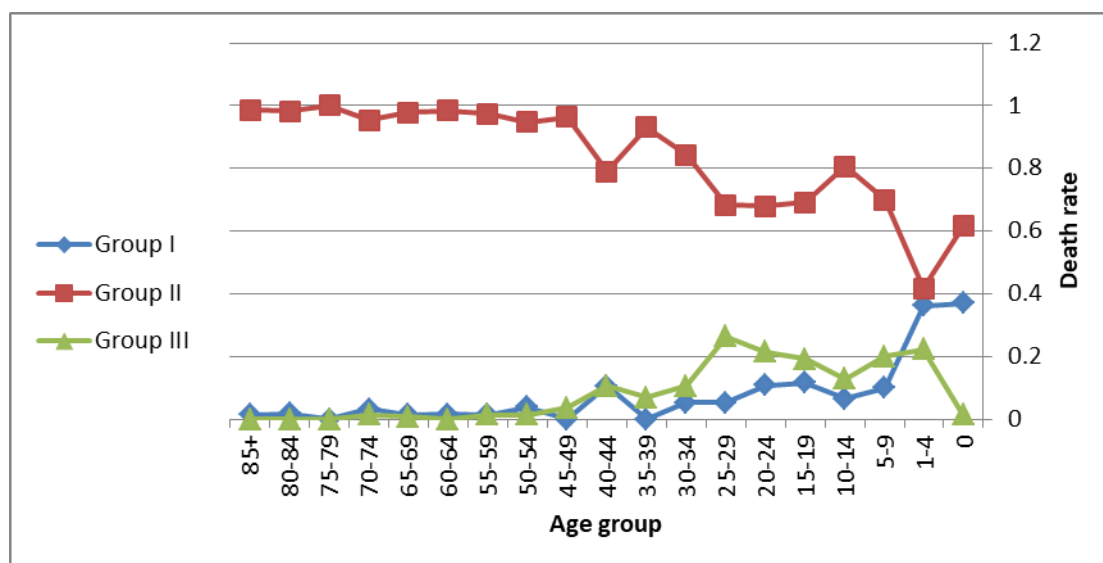
The study showed that the burden of disease in Salahaldin province shows a significant increase in the non-communicable diseases group (group II) by 84% of the causes of death. While the proportion of communicable diseases and maternal and neonatal morbidity (group I) was 5% of the total deaths, and the proportion of injuries (group III) 12% of total deaths as well.



**Figure (1): Disease burden in male**



Figure (1) shows the high rate of mortality (group III) in males in the age groups (5-10 years) and up to the age (40-44 years), while the second group is the largest proportion in the rest of the age groups, especially in Older phases.



**Figure (2): Disease burden in female**

Figure (2) shows that the mortality rate due to the causes of the second group is the highest in all age groups among females.

10. Ten major causes of death:

The study showed that the top ten causes of death in Salahaldin Governorate were as follows:

**Table (4): Major causes of death in Salahaldin province**

	Causes	Death number	Death rate
1	Other cardiovascular diseases	982	%30,0
2	Cerebrovascular diseases	457	%14,0
3	Ischemic heart diseases	444	%13,6
4	Nephrosis and nephritis	174	%5,3
5	Unspecified injuries and accidents	145	%4,4
6	Diabetes	107	%3,3
7	Other infectious diseases	101	%3,1
8	Hypertention	87	%2,7
9	Unintentional accidents	76	%2,3
10	Other genitourinary diseases	59	%1,8

11. Unspecified causes of death:

The total number of deaths due to unspecified causes was (1464) deaths (44.7%) of which (790) males and (674) females.

