

# Secular trend of infant mortality rate during wars and sanctions in Western Iraq

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## ABSTRACT

**الأهداف:** دراسة اتجاه التغيير لمعدل وفيات الأطفال دون السنة من عام 1987 ولغاية 2010 في مدينة حديثه، غرب العراق وذلك في فترة الحصار الاقتصادي والحرب.

**الطريقة:** أُجريت هذه الدراسة خلال الفترة من يوليو إلى ديسمبر 2010م. لقد تم جمع البيانات من سجلات الولادات والوفيات من مركز حديثه للإحصاءات الحياتية في مدينته حديثه (80000 نسمة) الواقعة في محافظة الأنبار غرب العراق. وتتضمن البيانات اسم، وعمر، وجنس، ومحل الإقامة، وولادة ومحل وفاة كل طفل رضيع مشمول في الدراسة في خمسة مراحل مرت على البلاد منذ 1987م إلى 2010م. لقد تمت مقارنة وتحليل معدلات وفيات الأطفال الرضع ومقارنتها مع معدلات الدراسات الأخرى.

**النتائج:** أشارت نتائج الدراسة إلى أن معدلات وفيات الأطفال الرضع قد كان 35.6 لكل 1000 ولادة حية في عام 1987، ثم تراجعت في فترة الهدوء وعدم وجود الحروب في البلاد لتصبح 28.6 لكل 1000 في عام 1990. وقد ازدادت هذه المعدلات تدريجياً بعد احتلال الكويت وبداية الحصار الاقتصادي (1991-2003م) وحرب الخليج لتصبح 46 لكل 1000 في نهاية عام 2002م قبل احتلال البلاد عام 2003م. ثم نزلت لتصل إلى 16 لكل 1000 في 2006م وذلك خلال فترة رفع الحصار وزيادة العنف في البلاد، ووصلت هذه المعدلات إلى 24.5 في عام 2010م. أظهرت النتائج أن ثلثي عدد وفيات الأطفال حدثت في الشهر الأول من العمر، والثلث الباقي كانت ما بين عمر شهر إلى سنة واحدة. وكان معدل الوفيات أكثر عند الذكور من الإناث، ونسبة الوفيات كانت أعلى في الريف عنها في المدينة.

**خاتمة:** لقد كان للحصار الاقتصادي تأثيراً أكبر على زيادة معدل الوفيات لدى الأطفال الرضع من تأثير الحروب. وعند المقارنة بمناطق العراق الأخرى وبالرغم من الحروب والحصار الاقتصادي للعراق فإن معدل الوفيات في مدينته حديثه خلال 24 عاماً المشمولة في الدراسة كانت أقل من نتائج الدراسات التي أجريت في مناطق أخرى للعراق ولكنها ما زالت أعلى من معدلات الدول المتقدمة وقسم من الدول النامية.

**Objectives:** To study the infant mortality rate (IMR) trend during wars and sanction periods in Western Iraq.

**Methods:** Data collected from the birth and death certificates of Haditha Health Vital Statistics Center, Haditha city (80,000 population), Western Iraq, included name, age, gender, residence, and infant's place and date of births and deaths, in 5 different sanction and war stages of the country from 1987 to 2010, in a study period from July to December, 2010. The IMRs were analyzed and compared between these stages and with other studies.

**Results:** The IMR of last 2 years of the Iraq-Iran war (1980-1988) was 35.6/1000 and 33.8/1000, this decreased in the war free period (1989-1990) to 28.6/1000, then increased during the sanction period (1991-2003) to 46/1000 in 2002, decreased to 16/1000 in 2006 during no sanctions but increased violence, then increased to 24.5/1000 in 2010. Approximately two-thirds of deaths occurred during the neonatal period, and one third in the post neonatal periods. Males had higher IMR than females, and rural residence higher than urban.

**Conclusion:** Economic sanctions increased IMR more than wars or violence in Haditha city. When compared with other parts of Iraq, and despite the different conflicts that faced the country during the 24 studied years, Haditha had a lower IMR, however, this was still higher than developed, and many developing countries.

