Higher Population Council - Jordan
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# Twin Births in Jordan

## Facts and Risks

2025

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# Introduction

Twin births in Jordan, like in other countries, can be either identical (monozygotic, derived from a single fertilized egg) or fraternal (dizygotic, derived from two separate fertilized eggs). According to Mayo Clinic[1], fraternal or dizygotic (DZ) twins, the most common type of twins, result from the fertilization of two separate eggs by two independent sperm. Each twin develops with its own placenta and amniotic sac[2]. Each twin has a distinct genetic makeup, meaning they are not genetically identical and can exhibit different characteristics, including a combination of sexes (male and female, two males, or two females).

On the other hand, identical or monozygotic twins (MZ) are produced when a single fertilized egg splits and grows into two embryos. After a period of between two and twelve days of pregnancy, the development of the embryonic layers begins to divide, forming clear members and structures in monozygotic twins. They share the same placenta and possibly the same amniotic sac within the same placenta, or they may have separate amniotic sacs within the same placenta. Genetically, the two children become identical, meaning they have the same genetic makeup and share the same sex (either two males or two females) as well as the same inherited traits or characteristics and physical features.

Triplets and higher-order multiples (more than three fetuses) can be either identical, fraternal, or a combination of both. In rare cases, identical twins fail to separate completely, resulting in conjoined twins. This is attributed to delayed division after fertilization, occurring between 13 and 15 days of gestation, which can lead to incomplete separation of the embryos.

Since the 1980s[3], the global twin birth rate has increased by one-third, from 9.1 twin births per 1,000 births in 1980-1985 to 12.0 twin births per 1,000 births in 2010-2015. Two main factors have contributed to this trend: the increased use of assisted reproductive technologies and the significant rise in the average maternal age at childbirth, as mothers around the world are having children at relatively older ages. At this age, the chances of having twins are higher due to hormonal changes that may lead to the release of more than one egg at a time.

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1 https://www.mayoclinic.org/ar/healthy-lifestyle/pregnancy-week-by-week/in-depth/twin-pregnancy/art-20048161

2 Amniotic sac: The fluid-filled sac that surrounds and protects the fetus in the uterus, helping to regulate its temperature.

3 Christiaan Monden, Gilles Pison, and Jeroen Smits, Twin Peaks: more twinning in humans than ever before, Human Reproduction, Vol.00, No.0, pp. 1–8, 2021, https://doi.org/10.1093/humrep/deab029

This "surge" in twin births presents a public health challenge[4], as twin pregnancies are associated with risks for both the mother and the child. There are higher risks of miscarriage, infant and child mortality, and twin births tend to be preterm. Their health is often weaker than singletons, at least during the early years of life. Twins are also born with lower birth weights, and the risks to the mother during pregnancy, delivery, and postpartum are increased. Deliveries are more complicated, and mothers are exposed to various risks such as preeclampsia, anemia, gestational diabetes, postpartum hemorrhage, preterm birth, and postpartum depression and anxiety. Additionally, families face financial pressures due to the ongoing challenges related to the health and growth of twins and the cost of neonatal care units, as well as the cost of their nutrition compared to families with single-birth children. Therefore, twin pregnancy and birth require additional care and support from the early stages of pregnancy through the early years of the children's lives to manage or address the complications associated with the pregnancy.

Jordan Population and Family Health Survey (JPFHS) indicate a rising trend in the twin birth rate. The rate increased from 24.4 twin births per 1,000 live births in 1990 to 26.2 in 1997, 27.7 in 2002, 28.6 in 2007, 31.2 in 2009, and 35.3 in 2012; representing a 45% increase over 22 years. However, it decreased to 29 twin births per 1,000 live births in 2023.

Therefore, the Higher Population Council and Share-Net Jordan prepared this paper to bridge the gap in scientific evidence related to twin pregnancies and births, to understand the specific health risks of twins and their impact on maternal and child health in Jordan. The goal is to support policies and programs that improve prenatal, natal, and postnatal maternal and child care, and to direct efforts toward enhancing care and addressing the challenges associated with twin births. This is part of the Council's objectives to improve the population’s sexual and reproductive health and to support the achievement of the Jordanian National Reproductive and Sexual Health Strategy 2020-2030, which aims to ensure comprehensive access to integrated reproductive and sexual health services and information to contribute to the well-being of individuals and families in Jordan. It also supports the achievement of the third goal of the Sustainable Development Goals 2030, which is to ensure that everyone enjoys healthy lives and well-being at all ages, specifically the first target of reducing maternal mortality and the second target of ending preventable deaths of newborns and children under five by 2030.

4 M. Mazharul Islam and Uzma Marium, Twin births in Jordan: incidence, trends, risk factors and implications for under-five mortality: evidence from the 2012 JPFHS, Cambridge University Press, 2019. Journal of Biosocial Science (2019), 51: 6, 857–874.

## 1. Global Twin Birth Rates

A study[5] titled "Twin Peaks: More Twinning in Humans Than Ever Before" aimed to answer a key question: how many twins are born in human societies, and how has this changed in recent decades? To address this, the study compiled information on national twin birth rates from statistical offices, demographic research institutes, individual survey data, and medical literature for the periods 1980-1985 and 2010-2015. As shown in Table (1), the global twin birth rate increased by one-third, from 9.1 twin births per 1,000 births in 1980-1985 to 12.0 twin births per 1,000 births in 2010-2015, representing a more than 70% increase in the number of twin births.

There are also clear increases in twin birth rates and a shift in the global distribution of twin births. With the exception of Africa and South America, where twin birth rates remained almost unchanged between the two periods, all regions showed significant increases, ranging from 32% in Asia to 71% in North America. The number of twin births increased everywhere except in South America. The table also shows that Asia and Africa are now home to more than 80% of the world's twin births, shared almost equally (42% and 41%, respectively).

**Table (1): Absolute and Relative Number of Twin Births and Total Births, by World Regions, 1980-1985 and 2010-2015**

| Continent | Number of Twin Births (Thousands) | | Relative Distribution of Twin Births | | Total Births (Thousands) | | Relative Distribution of Total Births | | Twin Rate (Twin Births/1,000 Births) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1980-1985 | 2010-2015 | 1980-1985 | 2010-2015 | 1980-1985 | 2010-2015 | 1980-1985 | 2010-2015 | 1980-1985 | 2010-2015 |
| Africa | 373 | 674 | 32% | 41% | 22,684 | 39,559 | 18% | 29% | 16.5 | 17.1 |
| Asia | 556 | 693 | 48% | 42% | 80,006 | 75,435 | 62% | 54% | 7 | 9.2 |
| Europe | 90 | 113 | 8% | 7% | 9,944 | 7,878 | 8% | 6% | 9.1 | 14.4 |
| North America | 38 | 71 | 3% | 4% | 3,937 | 4,251 | 3% | 3% | 9.9 | 16.9 |
| Oceania | 4 | 9 | 0% | 1% | 481 | 640 | 0 | 0 | 10.1 | 14.8 |
| South America | 102 | 100 | 9% | 6% | 11,772 | 10,823 | 9% | 8% | 8.7 | 9.3 |
| World | 1,156 | 1,663 | 100% | 100% | 128,827 | 138,590 | 100% | 100% | 9.1 | 12.0 |

Christiaan Monden, Gilles Pison, and Jeroen Smits, Twin Peaks: more twinning in humans than ever before, Human Reproduction Vol.00, No.0, pp. 1–8, 2021.

The study also revealed that the majority of countries experienced a significant increase in twin birth rates. In 74 out of 112 countries, the rate increased by more than 10%, while only seven countries saw a decrease of more than 10%. Furthermore, there is substantial evidence that the dramatic change in global twin birth rates is attributed to the increased use of Medically Assisted Reproduction

5 Christiaan Monden, Gilles Pison, and Jeroen Smits, Twin Peaks: more twinning in humans than ever before, Human Reproduction, Vol.00, No.0, pp. 1–8, 2021.

(MAR)[6]. MAR began in the 1970s in wealthier regions of the world, spread to emerging economies in Asia and Latin America in the 1980s and 1990s, and reached the wealthier populations of South Asia and Africa after 2000.

In the 1990s, the significant increase in twin births due to MAR began to raise concerns among medical authorities and policymakers. This was due to the public health issues associated with twin births during pregnancy, childbirth, and postpartum, including premature births, low birth weight, and increased rates of stillbirths, infants, and maternal mortality. As a result:

> Many developed countries began changing their regulations regarding MAR and clinical practices in 2000, where reductions were made in the number of embryos transferred, and attention was directed towards the successful birth of single live embryos. Therefore, the study predicts that the twin birth rates observed in these countries for the period 2010-2015 may have reached their highest level ever, and that the rates may start to decline in the next decade.

In a study[7] titled "Continuing Decline in Twin Births Since 2014," which was a response to the previous study "Twin Peaks: More Twinning in Humans Than Ever Before," the authors concluded that the previous study relied on data up to 2015 only. Their response aimed to highlight the decline in reported twin births between 2014 and 2019, both in the United Kingdom and the United States. In the UK, there was a 4.4% decrease between 2014 and 2019, from 16.0 births per 1,000 births to 15.3 per 1,000 births, according to the Office for National Statistics maternity data. In the US, a 5.3% decrease was reported, from 33.9 twin births to 32.1 twin births per 1,000 total births during the same period, according to the Centers for Disease Control and Prevention data. One explanation offered by this study for this trend is;

> Single embryo transfer policy and improvement of in vitro fertilization (IVF) techniques. The study indicates that the Human Fertilization and Embryology Authority (HFEA) in the United Kingdom introduced a policy for single embryo transfer in 2009 to reduce the chances of multiple pregnancies following IVF treatment. They set a national target to reduce the rate of multiple births conceived through IVF to 10%. This national goal was first achieved in 2017.

6 Medically Assisted Reproduction (MAR) refers to a wide range of treatments, including Assisted Reproductive Technology (ART), which involves surgically removing eggs from a woman's ovary, combining them with sperm in a laboratory, and returning them to the mother. The most common type is In Vitro Fertilization (IVF). MAR also includes procedures where a woman takes medication only to stimulate egg production without planning surgical egg retrieval.

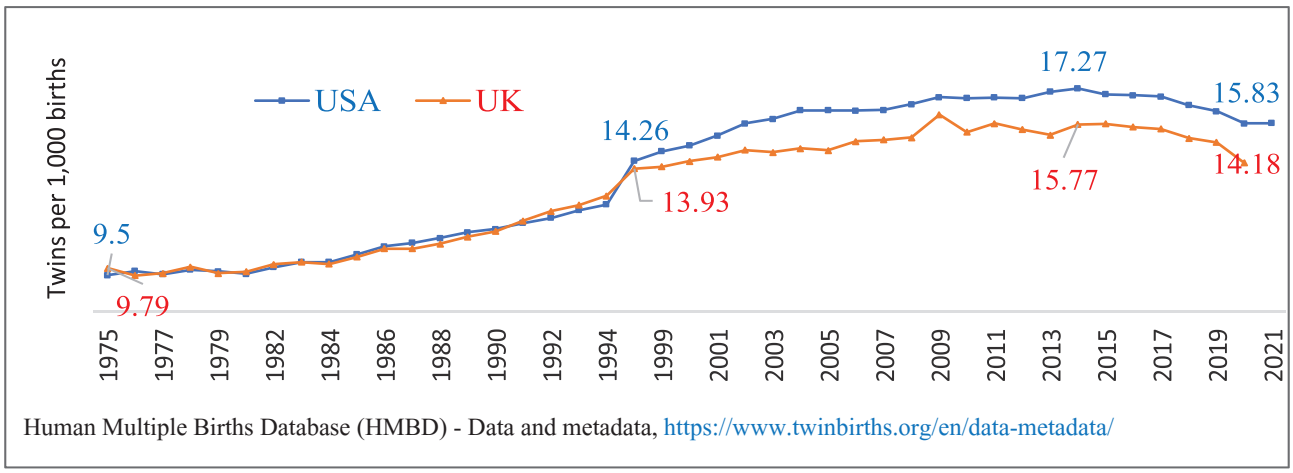
7 Asma Khalil, Continuing decline in twin births since 2014, Human Reproduction, Vol.36, No.7, pp.2062–2068, 2021.