Table (5): unspecified causes of death

Category	Number of unspecified death	Number of unspecified death in males	Number of unspecified death in females
I. Infectious diseases	88	47	41
II. Tumors	2	2	0
III. Blood diseases	0	0	0
IV. Endocrine and nutritional diseases	5	2	3
IX .Cardiovascular diseases	1017	501	516
X .Respiratory diseases	19	12	7
XI .Gastroenterological diseases	4	1	3
XIV .Genitourinary diseases	168	88	80
XVI .Perinatal diseases	0	0	0
XVIII .General signs and symptoms	16	8	8
XX .External causes	145	129	16

Table (5) shows that most of the unspecified causes mentioned in the deaths of Salahaldin governorate were in the category of diseases of the circulatory system, then diseases of the genitourinary system, and external causes, respectively.

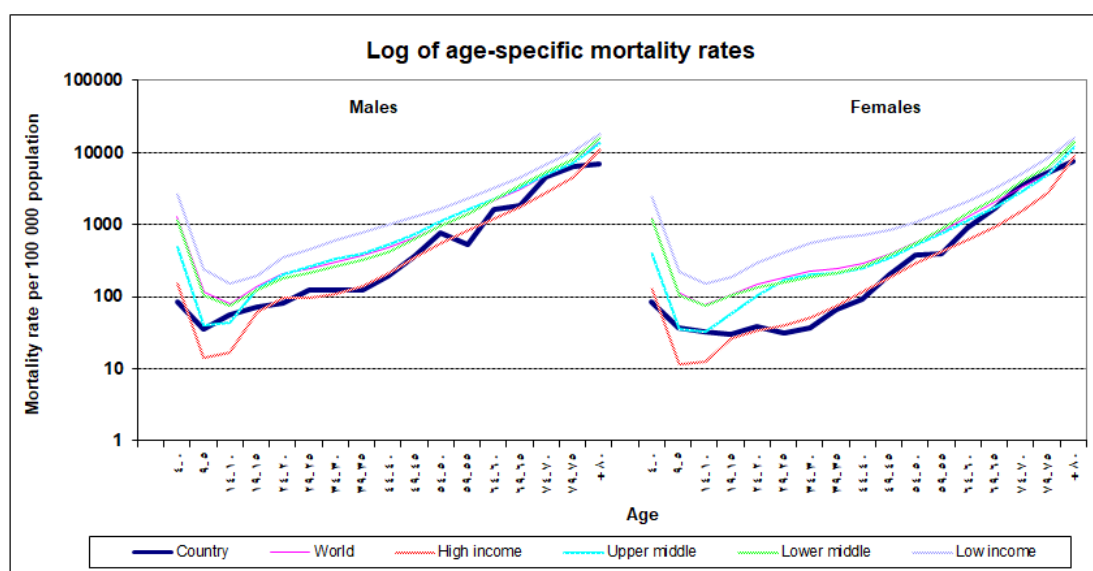


Figure (3): comparison between mortality rate in Salahaldin and other communities