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Infant mortality rate (IMR) is defined as the number of deaths occurring from birth to one year of age per 1000 live births.<sup>1</sup> It includes the neonatal and post neonatal mortality rates. Neonatal mortality rate (NMR) is the number of deaths in the first month of life per 1000 live births, and the post neonatal mortality rate (PNMR) is the number of deaths from one month of age to the end of the first year of life per 1000 live births.<sup>2</sup> From all childhood (0-14 years) mortalities, 70% occur within the first year, 46% within the first month, and 35% within the first week of life.<sup>3</sup> The IMR varies greatly by countries and it is highest in developing countries.<sup>1</sup> Iraq, a country which after decades of wars conflicts in the 1980s and the early 1990s, has been under comprehensive United Nations economic sanctions for 13 years from 1991 to 2003.<sup>4,5</sup> The United Nations Economic and Social Commission for Western Asia (ESCWA) reported that almost 3 quarters of the Iraqi population became poor despite the food rationing system, which was established in 1991 and that, the absolute poverty increased from 25% in urban and 33% in rural areas in 1988 to reach 72% in urban areas and 66% in rural areas in 1993.<sup>6</sup> In 2001, the World Bank estimated that 27.2% of the Iraqi population was living on less than \$2 per day.<sup>7</sup> Such a unique situation and extreme poverty causes the infant mortality in Iraq to increase to an upward trend never reached before.<sup>8,9</sup> Reports showed that countries such as Egypt, Indonesia, and Bangladesh have made the most progress in reducing the child mortalities, while Iraq, Botswana, and Zimbabwe have the most regress in reducing their IMRs.<sup>10</sup> The increased prevalence of low birth weight recorded in Iraq in the past 3 decades added another factor for the increase of the IMRs.<sup>11-13</sup> This is a study of the IMR in Western Iraq, and compare the rate through different stages of wars, sanctions and conflicts in the country, and studies the effect of these conditions on the IMR of Haditha city, one of the western districts of Al-Anbar Governorate, western Iraq.

**Methods.** This is a retrospective descriptive population record study carried out in Haditha city (260 Km west of Baghdad, 150 km west of Al-Ramadi, the center of the Governorate), Al-Anbar Governorate, Western Iraq. We studied the effect of wars, violence, and sanctions on the IMR over 24 years composed of 5 different stages imposed on the country from 1987 to 2010, and applied in a study period from July to December, 2010. The first stage was the last 2 years (1987 and 1988) of the Iraq-Iran war (1980-1988), the second stage was a 2 years war free period of the country (1989 and 1990) following the end of the Iraq-Iran war in August 1988 until the Iraqi occupation of Kuwait in August 1990. The third stage continued for 13 years

(1991-2003) starting from the Kuwait occupation that lead to the Gulf war in 1991 and its following comprehensive UN economic sanctions (1991-2003), until the invasion and occupation of Iraq in 2003 by the UN Coalition Forces militaries. The fourth stage from 2003 to 2007, started after the coalition forces occupation of the country, and despite the lifting of the sanctions in this period, there were successive different wars and increased violence inside most of Iraqi cities leading to loss of security and destruction of most of the health services and facilities. The fifth stage was from 2008 to 2010 when violence decreased, and health facilities and security conditions improved in most Iraqi cities including Haditha city.

All live births and infant deaths of the 24 studied years were included in the study. Data were collected from the birth and death certificates recorded in Haditha Health Vital Statistics Center of Haditha city (80,000 population). This included name, gender, residence, date of birth, and age of death of each infant that died during infancy during the 24 studied years. Deliveries occurred in Haditha general hospital, health centers, and midwife deliveries, and all deaths registered in the Haditha Vital Statistics Center were included in the study. Deliveries and deaths from outside Haditha residence were excluded.

The Research Ethical Approval Committee of the Medical College, Al-Anbar University, Iraq, approved the research.

The IMRs were compared between these stages and with other studies. Data were analyzed using the EPI-Info version 3.5.1, 2008 statistical package. Chi-square was used for statistical analysis, and  $p < 0.05$  was considered significant.