The study anticipates that this decline in twin births will continue. This intervention aligns with the expectations of Monden et al. in the decline of twin birth rates due to the implementation of new policies in single embryo transfer and improved IVF techniques, and in highlighting the trend of declining twin rates in both Britain and America over a longer period.

- A study issued by the US National Vital Statistics System[8] showed that the twin birth rate, defined as (twins per 1,000 births), trended downward from 33.9 in 2014 to 32.1 in 2019 and 2020, and to 31.2 in 2021 and 2022. The report considered the rates from 2020 to 2022 to be the lowest in two decades. A report issued by the US Centers for Disease Control and Prevention[9] attributed this decline to guidelines regarding the number of embryos transferred during the use of Assisted Reproductive Technology (ART), aimed at promoting single embryo pregnancies and reducing the number of multiple pregnancies, issued by the Practice Committee of the American Society for Reproductive Medicine and the Practice Committee of the Society for Assisted Reproductive Technology[10].

- Based on a unified definition of the twin rate, defined as (the number of twin births per 1,000 births) in America and Britain from the Human Multiple Births Database (HMBD)[11], as shown in Figure (1), the twin birth rate in Britain decreased by 10.1% between 2014 and 2020, from 15.77 twin births per 1,000 births to 14.18 twin births per 1,000 births. In the United States, it decreased by 8.3% between 2014 and 2021, from 17.27 to 15.83 twin births per 1,000 births. A study by (Gilles Pison and others)[12] also explains this decline by the adoption of the single embryo transfer

**Figure (1): Trend of Twin Birth Rates in the United States and the United Kingdom, 1975-2021**




Human Multiple Births Database (HMBD) - Data and metadata, https://www.twinbirths.org/en/data-metadata/

8 https://www.cdc.gov/nchs/data/nvsr/nvsr73/nvsr73-02.pdf

9 https://www.cdc.gov/nchs/data/databriefs/db512.pdf

10 https://www.asrm.org/globalassets/_asrm/practice-guidance/practiceguidelines/pdf/guidance_on_the_limits_to_the_number_of_embryos_to_transfer.pdf

11 The Human Multiple Births Database (HMBD), https://www.twinbirths.org/en/data-metadata/

12 Gilles Pison, Catalina Torres, Christiaan Monden, Jeroen Smits. Peaks in twin births? An international comparison of trends in twinning rates in 30 developed countries. European Population Conference- EPC 2022, Jun 2022, Groningen, Netherlands. pp.8. hal-03906675.

policy and improved IVF techniques, noting that this decline has been observed in many developed countries. It is linked to changes in MAR policies and practices following concerns raised by the increased frequency of twin births, as twin children are more vulnerable than other children.

## 2. Twins in Jordan

### 2.1 Characteristics of Twin Births Compared to Singleton Births

According to data from the 2023 JPFHS, the number of live births was (8,070) for women included in the survey sample during the five years preceding the survey (2018-2023)[13]. These births were distributed as follows: 97% singleton births and 2.9% multiple births, including twins and triplets[14]. We will now examine the characteristics of twin births compared to singleton births.

#### 2.1.1 Gender Distribution

According to Table (2), the gender ratio at birth among twins was 94 males for every 100 females, while the ratio among singleton births was 113 males for every 100 females. The same pattern in the gender[15] ratio was observed in the 2012 JPFHS, where the male-to-female ratio for twins dropped to 75 males for every 100 females, while the male-to-female ratio for singleton births rose to 111 males for every 100 females. This is despite the natural ratio being around 105 males for every 100 females. This variation in the gender ratio between twin births and single-births, as well as compared to the natural ratio, can be attributed to the fact that the JPFHSs rely on statistical samples from mothers, asking them about the number of births that occurred over a certain period (usually the last 5 years).

**Table (2): Distribution of Births by Sex**

| Sex | Singleton Births | | Twin Births | |
|---|---|---|---|---|
| | Number | % | Number | % |
| Males | 4160 | 53.1 | 115 | 48.5 |
| Females | 3673 | 46.9 | 122 | 51.5 |
| Total | 7833 | 100.0 | 237 | 100.0 |
| Sex Ratio | 113 males per 100 females | | 94 males per 100 females | |

Source: Department of Statistics, JPFHS 2023

13 Mid-2018 to mid-2023.

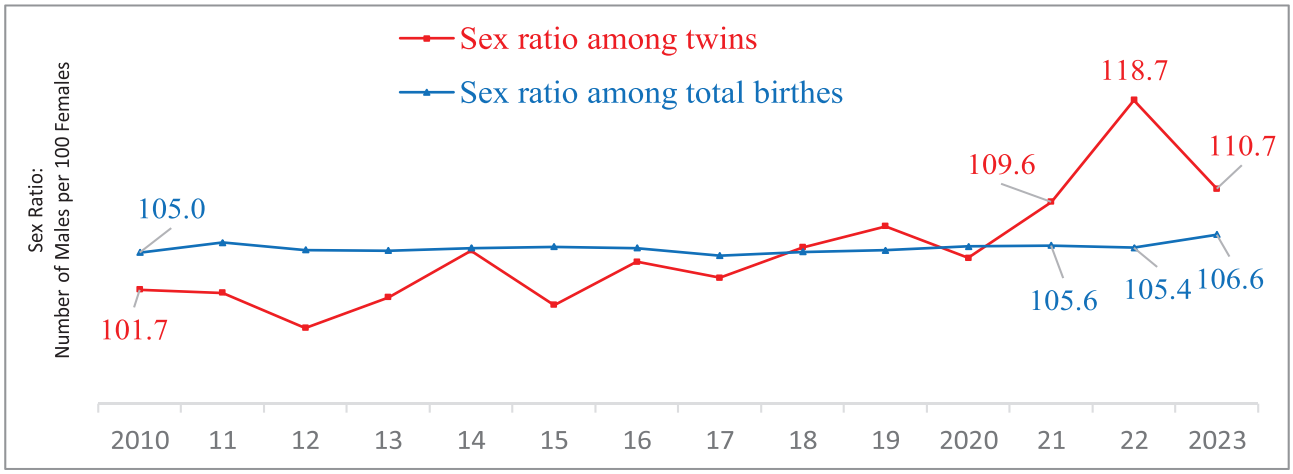
14 An unweighted table indicates that the number of births was (4,760), with singleton births accounting for (96.3%), twins (3.4%), and triplets (0.3%).

15 M. Mazharul Islam and Uzma Marium, Twin births in Jordan: incidence, trends, risk factors and implications for under-five mortality: evidence from the 2012 JPFHS, Cambridge University Press, 2019. Journal of Biosocial Science (2019), 51: 6, 857–874.

As a result, the births included in the survey might be relatively small compared to the total number of births, which can lead to statistically fluctuating results for twin births due to the small sample size. Additionally, as the surveys rely on mothers' memory, reporting errors can occur due to the forgetting of precise details.

This is confirmed by the sex ratio of Jordanian twins at birth, based on the Civil Status Department and Passports' (CSPD) vital records, as shown in Figure (2). The ratios fluctuated within normal limits between 2010-2020 and trended upward in the last three years (2021, 2022, 2023), reaching 109.6, 118.7, and 110.7 males per 100 females, respectively compared to the sex ratio of all Jordanian births, which amounted for the three years respectively to (105.6, 105.4, 106.6 males per hundred females). This could be related to medical intervention and pre-selection of male fetuses, which leading to an increase in the male birth rate and, consequently, some imbalance in the male-to-female population count.

**Figure (2) Sex Ratio Among Twins and the total birthes by Year from 2010 to 2023.**




Source: CSPD, Data requested by the Higher Population Council

The undesirable effects on family and society resulting from this demographic distortion due to the disruption of the natural balance between the sexes at birth necessitate statistical monitoring through annual birth statistics. Additionally, the role of fertility and infertility centers and medical technology in the phenomenon of sex selection should be investigated. This is also in line with the resolutions of the 1994 International Conference on Population and Development in Cairo[16], which recommended the elimination of all forms of discrimination against the girl child and the root causes of son preference.

### 2.1.2 Distribution of Births by Maternal Age

Mayo Clinic and the parenting education platform[17] indicate that the chance of having twins increases with age because hormonal changes may cause the release of more than one egg at the same time. According to the 2023 JPFHS, the average age of mothers who gave birth to twins was

16 United Nations, International Conference on Population and Development, Cairo, 1994, Article (4-16: a).

17 https://www.babycenter.com/pregnancy/your-baby/your-likelihood-of-having-twins-or-more_3575

32.7 years, compared to 31.4 years for mothers who gave birth to singleton births. The differences were more pronounced[18] in the 2012 JPFHS, where the average age of mothers was 29.6 years for twins compared to 27.4 years for mothers who gave birth to singleton births. As shown in Table (3), twin births among women in the 30-39 age group increased to 54.8%, compared to 47.5% for singleton births among women in the same age group. Similarly, twin births among women in the 40-49 age group increased to 14.4%, compared to 11.4% for women with singleton births in the same age group. A small percentage of twin births (1.6%) were to mothers under 20 years old, the least likely group to use Assisted Reproductive Technologies (ART). However, a large percentage of twin births (69%) were to mothers aged 30 and over, compared to (58.9%) of single-births in the same maternal age group.

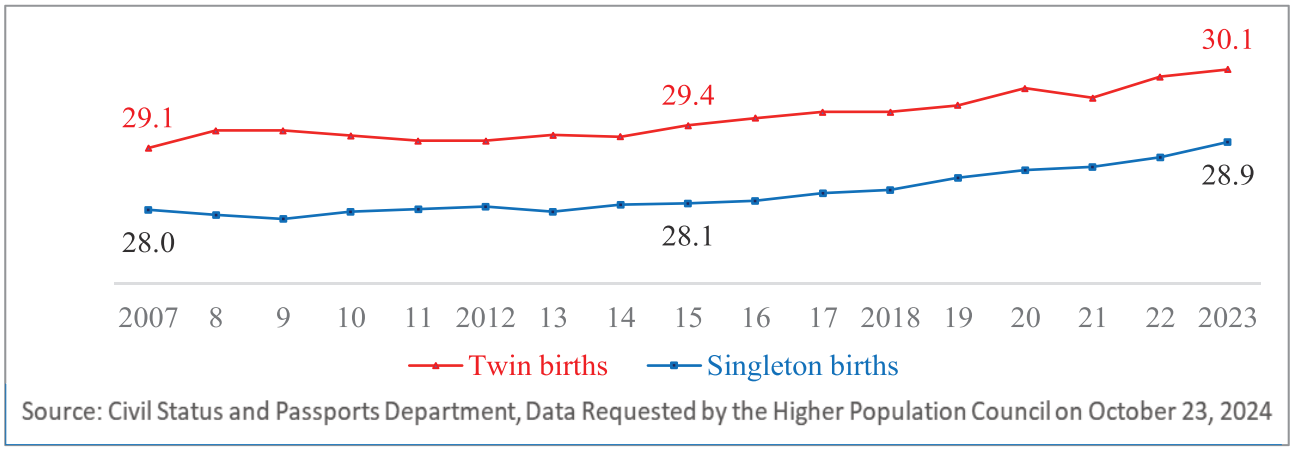
**Table (3): Distribution of Births by Maternal Age Groups (15-49 Years) and Birth Type**

| Maternal Age (Years) | Single Births % | Twin Births % |
|---|---|---|
| 15-19 | 1.4 | 1.6 |
| 20-29 | 39.7 | 29.3 |
| 30-39 | 47.5 | 54.8 |
| 40-49 | 11.4 | 14.4 |
| Total | 100.0 | 100.0 |
| Average Maternal Age at Birth (Years) | 31.4 | 32.7 |

Source: Department of Statistics, Final Results of the 2023 JPFHS.