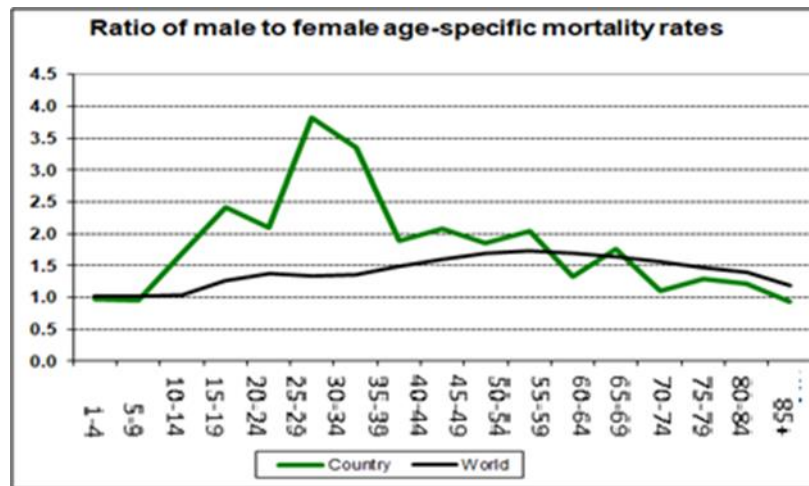


Figure (4): comparison between male/female ration in Salahaldin and world

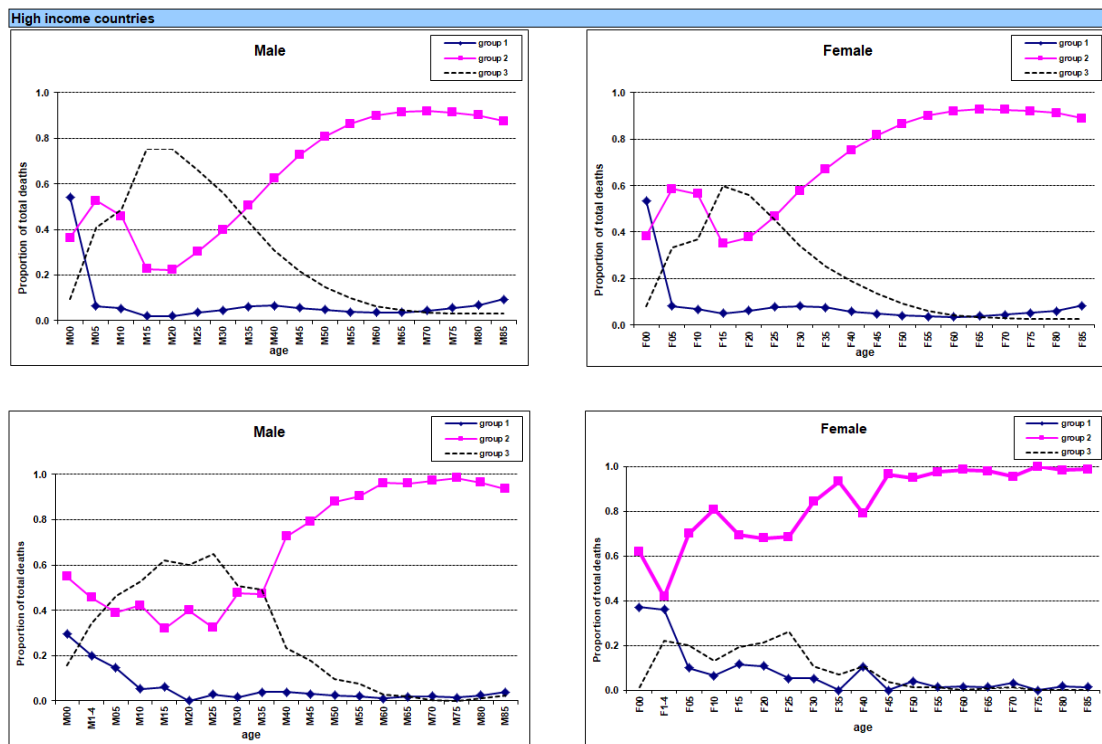


Figure (5): comparison between diseases burden in Salahaldin and other communities

### Discussion:

In 2018, Salahaldin province witnessed an increase of 921 deaths from 2017, which reached 2,523 deaths.(6) This increase is probably due to an increasing number of people displaced back to their places of residence resulting in an unforeseen increase in population.

With regard to the distribution of deaths by age groups, the age-specific mortality curve in Salahaldin governorate for 2018 is very similar to that in high-income communities, where the highest rates are in the older age groups, while the under-five group shows a slight increase in comparison with the next childhood and youth categories.

Figure (3) shows a comparison between the distribution of deaths by age groups in the current study with communities in terms of financial income per capita, and shows the similarity of the province curve to the curve of high-income communities.

Figure (3): comparison between mortality rate in Salahaldin and other communities

The slight increase in under-one mortality from other groups is mainly due to the fact that this group is more threatened by perinatal diseases and congenital malformations leading to death than other age groups.

The increase in the number of males deaths over females deaths in

most middle age groups is due to the fact that males are more vulnerable to external causes of death than females in Salahaddin governorate because they are the most active in the field of work and others.