**Results.** During the 24 studied years, the total number of live births in Haditha city was 59,424, composed of 29,931 males and 29,493 females, giving a male to female ratio of 1.01. The total number of deaths was 2002, composed of 1025 males and 977 females, giving a male to female ratio of 1.05, and comprising 3.4% of the live deliveries. The overall IMR of the 24 years was 33.7/1000 live births, 34.2 for males, and 33.1 for females/1000 live births. Their difference was statistically not significant ( $p=0.95$ ). Table 1 shows the number of births, deaths, and IMRs in Haditha city for each of the 24 studied years. The highest rate was seen in the economic sanction third stage period (1991-2003) when it reached 46/1000 in 2002, the last year of the economic sanctions. The IMR increased by approximately 62% in this period, while the lowest rate was seen in the fourth stage (2003-2007), the stage of lifting of sanctions, but with increased violence in which the rate came down to 16/1000 in 2006 that

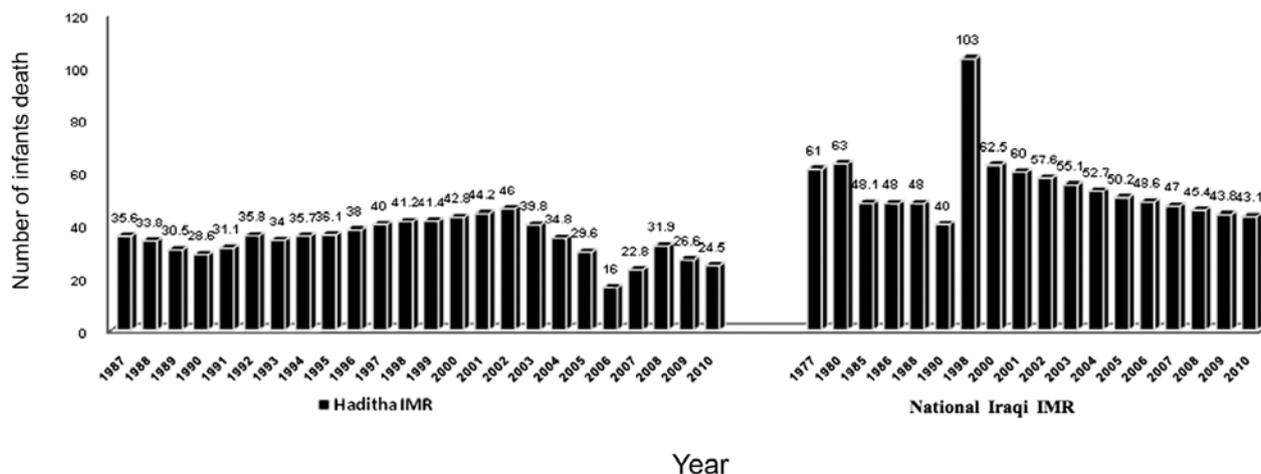
was the lowest recorded rate of all the 24 studied years. **Figure 1** compares the Haditha IMR with that of the Iraqi national rate. Both rates had a decreasing pattern in the first, second, and the fifth stages, and an increasing rate reaching its maximum during the sanction periods of the

third stage, while in the fourth stage (2003-2007), the stage of war and increased violence without sanctions, although both rates were decreasing, the recorded Haditha rate unexpectedly reached its minimum rate in 2006, the year of maximum terror and violence in the country and Haditha city. **Figure 2** shows the IMR in both the neonatal and post neonatal periods during the 24 studied years. Two-thirds (66.5%) of deaths found occurred during the neonatal, and one-third (33.4%) during the post neonatal periods of infancy. **Figure 3** shows the distribution of the IMR among rural and urban residence areas. The studied dead infants were found in 61% of rural and 39% of urban residences.