Figure (3) shows the general trend of delayed childbearing age, whether for twin or singleton births. The average maternal age for single births increased from 28 years in 2007 to 28.9 years in 2023, a difference of (0.9) years. Similarly, the average maternal age for twin births increased from 29.1 years in 2007 to 30.1 years in 2023, a difference of one year. The difference in average maternal age between twin and singleton births increased from (1.1) years in 2007 to (1.2) years in 2023.

**Figure (3): Average Maternal Age at Birth by Birth Type and Year of Birth, 2007-2023, from Vital Records Data**




Source: Civil Status and Passports Department, Data Requested by the Higher Population Council on October 23, 2024

18 M. Mazharul Islam and Uzma Marium, Twin births in Jordan: incidence, trends, risk factors and implications for under-five mortality: evidence from the 2012 JPFHS, Cambridge University Press, 2019. Journal of Biosocial Science (2019), 51: 6, 857–874.

### 2.1.3 Births Order

Twins were more likely to occur at a higher order than singleton births. According to Table (4), there are some differences between the order of twin births and singleton births. The average birth order was 3.3 for twins and 3.2 for singleton births, respectively. The percentage of births in the second or third order was 48.3% for twins and 43.4% for singleton births. Additionally, the percentage of births in the fourth order or higher was 36.1% for twins and 36.3% for singleton births. This may be due to the effect of mothers' age as they get older by the increase in their birth order.

**Table (4): Relative Distribution of Singleton and Twin Births by Birth Order**

| Birth Order | Singleton Births (%) | Twin Births (%) |
|---|---|---|
| 1 | 20.3 | 15.6 |
| 2-3 | 43.4 | 48.3 |
| 4-6 | 31.9 | 32.2 |
| 7+ | 4.4 | 3.9 |
| Total | 100.0 | 100.0 |

Source: Department of Statistics, JPFHS, 2023

### 2.1.4 Births by Maternal Education

Twin births are more likely to occur among mothers with higher education compared to singleton births. As shown in Table (5), the percentage of twin births among mothers with secondary education or higher increased to 83.1%, compared to 69.4% of singleton births among mothers with the same educational level. This may be attributed to the fact that education delays the age of marriage, which subsequently shows the effect of maternal age on twin births, as discussed earlier.

**Table (5): Relative Distribution of Singleton and Twin Births by Maternal Education Level**

| Education Level | Singleton Births (%) | Twin Births (%) |
|---|---|---|
| No Education | 2.3 | 0.7 |
| Less than Secondary | 28.3 | 16.2 |
| Secondary | 33.6 | 43.9 |
| Higher than Secondary | 35.8 | 39.2 |
| Total | 100.0 | 100.0 |

Source: Department of Statistics, JPFHS, 2023

### 2.1.5 Births According to Family Welfare Level

Table (6) shows that the percentage of singleton births decrease with increasing household wealth index. However, the pattern was different for twin births. It was observed that the percentage of twins was higher among mothers in the second (poorest) and fourth (wealthiest) quintiles compared to singleton births by wealth level. This may be related to several factors, most notably that mothers with low economic status usually have a longer reproductive life due to early marriage, and therefore have higher birth numbers, which creates a greater chance of having twins. On the other hand, wealthier mothers may be more likely to seek assisted reproductive methods.

**Table (6): Relative Distribution of Births According to Family Welfare Level**

| Welfare Level | Single Births (%) | Twin Births (%) |
|---|---|---|
| Lowest | 27.1 | 18.4 |
| Second | 23.4 | 25.0 |
| Middle | 21.0 | 18.6 |
| Fourth | 17.2 | 26.3 |
| Fifth | 11.3 | 11.7 |
| Total | 100.0 | 100.0 |

Source: Department of Statistics, JPFHS, 2023

### 2.1.6 Births by Survival Status

Out of the 8,070 live births recorded by the 2023 JPFHS, 117 births died within five years of their birth. There were 95 deaths among singleton births and 22 deaths among twin births. As shown in Table (7), the death rate among twin births was higher compared to singleton births, reaching 9.4% among twins compared to 1.2% among singleton births, meaning that twin deaths are 8 times higher than singleton birth deaths.

**Table (7): Relative Distribution of Births by Survival Status Within Five Years of Life at the Time of the Survey**

| Alive/Dead | Single Births (%) | Twin Births (%) |
|---|---|---|
| Alive | 98.8 | 90.6 |
| Dead | 1.2 | 9.4 |
| Number of Cases | 7833 | 237 |

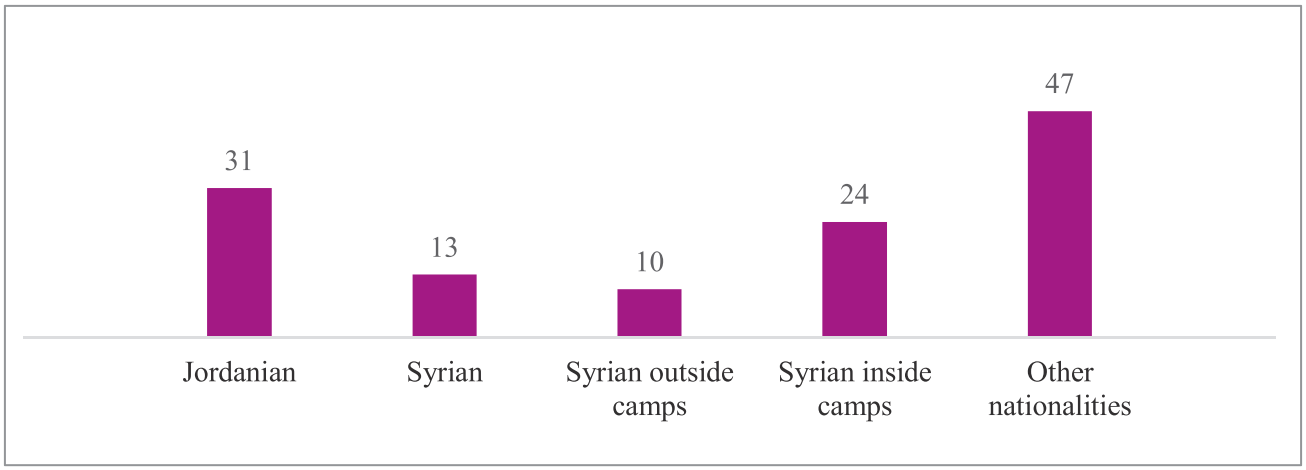
Source: Department of Statistics, JPFHS, 2023

## 2.2 Other Levels and Variations in Twin Birth Rates

### 2.2.1 Twin Birth Rates by Nationality

According to the results of the 2023 JPFHS, twin birth rates varied by maternal nationality. The rates were highest among mothers of other nationalities, reaching 47/1,000 births, followed by Jordanian mothers at 31/1,000 births. The rates were lowest among Syrian mothers in Jordan, reaching 13 births per 1,000. The rates were highest among Syrian women inside camps compared to those outside camps, as shown in Figure (4). The variation by nationality may be due to differences in age at marriage by nationality.

**Figure (4): Twin Birth Rates per 1,000 Births by Maternal Nationality**

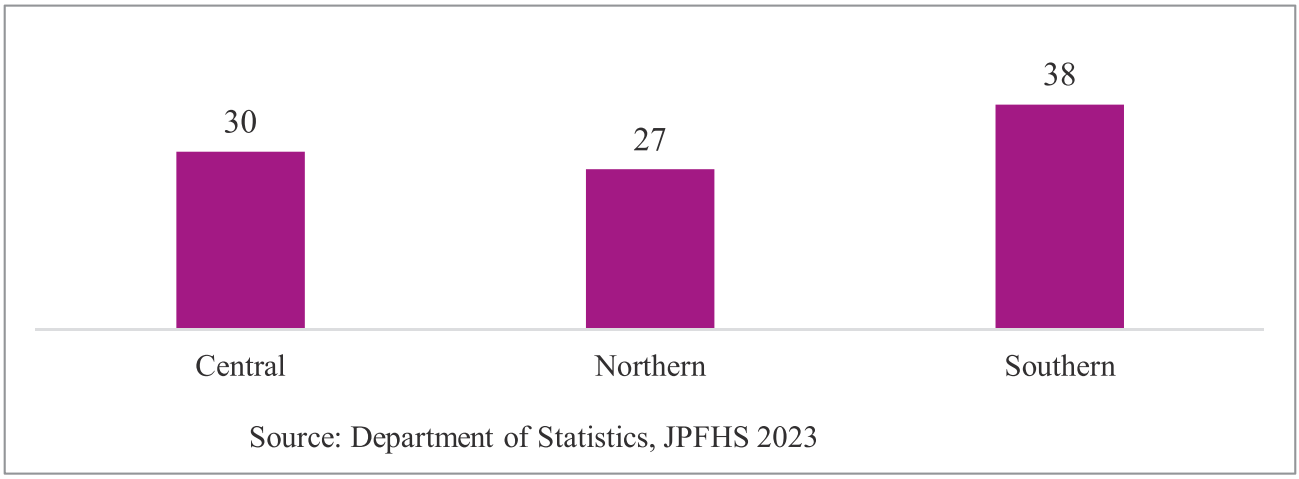



Source: Department of Statistics, JPFHS 2023

### 2.2.2 Twin Birth Rates by Region of the Kingdom

As shown in Figure (5), among the three main regions, the Southern region recorded the highest twin birth rate (38/1,000 live births), while the Northern region recorded the lowest rate (27/1,000 live births).

**Figure (5): Twin Rates per 1,000 Live Births by the Three Regions of the Kingdom**

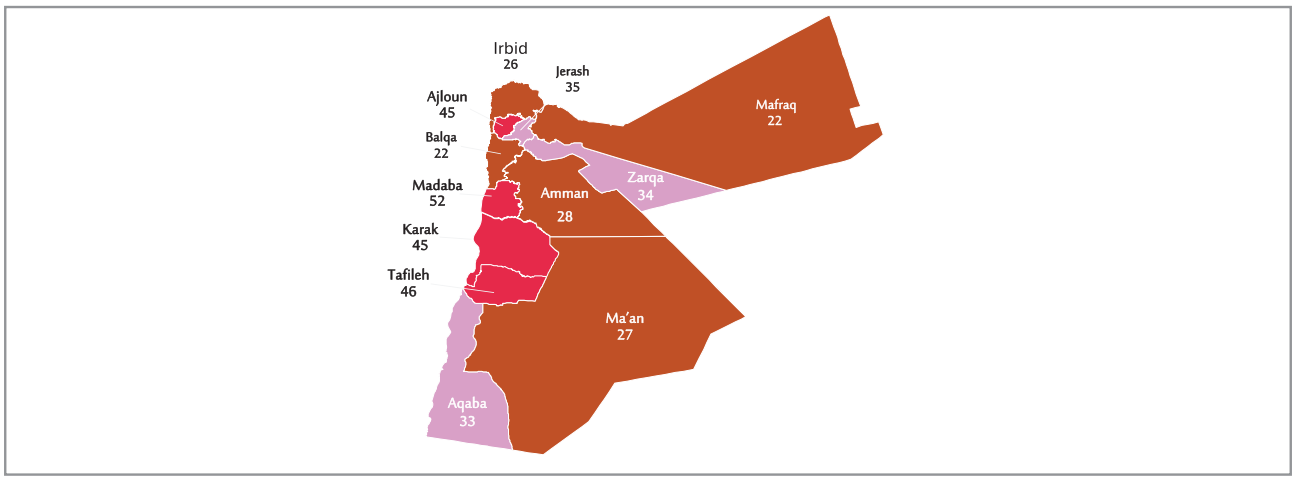



Source: Department of Statistics, JPFHS 2023

### 2.2.3 Twin Rates by Governorates of the Kingdom

As shown in Figure (6), the twin rate was highest in the governorates of Madaba, Tafilah, Karak, and Ajloun, ranging from 45-52/1,000 live births. It was lowest in the governorates of Mafraq and Balqa, at 22/1,000 live births each. There is no explanation for this variation.

