

Assessing the Impact of Healthcare Resources on Birth Outcomes at Private and Public Hospitals in Saudi Arabia

Ghofran Hani Jamaluddin

Executive Master's in Health Administration, Department of Health Services and Hospitals Administration, Faculty of Economics and Administration, King Abdulaziz University, Jeddah, Saudi Arabia
Ghofranhjamal@gmail.com

Bodor Fadel

Academic Supervisor, Department of Health Services and Hospitals Administration, Faculty of Economics and Administration, King Abdulaziz University, Jeddah, Saudi Arabia

Abstract

This study aimed to evaluate the impact of healthcare resources on birth outcomes in public and private hospitals in the Kingdom of Saudi Arabia. The study examined the effect of five main resources: obstetricians and gynecologists (OB/GYN), pediatricians, midwives, OB/GYN-specialized hospitals, and hospital beds, and investigated their contribution to key maternal and neonatal health indicators, namely normal and abnormal deliveries, maternal mortality, pregnancy and childbirth complications, and infant mortality. The study was motivated by the scarcity of empirical research on this relationship in the Saudi context and by the importance of healthcare providers and infrastructure in reducing maternal and infant mortality and informing healthcare resource allocation.

The study adopted a quantitative approach and relied on secondary data as the main source of information, collected from the annual Statistical Yearbooks published by the Saudi Ministry of Health for the period 2017 to 2023. Data were analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS), employing descriptive statistics (mean, median, mode, and standard deviation) and linear regression analysis.

The findings indicated a strong and statistically significant relationship between the number of OB/GYN physicians and normal deliveries, with an R^2 value of 0.898, while no statistically significant relationship was found with abnormal deliveries ($R^2 = 0.007$). A strong and statistically significant relationship was also found between the number of pediatricians and infant mortality, with an R^2 value of 0.841. In contrast, OB/GYN-specialized hospitals ($R^2 = 0.145$) and hospital beds ($R^2 = 0.039$) showed weak and statistically insignificant relationships with maternal mortality, as did the number of midwives with pregnancy and childbirth complications ($R^2 = 0.240$). These results highlight the importance of combining the availability of healthcare resources with improvements in the quality of care.

The study recommends improving the quality of care in specialized hospitals, strengthening midwives' training and emergency obstetric care skills, expanding pediatric services and early infant care programs, and increasing the number of pediatricians, particularly in rural and underserved areas. These measures can contribute to improving birth outcomes and maternal and neonatal health in the Kingdom of Saudi Arabia. The study also calls for future qualitative research addressing service quality, referral systems, and emergency response.

Keywords: Healthcare Resources, Birth Outcomes, OB/GYN Physicians, Midwives, Pediatricians, Maternal and Infant Mortality, Saudi Arabia.

Introduction

Maternal and newborn health is among the key indicators of health system performance, and birth outcomes depend heavily on the quality of the healthcare resources available to patients. The number of healthcare providers, such as OB/GYN physicians and midwives, has an effect on reducing neonatal and maternal mortality. To reduce neonatal deaths and enhance the quality of newborn care, competent health professionals and essential supplies, such as OB/GYN-specialized hospitals and hospital beds, are crucial (Birhanu & Mathibe-Neke, 2022). Deficiencies in resources and the lack of national guidelines for immediate newborn care hinder its practice and contribute to high neonatal mortality (Berhe et al., 2017). In addition, the quality of prenatal care is correlated with neonatal deaths, and primary healthcare affects both the neonatal and post-neonatal periods (Russo et al., 2019). As for maternal mortality, the number of trained healthcare providers during childbirth, such as midwives, is critical for reducing maternal deaths (Okonofua et al., 2018).

Newborn care also depends largely on hospitals and hospital beds. Hospital beds are indicators of existing care infrastructure and directly influence the capacity to meet maternal and neonatal needs (Russo et al., 2019). Inadequate infrastructure, specifically the lack of OB/GYN-specialized hospitals and hospital beds, is likewise a reason for poorer maternal outcomes (Masaba et al., 2022).

Pediatricians also play a role in reducing infant mortality, as specialized physicians and advocates for children. Promoting children's rights, acquiring expert knowledge, and keeping pace with medical technology have contributed significantly to reducing infant mortality (Serra et al., 2021). Beyond clinical care, pediatricians safeguard children's well-being within family and societal contexts, which makes them vital in the fight against infant mortality (Serra et al., 2021).

As healthcare reforms in Saudi Arabia continue (Al Khashan et al., 2021; Rahman & Alsharqi, 2019), this study offers a perspective on the reallocation of healthcare resources and the delivery of healthcare services in relation to birth outcomes. The study comprises five chapters: an introduction to the research problem, a literature review, the methodology, an analysis and discussion of the data, and a conclusion with recommendations.