The same interpretation applies to the statement of the cause of the high mortality rate among males than among females in the middle age groups, where males are more liable to external causes leading to death.

The crude mortality rate in Salahaldin governorate is not significantly different from the death rate across Iraq, where the crude death rate for Iraq in 2017 was (2.2) deaths per 1000 population, males (2.4) deaths per 1000 inhabitants, and females (2.1) death per 1000 population.(6) It should be noted that the mortality rate has gradually decreased over the past years, with the crude death rate in 2010 reaching 4.2 deaths per 1000 population.(7)

As for the average life expectancy, the study showed that the average life expectancy (80.0 years) is greater than what was confirmed in the annual statistical report of the Iraqi Ministry of Health for 2017. It is worth mentioning that the province of Salahaldin is the second province of Iraq in this criterion after Governorate of Mesan.(6)

The study showed that the infant mortality rate is very low compared to

the rest of the governorates of Iraq,(6) and the overall rate in Iraq and the world.(9) The main reason is mostly due to poor registration of deaths of children at the perinatal stage, as there are no restrictions on the burial of the dead in the province.

For the same reason mentioned above the mortality rate of children under five years of age is lower than the general rate for Iraq and the world.(4)

Figure (4) shows a comparison between the ratio of male to female mortality per age group with the global ratio where it is clear that mortality in Salahaldin province shows a higher rise in this ratio in the active age groups after childhood and up to the last year. This may be explained by the fact that males in post-puberty are more likely to have external causes of death than females, especially in rural and semi-rural communities such as Salahaldin.

Figure (4): comparison between male/female ration in Salahaldin and world

The study shows that the mortality rate of males begins to rise gradually in lower ages (5 years younger) than in females. This model is almost identical to mortality rates in the rest of the world.(8)

The disease burden study showed that the male mortality model in Salahaldin governorate is similar to that in high-income countries in terms

of injuries being the leading cause of death in middle age groups, while non-communicable diseases are the leading cause in other age groups. With the exception of the low incidence of females, the model is similar to that found in high-income countries(5), as shown in Figure 5

Figure (5): comparison between diseases burden in Salahaldin and other communities

By comparing the mortality rate from non-communicable diseases (group II) to deaths from communicable diseases (group I) (17.9) with the income-categorized communities, it appears that Salahaldin community is close to the high-middle-income community model (13.1).

The top ten causes of death in Salahaldin:

The study showed that the top ten causes of death in Salahaldin governorate are very similar to the first causes of death in high-income communities in that they are mostly associated with heart disease and circulatory system, with injuries being noted as one of the main causes in Salahaldin governorate due to the often weak traffic laws.

The list of major causes in females also shows the presence of cancerous tumors, especially breast cancer due to poor cancer control programs and lack of awareness of the importance of early detection.

The list of leading causes of death for children under five shows that birth defects and perinatal impairments are among the leading causes of this age group.

Unspecified reasons:

The presence of unspecified causes in such high percentage in Salahaldin Governorate can be considered as evidence of the weak diagnostic capacity of the health system. This weakness is generally due to three main reasons:

The lack of technical diagnostic capabilities in health institutions such as radiological and laboratory diagnostic devices, or because of the lack of materials and environment necessary for these technologies.

Lack of the necessary staff to work on the diagnostic aids such as radiologists, laboratory and other health staff, or lack of skills and experience to work on them.

Lack of accuracy in describing the diagnosis when writing the death certificate, due to poor awareness of the importance of documenting the causes of death or to avoid obligations based on the reasons.

Conclusion:

- Most of the deaths in Salahaldin province in 2018 were in the old age groups and for reasons mostly related to non-communicable diseases such

as heart disease, circulatory system, high blood pressure and diabetes.

- Deaths from infectious diseases were not high, especially among children, confirming the role of preventive programs and immunization in this regard.

- A large proportion of deaths are not adhered to in the fundamentalist form, especially in the category of newborns, due to the weak laws related to the burial of the dead and the issuance of death certificates.

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