**Figure (6): Twin Birth Rate per 1,000 Births**



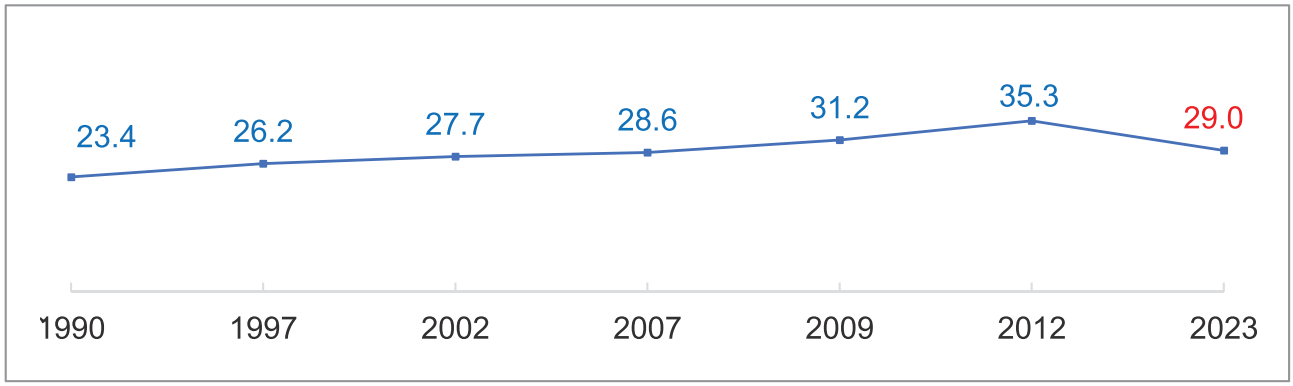

Source: Department of Statistics, JPFHS 2023

## 2.3 Trends in Twin Birth Rates in Jordan

### 2.3.1 Trends in Twin Birth Rates According to the Results of Population and Family Health Surveys

The Department of Statistics has conducted eight consecutive Population and Family Health Surveys (JPFHSs) in Jordan between 1990 and 2023. In this paper, we will rely on the final results of the 2023 JPFHS to present the twin birth rate according to this survey. We will also rely on a study[19] that analyzed data from the 1990-2012 JPFHSs to derive twin birth rates for the 1990 to 2012 surveys. All rates are based on live birth data, and the monitoring period was five years before the survey date. Figure (7) shows the twin birth rates obtained from all these surveys.

**Figure (7): Twin Rate per 1,000 Live Births by Rounds of Population and Family Health Surveys, 1990-2023**




Source: Population and Family Health Surveys, 1990-2023

19 M. Mazharul Islam and Uzma Marium, Twin births in Jordan: incidence, trends, risk factors and implications for under-five mortality: evidence from the 2012 JPFHS, Cambridge University Press, 2019. Journal of Biosocial Science (2019), 51: 6, 857–874.

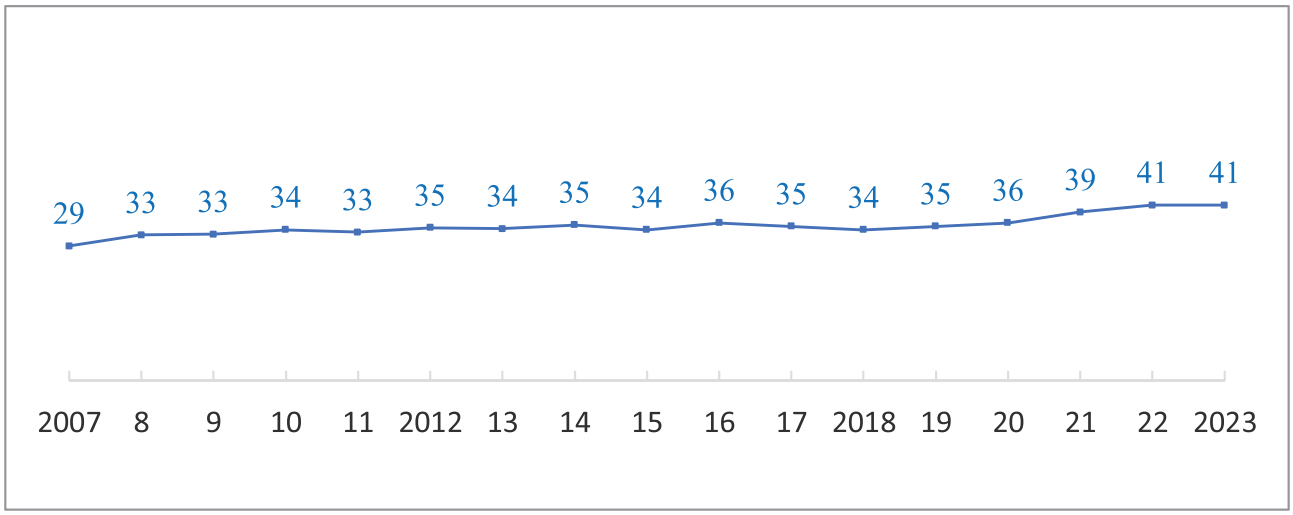
The results indicate an increasing trend in twin birth rates in Jordan, as the rate rose from 23.4 twin births per 1,000 live births in 1990 to 35.3 twin births per 1,000 live births in 2012. However, according to the 2023 JPFHS results, the rate slightly decreased to 29 twins per 1,000 births (i.e., one twin for every 34 births).

### 2.3.2 Trends in Twin Births Among Jordanians According to Vital Records Data from the Civil Status and Passports Department (CSPD)

The vital records data at the (CSPD) provides a record of births for Jordanians, including twin births. The results are likely to suffer from underreporting twin births when one of the twins is stillborn, as the surviving twin is likely to be recorded as a singleton. Additionally, deaths after birth but before registration in the vital records may not be recorded. However, the vital records provide a record of all officially registered births in the country, offering a more comprehensive picture compared to surveys.

Figure (8) shows the twin birth rates per 1,000 births among Jordanians from 2007 to 2023, where the rate of twin births per 1,000 live births increased according to the CSPD data from 29 twins per 1,000 live births in 2007 to 41 twins per 1,000 live births in 2023, with an increase of 39%.

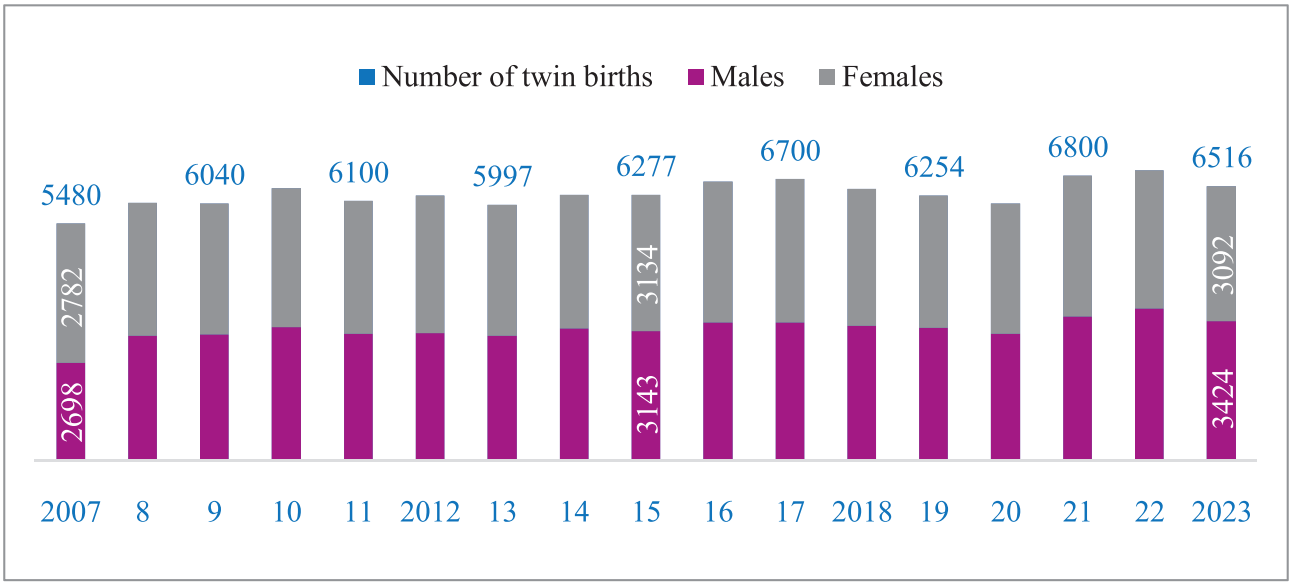
**Figure (8): Twin Birth Rates Among Jordanians per 1,000 Births by Year, 2007-2023**




Source: CSPD, Data Requested by the Higher Population Council on October 23, 2024

According to the CSPD's vital records, (107,248) Jordanian twins were born during the period 2007-2023, with an average of (6,309) births annually. Figure (9) shows the registered numbers of Jordanian twins during the period 2007-2023.

**Figure (9): Number of Jordanian Twin Births by Year, 2007-2023**




Source: CSPD Data Requested by the Higher Population Council on October 23, 2024

### 2.3.3 Trends in Twin Births According to Hospital Data

A study[20] analyzed all births and birth outcomes recorded in the Jordan Stillbirth and Neonatal Deaths Surveillance (JSANDS) system from August 2019 to January 2020 in five major hospitals (three public, one private, and one teaching hospital) located in three of the largest cities, with a 100% completion rate. As shown in the table from this study, after excluding (102) fetal deaths (88 stillbirths before delivery and 14 stillbirths during delivery), the twin birth rate was 44 twin births per 1,000 live births. The rate increased to 49 births (twins, triplets, and quadruplets) per 1,000 live births.

**Table (8): Birth Rates by Multiplicity from August 2019 to January 2020 in Five Major Hospitals**

| Birth Type | Births and Fetal Deaths | Fetal Deaths (Antenatal and Intrapartum) | Live Births Excluding Fetal Deaths* | Birth Rate per 1,000 Live Births* |
|---|---|---|---|---|
| Singleton Birth | 9777 | 85 | 9692 | 951 |
| Twin Birth | 457 | 11 | 446 | 44.4 |
| Triplet Birth | 43 | 3 | 40 | 4.2 |
| Quadruplet Birth | 8 | 3 | 5 | 0.8 |
| Total | 10285 | 102 | 10183 | - |

Khulood K. Shattnawi, and others, Rate, determinants, and causes of stillbirth in Jordan: Findings from the Jordan Stillbirth and Neonatal Deaths Surveillance (JSANDS) system, BMC Pregnancy and Childbirth (2020) 20:571.

• Columns Extracted from the Original Table Taken from the Source.

20 https://www.cdc.gov/nchs/data/nvsr/nvsr73/nvsr73-02.pdf

By reviewing twin birth rates in Jordan from the sources above, it appears that they are trending upwards. For Jordanian women in 2023, the rate was 41 twin births per 1,000 live births according to vital records, 31 twin births per 1,000 live births according to the 2023 JPFHS, and 44 twin births per 1,000 live births according to data from five hospitals for 2019/2020. Despite the variation in rates across the three Jordanian sources, these rates exceed the rate in the United States[21], which is 31.2 twins per 1,000 births for the period (2020-2022). This increase in the twin birth rate in Jordan can be attributed to the increasing trends in delayed childbearing age among mothers. The median age of mothers at first birth increased from 21.2 years according to the 1990 JPFHS to 24.2 years according to the 2023 JPFHS. As age advances, the chance of having twins increases due to hormonal changes in the mother, in addition to the increased use of Medically Assisted Reproduction (MAR).