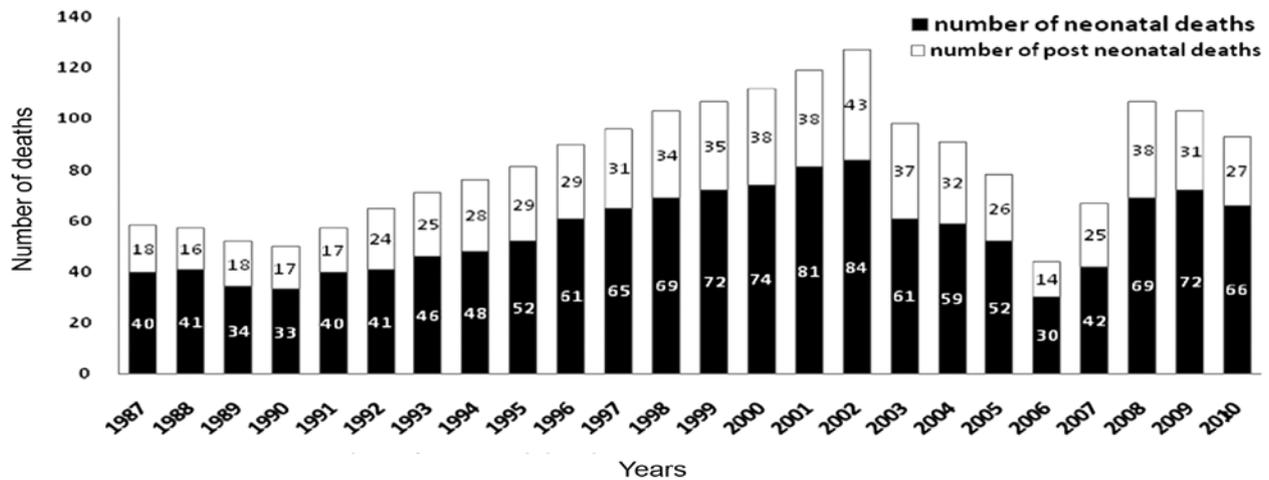
**Table 1** - Haditha infant's birth, death, infant mortality rate (IMR) and mean for each stage in the 24 studied years.

| Year         | Infant births | Infant deaths | IMR  | Mean IMR |
|--------------|---------------|---------------|------|----------|
| 1987         | 1631          | 58            | 35.6 | 34.7     |
| 1988         | 1688          | 57            | 33.8 |          |
| 1989         | 1703          | 52            | 30.5 | 29.5     |
| 1990         | 1748          | 50            | 28.6 |          |
| 1991         | 1835          | 57            | 31.1 | 38.8     |
| 1992         | 1982          | 65            | 35.8 |          |
| 1993         | 2091          | 71            | 34.0 |          |
| 1994         | 2126          | 76            | 35.7 |          |
| 1995         | 2241          | 81            | 36.1 |          |
| 1996         | 2368          | 90            | 38.0 |          |
| 1997         | 2403          | 96            | 40.0 |          |
| 1998         | 2502          | 103           | 41.2 |          |
| 1999         | 2586          | 107           | 41.4 |          |
| 2000         | 2618          | 112           | 42.8 |          |
| 2001         | 2693          | 119           | 44.2 |          |
| 2002         | 2761          | 127           | 46.0 |          |
| 2003         | 2461          | 98            | 39.8 | 28.6     |
| 2004         | 2612          | 91            | 34.8 |          |
| 2005         | 2684          | 78            | 29.6 |          |
| 2006         | 2737          | 44            | 16.0 |          |
| 2007         | 2939          | 67            | 22.8 |          |
| 2008         | 3355          | 107           | 31.9 | 27.7     |
| 2009         | 3863          | 103           | 26.6 |          |
| 2010         | 3797          | 93            | 24.5 |          |
| <b>Total</b> | <b>59424</b>  | <b>2002</b>   |      |          |