Research Problem

The core research problem is the lack of empirical studies on the impact of healthcare resources on birth outcomes in Saudi Arabia. Earlier studies have shown that public sector hospitals in Jeddah are equipped to deal with obstetric emergencies, and many follow evidence-based procedures (Altaweli et al., 2014). A study in the Jazan region reported adverse birth outcomes, with 12.1% miscarriage, 2.3% premature births, and 1.9% low birth weight (Dallak et al., 2022). Another study examined the respectful maternity care received by pregnant women and revealed a generally positive attitude toward hospital services (Alghamdi et al., 2023). However, research on the impact of healthcare resources on birth outcomes in Saudi Arabia is almost nonexistent.

Internationally, previous studies have shown that education, supplies such as gloves and syringes, and transport were key to increasing facility births (Webber et al., 2022). In Tanzania, community health worker education, birth kit distribution, and transport subsidies increased women's attendance for facility births, and the District Medical Office in Rorya included birth kits in its budget after these interventions proved successful (Webber et al., 2022). Inadequate resources at health facilities have been found to affect maternal and newborn services negatively. In Ghana, the challenges that weakened the quality of care in rural communities included the absence of medical equipment, a shortage of skilled workforce, and high informal costs of required medicines (Sumankuuro et al., 2018). Sufficient numbers of healthcare providers in referral hospitals are also important for guaranteeing access to emergency obstetric care, and research in Nigeria indicates that a higher ratio of antenatal care attendees to providers was correlated with higher maternal mortality (Okonofua et al., 2018).

Although information is abundant about healthcare resources and birth outcomes in many countries, empirical studies on the effect of healthcare resources on birth outcomes in Saudi Arabia are significantly limited (Alanazy & Brown, 2020; Altaweli et al., 2014). It therefore remains unclear how healthcare resources in Saudi Arabia affect maternal and newborn health. This constitutes a significant research problem, because understanding their exact impact can support policymaking and improve birth outcomes in the Saudi context.

Accordingly, the research problem lies in the need to assess the impact of healthcare resources, namely OB/GYN physicians, pediatricians, midwives, OB/GYN-specialized hospitals, and hospital beds, on birth outcomes in public and private hospitals in the Kingdom of Saudi Arabia. Based on this, the study seeks to answer the following main question:

What is the impact of healthcare resources on birth outcomes in public and private hospitals in Saudi Arabia?

Research Questions

Main question:

- What is the impact of healthcare resources on birth outcomes in public and private hospitals in Saudi Arabia?

Sub-questions:

- How does the number of OB/GYN physicians affect newborn births (normal and abnormal deliveries) in Saudi Arabia?
- How does the number of OB/GYN-specialized hospitals and hospital beds impact maternal mortality in Saudi Arabia?
- What is the relationship between the number of midwives and complications of pregnancy and childbirth in Saudi Arabia?
- How does the number of pediatricians impact infant mortality in Saudi Arabia?

Research Objectives

Main objective:

- To assess the impact of healthcare resources on birth outcomes in public and private hospitals in Saudi Arabia.

Sub-objectives:

- To identify the effect of the number of OB/GYN physicians on newborn births (normal and abnormal deliveries).
- To identify the impact of the number of OB/GYN-specialized hospitals and hospital beds on maternal mortality.
- To identify the relationship between the number of midwives and complications of pregnancy and childbirth.
- To identify the impact of the number of pediatricians on infant mortality.

Research Hypotheses

- **H1:** The number of OB/GYN physicians significantly affects newborn births in Saudi Arabia.
- **H2:** The number of OB/GYN-specialized hospitals and hospital beds significantly impacts maternal mortality in Saudi Arabia.
- **H3:** There is a potential relationship between the number of midwives and complications of pregnancy and childbirth in Saudi Arabia.

- **H4:** The number of pediatricians significantly impacts infant mortality in Saudi Arabia.

Second: Theoretical Framework and Previous Studies

First: Theoretical Framework:

The Healthcare System in Saudi Arabia:

The Saudi healthcare system consists of two main sectors, public and private hospitals, each with its own characteristics and dynamics (Alghamdi et al., 2023). Public hospitals managed by the Ministry of Health (MOH) are the primary providers of care, particularly for Saudi citizens; in 2019, 76 percent of Saudi women gave birth in government hospitals (Saudi MOH, 2021). Government hospitals are sometimes perceived to differ from private hospitals in service quality and infrastructure, which may lead to differences in patient satisfaction and healthcare experiences (Alghamdi et al., 2023; Altaweli et al., 2014). Private hospitals, by contrast, operate on a for-profit basis and offer more personalized services through self-employed practitioners (Alghamdi et al., 2023). Both sectors provide essential services, and the choice between them depends largely on patient preferences, financial situation, and the availability of resources (Mousa et al., 2024).