### 2.3.4 Trends in Twin Births by Delivery Method

To the extent of the knowledge in this paper, there are no recent national studies that relied on the last two JPFHSs 2017/2018 and 2023 to investigate this topic. We have two studies available: the first[22], titled "Rising cesarean deliveries among apparently low-risk mothers at university teaching hospitals in Jordan," analyzed data from married women aged 15-49 who had their last birth in a hospital within the five years preceding the Jordan JPFHSs in 2002, 2007, and 2012. The second study[23], titled "Trends in the prevalence and determinants of caesarean section delivery in Jordan: Evidence from Three Demographic and Health Surveys 1990, 1997, and 2002," used the same methodology. As shown in Table (9) from these two studies, cesarean delivery is the common method of birth in twin pregnancies. Cesarean deliveries among women with twin pregnancies have trended upwards from 22.2% according to the 1990 JPFHS to 65.7% according to the 2012 JPFHS. This percentage is expected to be higher, given the general trend of rising cesarean delivery rates recorded by the 2023 JPFHS, which was 42.8%.

21 https://www.cdc.gov/nchs/data/nvsr/nvsr73/nvsr73-02.pdf

22 Rami Al Rifaia, Rising cesarean deliveries among apparently low-risk mothers at university teaching hospitals in Jordan: analysis of population survey data, 2002–2012. Global Health: Science and Practice 2014 | Volume 2 | Number 2, https://pmc.ncbi.nlm.nih.gov/articles/PMC4168617/

23 M Khawaja and others, Trends in the prevalence and determinants of caesarean section delivery in Jordan: evidence from three demographic and health surveys, 1990—2002, World Health Population, 2007 Dec;9(4):17-28. doi: 10.12927/whp.2007.19395, https://pubmed.ncbi.nlm.nih.gov/18567949/

**Table (9): Cesarean Delivery Rates Among Women Aged 15-45 Who Had Their Last Birth in a Hospital Within the Five Years Preceding the Survey, by Birth Multiplicity (Singleton or Twin)**

| Birth Type | 1990* | 1997* | 2002* | 2002** | 2007** | 2012** |
|---|---|---|---|---|---|---|
| Percentage of women with singleton births delivered by cesarean section (%) | 8.3 | 12.4 | 16.9 | 17.3 | 19.3 | 29.5 |
| Percentage of women with twin births delivered by cesarean section (%) | 22.2 | 41.5 | 60 | 60 | 59.3 | 65.7 |

*M Khawaja and others, Trends in the prevalence and determinants of caesarean section delivery in Jordan.
**Rami Al Rifaia, Rising cesarean deliveries among apparently low-risk mothers at university teaching hospitals in Jordan.

To the extent of the knowledge in this paper, it is not possible to favor one method of delivery over another, as the choice is determined by the doctor based on the position of the first and second twins, the number of fetuses, the mother's health during pregnancy, and the gestational age.

## 3. Medically Assisted Reproduction and Twin Births

Medically Assisted Reproduction (MAR) refers to a wide range of treatments, including Assisted Reproductive Technology (ART). The U.S. Centers for Disease Control and Prevention (CDC)[24] distinguishes between ART and other medical assistance. ART is defined as assisted reproductive procedures that involve surgically removing eggs from a woman's ovary, combining them with sperm in the laboratory, and returning them to the mother. It also includes cryopreservation of eggs and embryos. The most common type of ART is In Vitro Fertilization (IVF). Other types of ART include Gamete Intra Fallopian Transfer (GIFT) and Zygote Intra Fallopian Transfer (ZIFT), but these techniques are less commonly used. Treatments that only involve handling sperm (such as intrauterine insemination) are not considered ART, nor are procedures where a woman takes medication only to stimulate egg production without planning for surgical egg retrieval. These treatments and procedures can fall under the broader definition of MAR.

Treating reproductive health problems is a major health achievement in Jordan, as the Kingdom's health sector was the first in the region to use the latest global technologies in treating infertility and delayed childbearing. The first IVF baby in Jordan was born in 1987[25]. The establishment of fertilization

24 https://www.cdc.gov/art/about/index.html

25 https://phajordan.org/AR-article-3872-

units/IVF units in private hospitals in Jordan is regulated by instructions issued in 2024 under the Private Hospitals Law[26].

One study[27] indicates that there is extensive evidence that the dramatic change in the twin rate worldwide is due to the increased use of Medically Assisted Reproduction (MAR). We will present scientific facts based on studies on the relationship between twin births in Jordan and the use of MAR, and the risks of adverse outcomes for the mother and the perinatal period among twin pregnancies resulting from ART, compared to pregnancies without ART or natural pregnancies.

### 3.1 Key Findings from Scientific Evidence Reviewed in This Area:

- In Jordan, women who underwent Intracytoplasmic Sperm Injection (ICSI) had a significantly higher rate of multiple pregnancies compared to women who conceived without ART.
- In Jordan, the ICSI group had higher cesarean delivery rates compared to women who conceived naturally without ART.
- In Jordan, the birth weight of newborns of women who underwent ICSI was lower due to the increased number of multiple pregnancies compared to women who did not undergo ICSI.
- In Jordan, ICSI pregnancies are exposed to a greater number of pregnancy complications compared to natural pregnancies.
- Globally, twin pregnancies resulting from IVF have significantly higher adverse outcomes for the mother and child compared to non-IVF twin pregnancies and natural pregnancies.
- Globally, ART twin pregnancies are more likely to have preterm birth, hypertensive disorders of pregnancy, gestational diabetes, and cesarean delivery compared to non-ART twin pregnancies and natural pregnancies.
- Globally, newborns from ART twin pregnancies are more likely to have birth defects, weight discordance (weight difference between twins >25%), respiratory distress syndrome, and neonatal illnesses requiring admission to neonatal intensive care units compared to non-ART twin pregnancies.

26 Official Gazette, Issue 5028, Instructions for Establishing Fertility Units / In Vitro Fertilization (IVF) Units in Private Hospitals for the Year 2024.

27 Christiaan Monden, Gilles Pison, and Jeroen Smits, Twin Peaks: more twinning in humans than ever before, Human Reproduction, Vol.00, No.0, pp. 1–8, 2021.

### 3.2 Scientific Evidence

A study[28] titled "The practice of intracytoplasmic sperm injection in Jordan" aimed to evaluate the clinical practice of Intracytoplasmic Sperm Injection ICSI in Jordan. This retrospective study was conducted in a university hospital in Jordan, identifying women who achieved successful pregnancies through ICSI over a ten-year period. Two hundred and ninety-one women were included in the study as successful ICSI cases out of 2,059 total ICSI cases, with a success rate of 14.1%. 466 women who conceived naturally without ART were included as a control group. Key findings of interest in this paper, as shown in Table (10) from this study, include: women who underwent ICSI had a significantly higher rate of multiple pregnancies, with 27.1% delivering twins or triplets compared to 2% of women who conceived naturally. As a result, the ICSI group had higher cesarean delivery rates, with 87.6% of women who conceived through ICSI undergoing cesarean delivery compared to 42.1% of women who conceived naturally. Additionally, the ICSI group produced a greater number of female newborns (72.9 females per 100 mothers) compared to natural pregnancies (46.8 females per 100 mothers). The study indicates that the birth weight of newborns of women who underwent ICSI was lower due to the increased number of multiple pregnancies, with an average birth weight of 2.7 kg for ICSI women compared to 3.1 kg for non-ICSI women. The percentage of mothers with pregnancy complications was higher in the ICSI group (28.3%) compared to the natural pregnancy group (15.7%).

**Table (10): Pregnancy Outcomes of ICSI Compared to Natural Pregnancy**

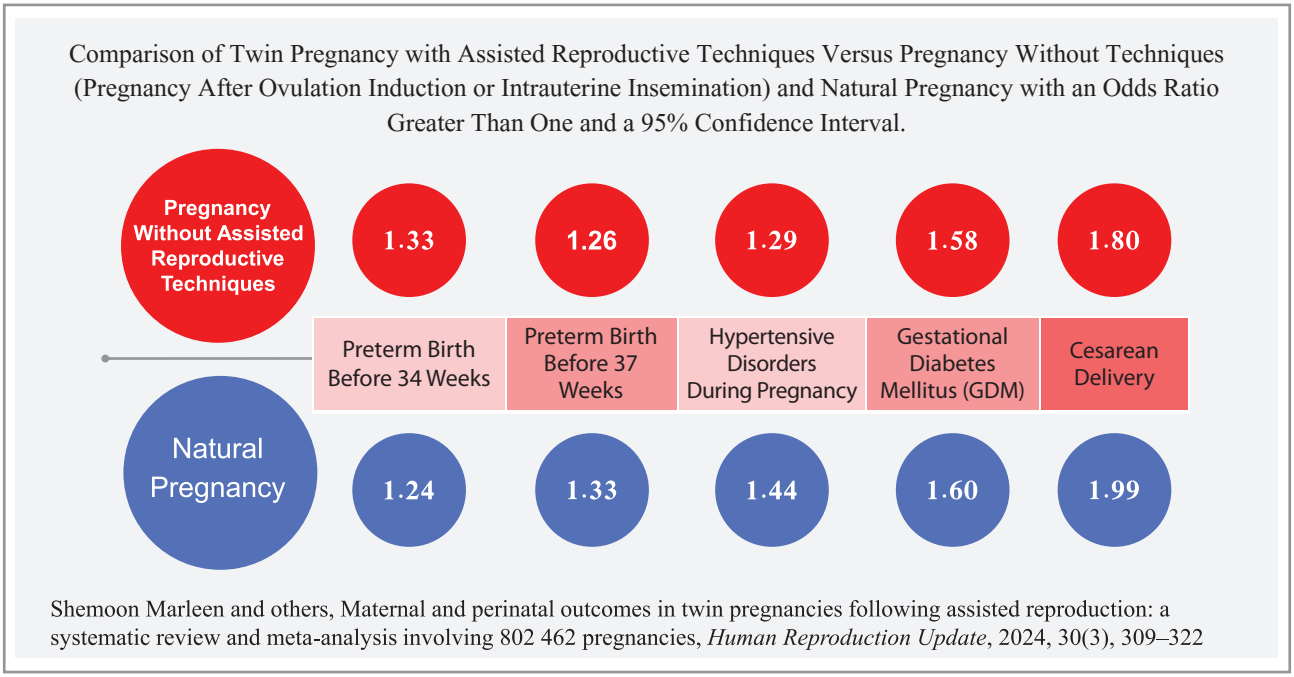
| Variable | ICSI Pregnancy Group | Natural Pregnancy Group |
|---|---|---|
| Average Age | 30 | 29.6 |
| Delivery Method | | |
| Vaginal | 36 (12.4%) | 270 (57.9%) |
| Cesarean | 255 (87.6%) | 196 (42.1%) |
| Number of Pregnancies | | |
| Single Pregnancy | 212 (72.9%) | 456 (97.9%) |
| Twin Pregnancy | 66 (22.7%) | 10 (2.1%) |
| Triplet Pregnancy | 13 (4.5%) | 0 (0) |
| Newborn Gender (Number of Births/Number of Women in Sample) | | |
| Male | 171 (58.8 males per 100 mothers) | 258 (55.4 males per 100 mothers) |
| Female | 212 (72.9 females per 100 mothers) | 218 (46.8 females per 100 mothers) |

Omar F. Altal, and others, The practice of intracytoplasmic sperm injection in Jordan: a clinical outcome study Authors, Annals of Medicine and Surgery 57 (2020) 196–200.

28 Omar F. Altal, and others, The practice of intracytoplasmic sperm injection in Jordan: a clinical outcome study Authors, Annals of Medicine and Surgery 57 (2020) 196–200.