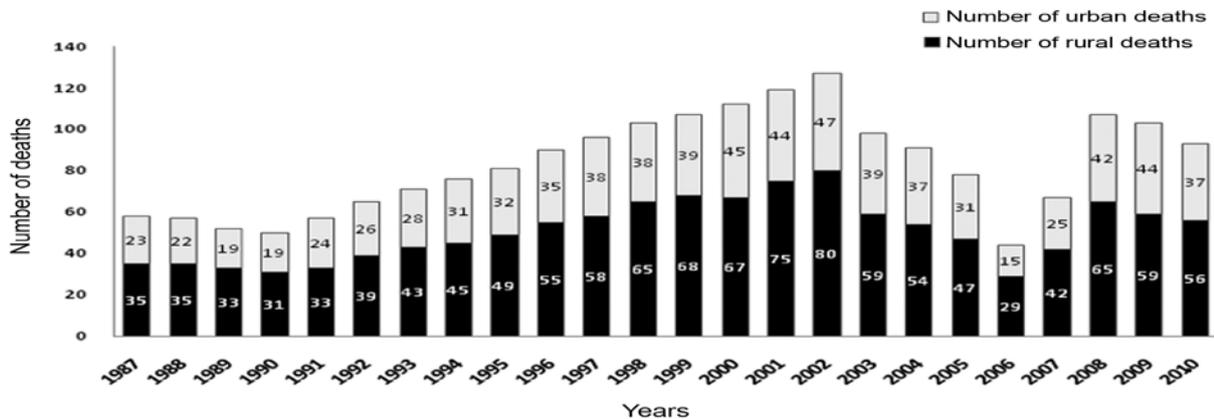
**Discussion.** Infant mortality rate and income remains an important closely associated demographic and social indicator, revealing the socioeconomic disparities between the different social groups, especially in the less developing countries.<sup>14</sup> The IMR varies greatly with the economic status of countries. Low rates were recorded in Singapore (2.29/1000), Sweden (2.77/1000), and Japan (3.26/1000), moderate rates in Saudi Arabia (13.2/1000), United Arab Emirates (14.5/1000), and Jordan (17.35/1000), while higher rates were recorded in the poor Angola (187.4/1000), Afghanistan (163/1000), and Sierra Leone (162.55/1000) countries in 2005.<sup>15</sup> In 1977, and before the starting of wars in Iraq, the estimated Iraqi national IMR was 61/1000.<sup>16</sup> Targeted programs were implemented since the 1980s, despite the Iraq-Iran War (1980-1988), to improve the infant's health conditions through vaccine coverage, promoting breast feeding, planning for reducing diarrheal morbidities and mortalities as well as the provision of facilities for improving domestic hygiene.<sup>17</sup> These measures were successful and followed by an accelerated decrease in the national IMR from 63/1000 in 1980, to 48.1/1000 in 1985, and 40/1000 in 1990



**Figure 1** - Haditha infant mortality rate (IMR) compared with the National Iraqi IMR.



**Figure 2** - Number of neonatal and post neonatal deaths in Haditha city of each of the 24 studied years.



**Figure 3** - Number of rural and urban infant's deaths in Haditha city for each of the studied year.

(Figure 1), before the start of the Gulf war in January 1991.<sup>18-20</sup> Haditha city was included in these programs, and its IMR was 35.6/1000 in 1987, and decreased to 28.6/1000 in 1990. Such lower Haditha IMRs compared with the national rates may be due to the far western location of the city far away from the burning eastern Iraqi-Iranian frontiers during the Iraq-Iran war. Since the 1990s, and after the Iraqi invasion of Kuwait in August 1990 and the start of the Gulf War and its following associated 13 years UN economic sanction period (1991-2003), many reports from Iraq recorded a significant increase in the infant mortalities and massive deterioration of the health services and socioeconomic circumstances with reduction of the survival chances among young children under the effect of the economic sanctions.<sup>10,21</sup> During this period, the Iraqi gross national product (GNP) per capita dropped from a moderate income of \$3,508 in 1987 despite the 8 years Iran-Iraq war, to reach a very low income of \$65 in 1992 during the sanction years.<sup>16</sup> The IMR in Haditha city increased

from 31.1/1000 in 1991, the first year of sanction, to reach its maximum rate of 46/1000 in 2002, the last sanction year, before the lifting of sanctions in May 2003 following the 2003 occupation of Iraq.<sup>5</sup> Also, the national IMR in this period increased from 40/1000 in 1990, to reach its maximum rate of 103/1000 in 1998.<sup>19</sup> The IMR in the center and south of Iraq was higher and was 102.8/1000 in 1994, and 113/1000 in 1998<sup>22</sup> when compared with the same years recorded in Haditha city (35.7/1000 in 1994, 41.2/1000 in 1998). The center and south of Iraq were severely affected by the 1991 post Gulf War uprising, and the health and social services were looted or destroyed during these events when compared with other parts of the country.<sup>22</sup> Such uprising did not occur in Haditha city and other districts of the Al-Anbar Governorate. Following the Gulf War and its 13 associated sanction years, several events, conflicts and incomppliance between the Iraqi government and UN members, especially USA and UK, ended finally with another disaster, the invasion