A study[29] titled "Maternal and Perinatal Outcomes in Assisted Reproductive Technology Twin Pregnancies: A Systematic Review[30] and Meta-Analysis" based on 111 relevant studies (802,462 pregnancies) aimed to measure the effects of Assisted Reproductive Technology[31] (ART) on twin pregnancies regarding maternal and perinatal risks, compared to pregnancies without ART (pregnancy after ovulation induction or intrauterine insemination) and natural pregnancies. Figure (10) shows the maternal risks with an odds ratio[32] greater than 1 and a statistically significant p-value less than (0.05)

**Figure (10): Risks of Twin Pregnancy with Assisted Reproductive Techniques on the Mother**




As shown in the figure, the group of ART twin pregnancies was more likely to experience preterm birth before 34 weeks and also before 37 weeks, hypertensive disorders of pregnancy, gestational diabetes, and cesarean delivery compared to non-ART twin pregnancies. The aforementioned risks were also increased in the ART group compared to natural pregnancies.

29 Shemoon Marleen and others, Maternal and perinatal outcomes in twin pregnancies following assisted reproduction: a systematic review and meta-analysis involving 802 462 pregnancies, Human Reproduction Update, 2024, 30(3), 309–322, https://doi.org/10.1093/humupd/dmae002

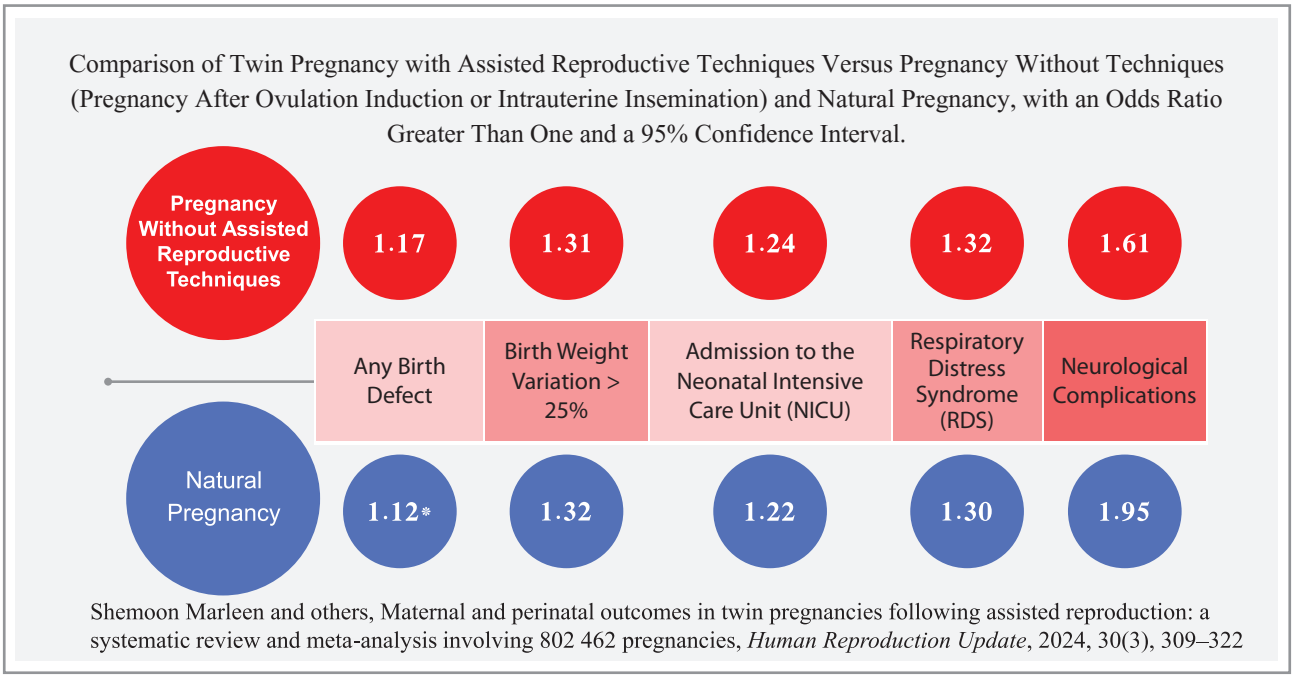
30 Meta-Analysis is an analysis that involves applying statistical methods to the results of several studies, which may be either consistent or contradictory, in order to determine a trend or direction of those results or to find a potential common relationship among them.

31 Work in the laboratory on both the egg and sperm, such as artificial insemination, intracytoplasmic sperm injection (ICSI), gamete intrafallopian transfer (GIFT), or zygote intrafallopian transfer (ZIFT).

32 It is the odds ratio of the occurrence of an event in a group of twin pregnancies with assisted reproductive techniques compared to the odds of the same event occurring in a group of pregnancies without assisted reproductive techniques, or in the natural pregnancy group. Therefore, if the odds ratio is 1, it means there is no difference between the two groups. If it is greater than 1, it means that the use of assisted reproductive techniques increases the likelihood of risks. If the odds ratio is less than 1, it means that the use of assisted reproductive techniques reduces the risks.

Figure (11) shows the perinatal risks with an odds ratio greater than 1 and a statistically significant p-value less than (0.05).

**Figure (11): Perinatal Risks of Twin Pregnancy with Assisted Reproductive Techniques**




As shown in the figure, the ART twin pregnancy group, compared to the non-ART twin pregnancy group, was more likely to experience birth defects, weight discordance (weight difference between twins >25%), respiratory distress syndrome, neonatal illnesses requiring admission to neonatal intensive care units, and neurological complications. When comparing the ART twin pregnancy group to the natural twin pregnancy group, it exhibited a similar trend of increased risk for the aforementioned outcomes, except for birth defects.

The study recommended the need to identify and manage ART twin pregnancies as a higher-risk group, in addition to counseling women seeking ART about the increased risks of twin pregnancies through ART, and they should be closely monitored during pregnancy for complications.

## 4. Implications of Twin Pregnancies on Maternal Health

### 4.1 Facts

- In 29 countries, including Jordan, twin pregnancies double the risk of life-threatening complications for the mother, such as (bleeding disorders, placental abruption, uterine rupture, and hypertensive disorders) compared to singleton pregnancies.

- In 29 countries, including Jordan, twin pregnancies triple the risk of maternal near-miss events (respiratory distress, urinary retention, blood clotting failure, stroke, loss of consciousness, and cardiac arrest) compared to singleton pregnancies.
- In 29 countries, including Jordan, twin pregnancies quadruple the risk of maternal mortality during pregnancy or within 42 days of the end of pregnancy) compared to singleton pregnancies.
- In 29 countries, including Jordan, twin pregnancies with maternal complications (life-threatening conditions, maternal near-miss events, and maternal deaths) were twice or more as high compared to singleton pregnancies.
- According to the National Maternal Mortality Surveillance and Response System implemented by the Ministry of Health, three women pregnant with twins died in 2022 and 2023. These deaths were among mothers aged 26-29 years, and two of the three cases were conceived through in vitro fertilization, while the third case was a natural pregnancy.

### 4.1.2 Scientific Evidence

A study[33] titled "Perinatal outcomes in twin pregnancies complicated by maternal morbidity: evidence from the World Health Organization Multi-country Survey on Maternal and Newborn Health" aimed to assess the adverse birth outcomes associated with twin pregnancies, according to WHO definitions and criteria, specifically to evaluate the prevalence of life-threatening conditions, maternal near-miss events, and maternal deaths between twin pregnancies and singleton pregnancies using the WHO Multi-country Survey on Maternal and Newborn Health (WHOMCS), a cross-sectional study conducted in 29 countries, including Jordan. Data from 8,568 twin births were compared with 308,127 singleton births to assess the occurrence of adverse birth outcomes and maternal complications. Key findings of the study regarding maternal complications, as shown in Table (11) from the study, include:

Twin pregnancies double the risk of life-threatening maternal complications such as (bleeding disorders, placental abruption, uterine rupture, and hypertensive disorders) compared to singleton pregnancies, triple the risk of maternal near-miss events (respiratory distress, urinary retention, blood clotting failure, stroke, loss of consciousness, and cardiac arrest), and quadruple the risk of maternal mortality during pregnancy or within 42 days of the end of pregnancy) compared to singleton pregnancies. Overall, the occurrence of (life-threatening conditions, maternal near-miss events,

33 Danielly S. Santana, and others, Perinatal outcomes in twin pregnancies complicated by maternal morbidity: evidence from the WHO Multicounty Survey on Maternal and Newborn Health Network, BMC Pregnancy and Childbirth (2018) 18:449, https://doi.org/10.1186/s12884-018-2082-9

and maternal deaths) was twice or more as high in twin pregnancies compared to singleton pregnancies. The percentage of complicated pregnancies was 15.3% of all twin pregnancies compared to 6.8% of all singleton pregnancies.

**Table (11): Percentage Distribution of Twin Pregnancies and Singleton Pregnancies by Complications**

| Incidence | Twin Pregnancies (%) | Singleton Pregnancies (%) |
|---|---|---|
| No Complication (NC) | 84.8 | 93.2 |
| Potentially life-threatening condition (PLTC) | 13.4 | 6.2 |
| Maternal Near Miss (MNM) | 1.5 | 0.5 |
| Maternal Death (MD) | 0.4 | 0.1 |

Danielly S. Santana, and others, Perinatal outcomes in twin pregnancies complicated by maternal morbidity: evidence from the WHO Multicounty Survey on Maternal and Newborn Health Network, BMC Pregnancy and Childbirth (2018)18:449.

These results reinforce the idea that twin pregnancies are associated with worse maternal outcomes, which justifies the need for more specialized care for women with twin pregnancies, not only for good birth outcomes but also for maternal health.

The National Maternal Mortality Surveillance and Response System implemented by the Ministry of Health[34], as shown in Table (12), indicates that in 2022, there was one maternal death with a twin pregnancy out of 60 maternal deaths, while in 2023, there were two deaths out of 41 maternal deaths. The three cases of death were among mothers aged 26-29 years, and two of the three cases were conceived through in vitro fertilization, while the third case was a natural pregnancy. This confirms that twin pregnancies are high-risk cases that require special care, and this necessitates the implementation of protocols to identify high-risk cases and provide them with care.

**Table (12): Number of Maternal Deaths with Twin Pregnancies by Selected Characteristics from the National Maternal Mortality Surveillance and Response System for 2022 and 2023**

| Year | Number of Maternal Deaths | Maternal Deaths with Twin Pregnancies | Age | Conception Method | Cause of Death |
|---|---|---|---|---|---|
| 2022 | 60 | 1 | 26 | In Vitro Fertilization | Pulmonary Embolism |
| 2023 | 41 | 2 | 26 & 29 years | Natural Pregnancy, In Vitro Fertilization | Eisenmenger Syndrome, Pulmonary Embolism |

Ministry of Health, National Maternal Mortality Surveillance and Response System 2022, 2023

34 The system began reporting deaths of women of reproductive age throughout the Kingdom at the beginning of 2018, with the aim of contributing to the reduction of preventable maternal deaths by obtaining information related to each death and using it to determine public health measures in response and monitor their impact. The main unit in the system is death resulting from complications of pregnancy or childbirth for a woman during her pregnancy or within 42 days of the end of pregnancy, regardless of the duration and location of the pregnancy, due to any cause related to the pregnancy or that the pregnancy and its management exacerbated without resulting from an accident or incidental emergency.

# 5. Implications of Twin Pregnancies on Child Health

## 5.1 Facts

- In Jordan, twin pregnancies were a factor contributing to low birth weight.
- In Jordan, two-thirds of twin births have low or very low birth weight, compared to less than one-eighth of singleton births.
- In sixty countries, including Jordan, low birth weight in twins was associated with a significantly increased risk of early mortality in twins compared to singleton births.
- In sixty countries, including Jordan, early mortality among twin births was significantly higher compared to singleton births.
- In Jordan, the stillbirth rate (at or after 24 weeks of gestation per 1,000 total births) is significantly higher in multiple births (twins, triplets, and quadruplets) compared to singleton births.
- In Jordan, risk factors in twin pregnancies were mainly associated with prematurity, low birth weight, pregnancy-induced hypertension, lack of adequate prenatal care, birth asphyxia, and poor fetal presentation at birth.
- In Jordan, the infant mortality rate (0-11 months) among twins was 3.3 times higher than among singletons. Most of these deaths occurred among infants during the neonatal period (0-1 month).
- In Jordan, the neonatal mortality rate (0-1 month) among twins is four times higher than the neonatal mortality rate among singletons.
- In Jordan, the under-five mortality rate among twins was 3.3 times higher than among singletons.
- In 29 countries, including Jordan, twin births were associated with higher rates of preterm birth (gestational age at birth less than 37 weeks) compared to singleton births. High preterm birth rates are significant because they are associated with high rates of neonatal morbidity and perinatal mortality.
- In 29 countries, including Jordan, twin births were associated with low birth weight (less than 2500g), and the decrease was higher among second twins compared to first twins. The decrease was also 5-5.7 times higher among twin births compared to singleton births.
- In 29 countries, including Jordan, the risk of low Apgar score (a comprehensive scoring system used to assess the health of a newborn immediately after birth) at five minutes was three times higher in first twin births and 3.8 times higher in second twin births compared to singleton births.

- In 29 countries, including Jordan, the risk of fetal death (death after 28 weeks) was 1.8 times higher for the first twin and 2.9 times higher for the second twin compared to singleton pregnancies.
- In 29 countries, including Jordan, perinatal mortality was described as 2.5 times higher for first twin births and 3.6 times higher for second twin births compared to singleton births, mainly due to preterm birth and fetal growth restriction.
- In 29 countries, including Jordan, twin births were associated with admission to the neonatal intensive care unit compared to singleton births.

### 5.2 Scientific Evidence

**• Low Birth Weight**

A study[35] titled "Prevalence and risk factors for low birth weight[36] in Jordan, and Its Association with Under-Five Mortality" based on the analysis of data from the 2012 JPFHS, indicates that among 9,734 births analyzed, 13.8% had low birth weight, and 1.3% had very low birth weight. Significant risk factors for low birth weight included: maternal age less than 30 years and less than or equal to 35 years, education level less than higher education, birth intervals less than 24 months after the first birth, unplanned pregnancy, family financial status (poorest and wealthiest), consanguineous marriage, residence in the central and southern regions of Jordan, first and sixth birth order, maternal smoking during pregnancy, and twin pregnancy. As shown in Table (13) from the study, twin births with low birth weight constituted 56% of all twin births, compared to 12.3% of singleton births with low birth weight out of all singleton births.

**Table (13): Distribution of All Live Births in the Five Years Prior to the Survey by Weight, Birth Time, and Type of Birth**

| Type of Birth | Live Births | Normal Weight Births | Low Birth Weight[37] | Very Low Birth Weight |
|---|---|---|---|---|
| Single | 9,391 (96.5%) | 8,234 (87.7%) | 1,157 (12.3%) | 87 (0.9%) |
| Twin | 343 (3.5%) | 152 (44.3%) | 191 (55.7%) | 36 (10.5%) |

M Mazharul Islam, Faisal Ababneh and others, Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality a population-based analysis, EMHJ–Vol. 26 No. 10 – 2020.

35 M Mazharul Islam , Faisal Ababneh and others, Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality: a population-based analysis, EMHJ – Vol. 26 No. 10 – 2020, https://pubmed.ncbi.nlm.nih.gov/33103755/

36 Low birth weight (LBW) is defined by the World Health Organization (WHO) as a birth weight of less than 2,500 grams, regardless of gestational age.

37 Low birth weight infants include those with very low birth weight.

The study indicates that the risk of death for children under the age of five was 4.8 times higher for children with low birth weight compared to those with normal birth weight. The most significant impact of birth weight on mortality occurred during the neonatal period, with the risk of death being approximately 6 times higher for children born with low birth weight compared to those born with normal birth weight.

A study titled[38] "Early Mortality of Newborn Twins: Results from 60 Low- and Middle-Income Countries" aimed to evaluate the relationship between twin births and early mortality (death within the first week of life, from 0-6 days) compared to single births. The study analyzed individual-level data from the population and health surveys of 60 countries, including Jordan, with a total of 521,867 single births and 14,312 twin births. The results of this study showed that early mortality rates for twins were significantly higher compared to single births across the 60 countries. The early mortality rate for twin births was 12.1 deaths per 100 live twin births, compared to 2 deaths per 100 live births for single births. In Jordan, the early mortality rate for twins was 6.6 deaths per 100 live twin births, compared to 1 death per 100 live births for single births. The study found that in twenty countries, including Jordan, where birth weight data was available for more than 80% of cases, low birth weight for twins significantly increased the risk of early neonatal death compared to single births.

**• Stillbirths[39] Among Twin Pregnancies**

In a study[40] titled "Rate, determinants, and causes of stillbirth in Jordan: Findings from the Jordan Stillbirth and Neonatal Deaths Surveillance (JSANDS) system," based on all births and birth outcomes recorded in the system from August 2019 to January 2020 in five major hospitals (three public, one private, and one teaching hospital) located in three of the largest cities in Jordan, with a 100% completion rate. The study defined stillbirth as any fetal death occurring at or after 24 weeks of gestation, and the stillbirth rate was calculated as the number of stillbirths per 1,000 total births. A total of 10,328 births were recorded during the reporting period. Out of the total births, 102 were stillbirths (88 antepartum and 14 intrapartum), with a rate of 9.9 per 1,000 total births. The study concluded that the stillbirth rate varied according to multiplicity. The rate per 1,000 total births was significantly higher in multiple births compared to singleton births (8.7 in singleton births, 24.1

38 Saverio Bellizzi, Howard Sobel, Ana Pilar Betran, Marleen Temmerman, early neonatal mortality in twin pregnancy: Findings from 60 low- and middle-income countries,www.jogh.org • doi: 10.7189/jogh.08.010404, June 2018 • Vol. 8 No. 1.

39 Fetal death after 28 weeks of gestation, but before or during birth.

40 Khulood K. Shattnawi, and others, Rate, determinants, and causes of stillbirth in Jordan: Findings from the Jordan Stillbirth and Neonatal Deaths Surveillance (JSANDS) system, BMC Pregnancy and Childbirth (2020) 20:571,https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-020-03267-2

in twins, 69.8 in triplets, and 375.0 in quadruplets). Multiple pregnancies are a risk factor for stillbirth, and since stillbirth rates are highly sensitive to access to high-quality prenatal care, appropriate assessment and early identification of multiple pregnancies may contribute to reducing stillbirths.

**• Mortality Among Twin Births**

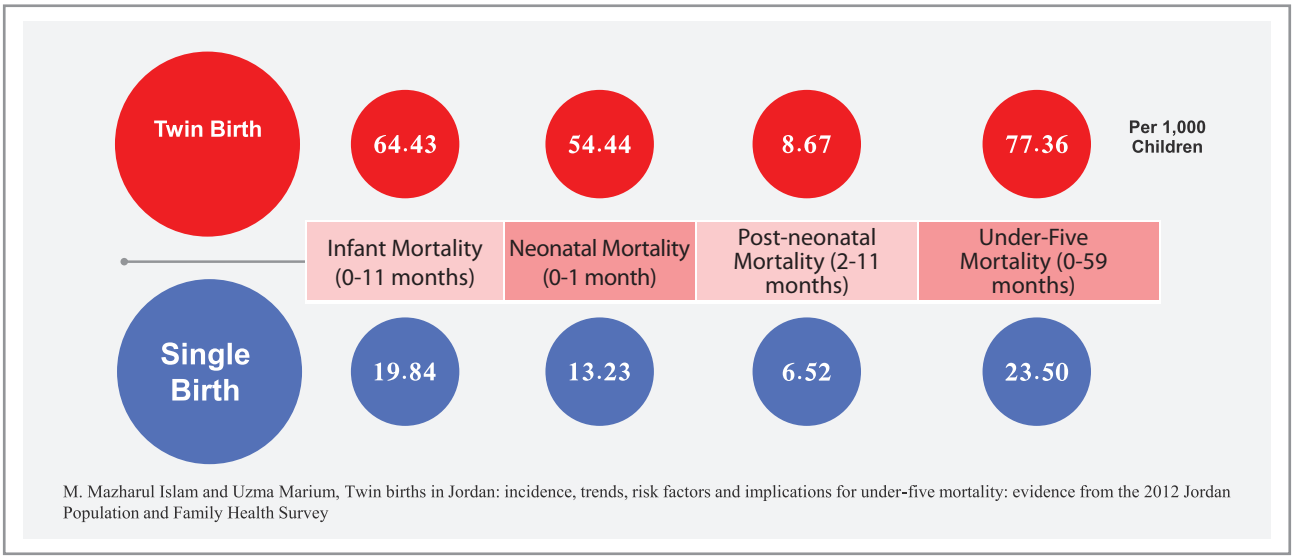
In a study[41] titled "Outcome of twin pregnancies in North Jordan", examining twin birth outcomes at Princess Badeeah Teaching Hospital from January 1, 1996, to June 30, 1999, the twin birth rate was 11.6 twins per 1,000 live births, with a total perinatal mortality rate of 178 per 1,000 births. Breech presentation was associated with the highest perinatal mortality rate (278 per 1,000). One hundred and eighty-four out of 386 twin pregnancies were preterm, with the highest perinatal mortality rate (184 per 1,000). The neonatal twin mortality rate decreased with increasing birth weight, from 532 per 1,000 at 1500 grams to 16 per 1,000 births at 2500 grams. The study concluded that risk factors in twin pregnancies were mainly prematurity, low birth weight, pregnancy-induced hypertension, lack of adequate prenatal care, birth asphyxia, and poor fetal presentation at birth.

In a study[42] titled "Twin births in Jordan: incidence, trends, risk factors and implications for under-five mortality: evidence from the 2012 JPFHS", which examined the association of twin births with an increased risk of under-five mortality, using data from the 2012 JPFHS, as shown in Figure (12) from this study, the infant mortality rate (IMR) among twins was 64.4 deaths per 1,000 twin births compared to 19.8 deaths per 1,000 singleton births, indicating that the IMR was 3.3 times higher among twins than among singletons. Most of these deaths occurred among infants during the neonatal period (0-1 month), with a neonatal mortality rate of 54.4 deaths per 1,000 twins, while for singletons it was 13.2 deaths per 1,000 singletons. The under-five mortality rate also indicates that the mortality rate among twins was 3.3 times higher than among singletons, with 77.36 deaths per 1,000 twins compared to 23.5 deaths per 1,000 singletons.

41 S. Ziadeh, Outcome of twin pregnancies in North Jordan, Journal of Obstetrics and Gynecology Volume 20, 2000 - Issue 5, https://doi.org/10.1080/014436100434677

42 M. Mazharul Islam and Uzma Marium, Twin births in Jordan: incidence, trends, risk factors and implications for under-five mortality: evidence from the 2012 JPFHS, Cambridge University Press, 2019. Journal of Biosocial Science (2019), 51: 6, 857–874.

**Figure (12): Mortality Rates Among Infants and Children Under Five for Live Births of Twins and Singletons**




In a study[43] titled "Perinatal outcomes in twin pregnancies complicated by maternal morbidity: evidence from the World Health Organization Multicounty Survey on Maternal and Newborn Health," a cross-sectional study conducted in 29 countries, including Jordan. Data from 8,568 twin births were compared with 308,127 singleton births. Key findings of the study regarding fetal and neonatal complications are shown in Table (14) from the study.