and occupation of Iraq in March 2003 by the Coalition Forces Militaries.<sup>23</sup> This invasion, despite the lifting of sanctions, added a disastrous second destruction of the remaining weak infrastructure and health facilities, causing further loss of health services, resources, and security conditions. This was also the cause of increasing violence and terror in most Iraqi cities including Haditha city, and the spread of this violence from one region to another, which forced people to either migrate or face life tragedies.<sup>24</sup> The recorded IMR of Haditha city in this period was 39.8/1000 in 2003, decreased to 29.6/1000 in 2005 and to an unexpected minimum rate of 16/1000 in 2006, the 2 years of peaked violence in Iraq, then increased to 22.8/1000 in 2007. This paradoxical decrease of IMR during violence and wars was due to some families left the city migrating to other safer areas inside or outside the country, and the violence and terror in the country were directed more to selected adult males, causing an increase of their mortality rates more than infants or adult females.<sup>25,26</sup> Also the health facilities, services, and birth and death registrations in Haditha city became poor since many doctors and health employers left the city and the communication and supplements of new drugs and certificates from the central health administration was very difficult or absent. This led some families to bury their dead infants without death certificates, while for the new births, parents were more encouraged to register, since most deliveries were of midwife types with delivery certificates, and any registered neonate in Iraq receives a monthly dried milk and food ration that continues as long as he is alive. Such a constellation of diverse and different variables made the recorded Haditha IMR which is expected to be higher during this violence or at least not affected, reaching unexpectedly low rates. Since 2008, the violence has decreased and security conditions improved, and recording of births and deaths was more complete and the IMR in Haditha city reached a reasonable level of 31.9/1000 in 2008 to decrease with more improved conditions to 24.5/1000 in 2010.

Two obvious major factors were affecting the IMR in our study wars or violence, and economic sanctions. This study passed through 5 different stages within the 1987-2010 study period with different effects on the IMR. The first stage (1987 and 1988) is the stage of war (Iraq-Iran war) without economic sanctions. The second (1989 and 1990) is the stage of no wars and no sanctions. The third (1991-2003) is the stage of no war but of comprehensive economic sanctions. The fourth (2003-2007) is the stage of wars and increased violence despite the lifting of economic sanctions. The fifth stage (2008-2010) is the stage of no war with decreased violence and no sanction periods. Both the

national and Haditha IMRs showed a decreasing rate in the no sanction no war second stage and fifth stage periods, while in the third stage of the no war but 13 years economic sanctions period, both the national and Haditha IMRs progressively increased reaching their maximum rates, while in the first and fourth stages, the stages of wars and increased violence without sanction, both showed decreasing rates.<sup>27</sup> Iraq is one of the well-known important oil producing and exporting countries in the world, and is the fourth country in the world in its oil reserves after Saudi Arabia, Canada, and Iran,<sup>28</sup> and it continued exporting oil, although in a decreased rate, during the Iraq-Iran war (1980-1988),<sup>29</sup> which was the longest and the most destructive war in recent centuries since the second world war. The lowered IMRs in this period may be because the Iraq-Iran war was mainly on the eastern borders of the country far away from the capital and most of the Iraqi cities including Haditha city, and no sanctions were applied to the country in this war, and financially, people were less affected than the sanction period in 1990s, and also the government spending on health services and program applications helped in reducing the IMR.<sup>17</sup> In the fourth stage from 2003-2007 after the lifting of the UN economic sanctions and the increased Iraqi GDP from \$25.77 Billion in 2004 to \$84.14 in 2010,<sup>30</sup> there was an increase of violence and bombings in the country while the national infant mortality was found to decrease in its rate. This may be because the continuous military actions and increased violence and explosions inside cities were mainly in the center including Haditha city, while the large north and south parts of the country were less affected, making the recorded local perinatal mortality rates, birth defects, low birth weight rates and IMRs high,<sup>31-34</sup> while the national IMR continued decreasing in its rate, as these are hospital based studies, their registrations may be less affected during the loss of security conditions than population based studies, and also the low birth deliveries, neural tube defects, and perinatal mortalities are related directly to the health of mother during the pregnancy, and different than the IMR which is more related and affected by the post natal environmental and security conditions. The secular trend of the under-5 mortality rate was of a similar pattern to that of IMR when it decreased from 127/1000 in 1970, and 87.8/1000 in the second half of the 70's during the prewar period of Iraq, to 63/1000 in 1980, then to 58.9/1000 in the second half of the 80's during the Iraq-Iran war, to reach 50/1000 in 1990 after the end of this war, then increased during the sanction period in 1994-1999 to 124.5/1000, reaching its maximum in this period at 125/1000 in year 2000, to continue on this rate following lifting of sanctions until 2004, then decreased again to 40/1000

in 2008 and 39/1000 in year 2010,<sup>21,35,36</sup> which was the lowest recorded rate in this period after improvement of the country's security conditions. These indicate that economic sanctions, especially when prolonged, have a more dangerous effect on the health and survival of infants and children than wars or violence. This is through the slow sustained long uniform comprehensive effect on the availability of nutrition, drugs, and health facilities, exhausting the people's financial resources, limiting their choices for survival or migration, leading to epidemic different malnutrition and organic and psychological diseases of both infants and their pregnant or feeding mothers, and causing an increase of the infant and child morbidities and mortalities, while wars or increased violence without sanctions, especially when occurs in oil producing countries, since they can find a way to export their oil, will mostly increase the rates of accidental traumatic injuries, which can differ from one region to other, and the violence is directed mostly to adults rather than infants, and the recorded IMR may be low while the real rate is expected to increase, but not to the level of sanction IMR. Such a sanction effect was found different in Berggren et al's study,<sup>37</sup> when they found during the 1991-1994 Haiti economic sanction period a decline in their IMRs from 48/1000 to 39/1000 in the first 2 sanction years, while the mortality of 1-4 year old children increased from 10/1000 to 18/1000 in its rate. Also, the result was found different from that of Damrosch's study when he hypothesized that sanctions had a similar but less severe effect on civilian populations than the effect of wars.<sup>38</sup>

We recorded a high NMR when compared with the PNMR mortalities. This was consistent with records of Iraqi<sup>22</sup> and Brazilian studies.<sup>14</sup> Mortality in the first month of life is associated with problems related to the infant and the pregnancy conditions such as preterm delivery, low birth weight, and birth defects and anomalies, while after the first month of life, it is greatly associated with social and environmental factors such as the availability of nutrition, drugs, and access to health care facilities.<sup>39</sup> The increased rate of low birth weight, premature, and birth defect associated deliveries in Iraq in the last decades was noticed by many studies,<sup>9,11-13,31-33</sup> which adds another factor for increasing the IMR.

No significant association was noticed between the IMR and gender in this study. This was inconsistent with other studies<sup>14,21</sup> that recorded a higher IMR in males than females. We recorded a higher IMR among infants from rural areas than urban, which is in agreement with other studies.<sup>14,21,24</sup> The rural death rate was found approximately 33% higher than the urban rate in this study. This is expected since poverty, poor health services and facilities are more common in rural than urban areas.<sup>40</sup>

The study was limited by the fact that it did not record the causes of infant deaths which will clarify whether deaths were due to malnutrition and medical diseases of sanctions, or the trauma or injuries of wars, or of both.

In conclusion, the recorded IMR in Haditha city was found to increase more during economic sanctions than violence or wars. A very low IMR was seen during the peak of violence in Haditha city as which may be due to the effect of poor security on the registration of births and deaths rates. When compared with other parts of Iraq and during the different conflicts that faced the country over the 24 studied years, Haditha was found of lower IMR, however, this was still higher than developed and many developing countries. Another study which includes the whole Anbar Governorate IMR is recommended and will be more informative when compared with the national IMR.

**Implications of results.** Local population based records and national mortality rates may give results that do not always follow their current environmental conditions during increased violence and wars when compared with during economic sanctions, since death and birth registration are more affected during poor security conditions and wars, while during economic sanctions, registrations are strictly followed by the government for financial reasons, and their results usually follow their expected rates. Hospital based studies are better at following the current environmental conditions since birth, death, and other registrations are more precise and accurate in hospitals and less affected by security conditions than population record studies, and their results usually follow the expected rates during both economic sanctions and increased violence and wars. The disastrous effect of imposing prolonged economic sanctions on populations will destruct the population's health and facilities, increasing their morbidities and mortalities.

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