**Table (14): Perinatal Outcomes in Twin and Singleton Births According to the WHO Multi-country Survey, 2010-2011**

| Outcome | Twin Births | | Singleton Births (%) |
|---|---|---|---|
| | First Twin (%) | Second Twin (%) | |
| Gestational age at birth <34 weeks | 13 | | 2.4 |
| Gestational age at birth 34-36 weeks | 24.1 | | 4.9 |
| Birth weight <2500g | 53.2 | 61.1 | 10.6 |
| Apgar Score <7 at 5 minutes of birth | 7.8 | 10.1 | 2.6 |
| Fetal death (death after 28 weeks before birth) | 3,6 | 5.7 | 2.0 |
| Early neonatal death (death in the first week of life) | 3.5 | 5.2 | 0.9 |
| Perinatal death (early neonatal death and fetal death) | 7.0 | 10.0 | 2.8 |
| Admission to neonatal intensive care unit | 23.6 | 29.3 | 6.4 |
| Any adverse perinatal outcome (APO)[44] | 67.0 | 72.3 | 23.4 |

Danielly S. Santana, and others, Perinatal outcomes in twin pregnancies complicated by maternal morbidity: evidence from the WHO Multicounty Survey on Maternal and Newborn Health Network, BMC Pregnancy and Childbirth (2018) 18:449.

43 Danielly S. Santana, and others, Perinatal outcomes in twin pregnancies complicated by maternal morbidity: evidence from the WHO Multicounty Survey on Maternal and Newborn Health Network, BMC Pregnancy and Childbirth (2018) 18:449, https://doi.org/10.1186/s12884-018-2082-9

44 APO): Apgar score <7 at 5 minutes, or stillbirth, or admission to the neonatal intensive care unit, or birth of a small for gestational age infant.

- Twin births were associated with higher rates of preterm birth (gestational age at birth less than 37 weeks), with 37.1% among twin births compared to 7.3% among singleton births. Preterm birth between 34 and 36 weeks was more frequent than preterm birth before 34 weeks. In general, high preterm birth rates are significant because they are associated with high rates of neonatal morbidity and perinatal mortality, mainly due to respiratory complications.
- Twin births were associated with low birth weight (less than 2500g) compared to singleton births, with rates of 53.2% among first twins and 61.1% among second twins, compared to 10.6% among singleton births, i.e., 5-5.7 times higher among twin births compared to singleton births. This risk is associated with an increased risk of Apgar score less than 7 at 5 minutes and death within the first year of life.
- The risk of low Apgar score at 5 minutes in twin births compared to singleton births was 3 times higher in first twin births and 3.8 times higher in second twin births compared to singleton births, and 1.3 times higher when comparing the second twin to the first.
- The risk of fetal death (death after 28 weeks) was 1.8 times higher for the first twin (3.6%) and 2.9 times higher for the second twin (5.7%) compared to singleton pregnancies (2.0%).
- Perinatal mortality was described as 2.5 times higher for first twin births and 3.6 times higher for second twin births compared to singleton births, mainly due to preterm birth and fetal growth restriction.
- Twin births were associated with admission to the neonatal intensive care unit compared to singleton births, with rates of 23.6% among first twins and 29.3% among second twins, compared to 6.4% among singleton births.
- Any adverse perinatal outcome (APO) was associated with twin births compared to singleton births, with 67% among first twin births and 72.3% among second twin births compared to 23.4% among singleton births.
- Among all perinatal outcomes, rates were significantly higher for twins compared to singletons, and for the second twin compared to the first twin.

These results reinforce the idea that twin pregnancies are associated with worse fetal and neonatal outcomes, which justifies the need for more specialized care for women with twin pregnancies, care capable of reducing the risk of significant long-term adverse outcomes.

45 The Apgar test is a comprehensive scoring system used to assess the health of a newborn immediately after birth. The assessment is based on five categories: heart rate, respiratory effort, muscle tone, reflexes, and skin color.

# 6. The Social Cost of Twin Births

## 6.1 Facts

Twin pregnancies and births, compared to singleton pregnancies, pose significant challenges for families in health aspects such as pregnancy complications and preterm birth, as well as psychological challenges such as stress, anxiety, postpartum depression, sleep deprivation, and fatigue, economic challenges such as increased costs and impact on parental employment, and social challenges such as reduced personal time for parents, impact on other siblings, difficulty in family mobility, meeting individual child needs, competition between twins, and financial pressures that twins impose on family health and well-being. To the extent of knowledge in this paper, Jordanian studies have not addressed this aspect, and due to the importance of considering the unique challenges faced by families with multiple births, we will highlight these challenges from studies in other countries.

## 6.2 Scientific Evidence

A study[46] issued by the Australian Multiple Birth Association titled "Multiples Matter, Investigating the Support Needs of Multiple Birth Families" concluded that families with multiple children face a greater set of challenges compared to those with a single child. The following are the most prominent findings of the study in this area:

- The costs of twins and other multiple births up to one year of age are approximately 5 times and 13 times higher, respectively, than the costs of a single child, with the cost concentrated in the perinatal period due to increased medical expenses and the need for specialized care.
- The increased risk of preterm birth and low birth weight results in hospital visits and costs during the first year of life, and hospital visits and costs tend to be similar to those of single children in subsequent years.
- Parents with multiple children were more likely to report financial stress compared to parents of single children, and were more likely to experience difficulties in paying medical bills.
- Mothers of multiple children are more likely to experience a decrease in income after the birth of their children, as they are more likely to reduce their working hours or leave the workforce altogether. This can lead to long-term economic consequences for families, including reduced savings.
- Mothers of multiple children have a higher prevalence of prenatal depression compared to mothers of single children, due to increased stress and anxiety associated with managing a high-risk pregnancy and the possibility of complications.

46 Michael D'Rosario, Multiples Matter, Investigating the Support Needs of Multiple Birth Families, AMBA, Per Capita.

- Mothers of multiple children have three times higher rates of clinical anxiety, five times higher rates of depression, and nine times higher rates of disabling fatigue compared to mothers of single children.
- Fathers of multiple children experience double the levels of anxiety, four times the rates of depression, and five times the prevalence of impaired daily functioning compared to fathers of single children.
- Preterm birth is associated with an increased risk of complications, such as respiratory distress syndrome, cerebral palsy, and developmental delays, and parents of multiple children may face unique challenges related to the increased risk of their children developing health issues. Caring for multiple infants with health problems can be exhausting, stressful, and time-consuming, which can negatively impact parental mental health and well-being.
- The breastfeeding rate among mothers of multiples was lower compared to mothers of singletons, and they were more likely to stop breastfeeding earlier than mothers of singletons.
- Parents of multiple children experience more sleep deprivation compared to those with single children.

In a study[47] titled "Healthcare expenses associated with multiple vs singleton pregnancies in the United States" the cost associated with multiple pregnancies versus singleton pregnancies was investigated by analyzing the Market Scan database. The cost for mothers included medical expenses during the 27 weeks prior to delivery and up to 30 days after delivery, and for infants, the cost included all medical expenses up to their first birthday. A total of 437,924 eligible births were identified from January 1, 2005, to September 30, 2010. Among the eligible births, 424,880 (97.02%) were singleton births, 12,482 (2.85%) were twin births, and 562 (0.13%) were triplet or higher-order births. Assisted reproductive technology (ART)/intracytoplasmic sperm injection (ICSI) was used in 1.0% of singleton births, 16.9% of twin births, and 24.7% of higher-order multiple births. The study concluded that the cost of a twin pregnancy is approximately 5 times higher than the cost of a singleton pregnancy, and the cost of a triplet or higher-order pregnancy is approximately 20 times higher. The study attributed the high expenses to increased comorbidities, almost exclusive use of cesarean delivery, and longer hospital stays for women with multiple pregnancies, as well as increased admissions and longer stays in the neonatal intensive care unit for twins and higher-order multiples. Maternal and infant care expenses were also significantly higher for known ART/ICSI pregnancies compared to other pregnancies for both singletons and twins.

47 Lemos EV, Zhang D, Van Voorhis BJ, et al. Healthcare expenses associated with multiple vs singleton pregnancies in the United States. Am J Obstet, Gynecol 2013;209:586.e1-11.

A study[48] titled "Social Cost of Twin Births" concluded that it is useful for health planners to know that for every singleton birth, 0.36 days of neonatal intensive care unit time are used, and this number for a twin birth is 4.168 days, and for any twin pregnancy, it is 8.336 days. The probability of severe disability for any singleton pregnancy is 0.00199, and for any twin pregnancy, it is 0.01368, which is about seven times greater. Costs can be calculated by considering the cost of one day of neonatal care and including the cost of care for any child with a severe disability. These costs for twins compared to singletons are closely related to unfavorable birth weight distributions. Therefore, it is possible to calculate the savings that can be achieved if a preterm birth prevention policy is implemented that allows for the adjustment of birth redistribution within birth weight categories. Each twin pregnancy may cost ten times the cost of a singleton pregnancy. The research showed that a very slight decrease in the number of low-birth-weight infants in the highest risk group would reduce costs and lead to significant savings. The study recommended the need to implement a preterm birth prevention policy in the case of twin pregnancies, because twin pregnancies carry a much higher risk of preterm birth than singleton pregnancies.

48 Emile Papiernik, Social Cost of Twin Births, Acta Genet Med Gemellol 32:105-111 (1983) https://www.cambridge.org/core/journals/amg-acta-geneticae-medicae-et-gemellologiae-twin-research/article/social-cost-of-twin-births/768C9533C6318B6B13FB1ECFE0CC86F9

## 7. Recommendations

1. Enhance health awareness through educational programs provided by healthcare service providers about the risks of twin pregnancies, and provide counseling to women seeking assisted reproductive technology (ART) about the risks of twin pregnancies through ART.

2. Manage twin pregnancies as a high-risk group through more specialized care for women with twin pregnancies, educating mothers about danger signs during pregnancy, and raising awareness of the importance of medical follow-up to ensure early detection of any problems, manage potential complications, and prevent preterm birth.

3. Reduce multiple pregnancies through medically assisted reproduction by implementing strict medical protocols in the use of ovulation-stimulating drugs, and reducing the number of embryos transferred to the uterus in cases of in vitro fertilization (IVF) using a single embryo transfer policy and focusing on successful singleton live births.

It is worth noting that the Human Fertilization and Embryology Authority (HFEA) in the United Kingdom introduced a single embryo transfer policy in 2009 to reduce the chances of multiple pregnancies after IVF treatment, and they set a national goal of reducing the multiple birth rate conceived through IVF to 10%, which was achieved for the first time in 2017. The Practice Committee of the American Society for Reproductive Medicine, the Practice Committee of the Society for Assisted Reproductive Technology, the American Society for Reproductive Medicine, and the Society for Assisted Reproductive Technology have also developed guidelines regarding the number of embryos transferred during assisted reproductive technology aimed at promoting singleton pregnancies and reducing the number of multiple pregnancies. It is also worth noting that Jordanian instructions have imposed penalties on fertilization units in case the unit returns more than 2 embryos as a maximum, unless the wife is forty years of age or older, in which case 3 embryos can be returned as a maximum.

4. Explore the possibility of supporting families who give birth to twins, both financially and morally and considering the possibility of increasing maternity and paternity leave, given the significant burdens borne by parents in raising their twin children.

5. Given the long-term negative impacts of male fetal sex selection at various levels on men, women, families, and society due to the resulting gender imbalance at birth and beyond, this paper recommends monitoring the sex ratio at birth statistically through annual birth statistics by gender, as well as examining the role of fertility and infertility centers and medical technology in the phenomenon of fetal sex selection. It is worth noting that the sex ratio at birth in Jordan in 2023 was 106.6 males per 100 females, which is one point higher than in previous years.

6. Add questions within the JPFHS about whether medical assistance was received for reproduction to determine whether twins are medically assisted or not and the extent of infertility among couples and its increase in Jordan.

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