Over the past decades, Saudi Arabia has made notable progress in maternal and child health. The Under-Five Mortality Rate declined from 44.3 deaths per 1,000 live births in 1990 to 7.0 in 2020 (Al-Nafeesah & Alnafeesah, 2025), and the Maternal Mortality Ratio was recorded at 17 per 100,000 live births in 2017, below the global average (Alghamdi et al., 2023). Nearly 99 percent of births take place in healthcare facilities (Saudi MOH, 2021). Nevertheless, disparities across regions and hospitals persist, and congenital anomalies remain a challenge, with a prevalence of 3.21% over five years (Narapureddy et al., 2024).

Healthcare Resources and Birth Outcomes:

Healthcare resources and birth outcomes are closely related, and adequate resources are fundamental to positive maternal and neonatal health. Skilled attendance at birth helps reduce maternal and neonatal mortality resulting from hemorrhage, infection, and preeclampsia (Sumankuuro et al., 2018). A sufficient number of healthcare providers is a core human resource for delivering quality maternal and neonatal care (Okonofua et al., 2018), while the availability of emergency obstetric care and an efficient referral system is equally important for improving outcomes (Sumankuuro et al., 2018). Shortages of medical equipment, essential medicines, and appropriate infrastructure, along with inadequate space, stockouts, and poor infection prevention, constrain neonatal care and increase risks around childbirth (Birhanu & Mathibe-Neke, 2022; Sumankuuro et al., 2018). Geographical barriers such as long travel distances and poor roads also delay treatment and contribute to childbirth complications (Rizkianti et al., 2021).

The Role of Obstetricians and Gynecologists (OB/GYN):

Physicians and nurses play a fundamental role in safe delivery and optimal newborn care, and in Saudi Arabia 95% of deliveries are attended by skilled healthcare providers (Mahmood et al., 2018; Saudi

MOH, 2021). Skilled birth attendants, mainly obstetricians and gynecologists, are strongly linked to lower risks of maternal and neonatal death because they can immediately manage life-threatening emergencies such as hemorrhage, infection, and preeclampsia, and can perform timely interventions such as cesarean section in cases of fetal distress or eclampsia (Al-Shahrani et al., 2024; Sumankuuro et al., 2018). Conversely, shortages of skilled obstetricians, particularly in rural areas, weaken prenatal, intrapartum, and postpartum care, and the unequal distribution of professionals in favor of urban centers widens healthcare inequalities (Masaba et al., 2022; Stabnick et al., 2022).

Healthcare Facility Capacity: Hospitals and Beds:

Hospitals and their infrastructure make timely and effective maternal care possible. They provide skilled birth attendance and emergency obstetric care, adequate maternity and labor beds, and intensive care units for emergencies (Alharbi et al., 2024; Nassif et al., 2022). Obstetrics and gynecology-specialized hospitals contribute further through targeted, high-quality care, the availability of Comprehensive Emergency Obstetric Care (CEmOC), specialized obstetric teams for complex conditions, and Neonatal Intensive Care Units (NICUs) for high-risk newborns (Al-Shahrani et al., 2024; Alharbi et al., 2024). Where such hospitals are scarce, women may rely on unskilled attendants or home deliveries, which increases the risk of complications and death (Alharbi et al., 2024; Masaba et al., 2022).

Midwives and Pregnancy Complications:

Midwives are central to caring for pregnant women and managing pregnancy complications, particularly through early detection, routine antenatal care, and counseling. They are often the first to identify warning signs such as abnormal fetal status or high blood pressure (Al-Shahrani et al., 2024; Millington et al., 2019). When well trained and resourced, they reduce complications such as hemorrhage, infection, and preeclampsia, and their continuous support during labor improves outcomes for mothers and babies (Al-Shahrani et al., 2024). However, limited training in advanced emergency skills, such as Advanced Life Support, restricts their ability to manage crises like eclampsia or fetal distress, which makes robust referral systems and collaboration with obstetricians essential (Al-Shahrani et al., 2024; Mahmood et al., 2018).

Pediatricians and Infant Mortality:

Pediatricians contribute to reducing infant mortality by providing early and effective care starting from the first well-baby visits, which allow problems such as jaundice and feeding difficulties to be detected before serious complications develop (Alnasser et al., 2022; Serra et al., 2021). They also educate parents on infant care, vaccination, and the prevention of common childhood diseases, and they address maternal risk factors such as smoking, poor nutrition, and infections that affect infant survival (Bhatia et al., 2019; Russo et al., 2019). Their role is especially critical during the neonatal stage (0–27 days) and the post-neonatal stage (28–364 days) (Russo et al., 2019).

Second: Previous Studies:

Study of Altaweli et al. (2014), entitled "Childbirth care practices in public sector facilities in Jeddah, Saudi Arabia: A descriptive study." The study found that public sector hospitals in Jeddah were equipped to deal with obstetric emergencies and that many of them followed evidence-based procedures.

Study of Dallak et al. (2022), entitled "Prevalence of adverse birth outcomes and associated factors in Jazan, Saudi Arabia: A cross-sectional study." The study investigated the frequency of adverse birth outcomes in the Jazan region and reported a miscarriage rate of 12.1%, preterm births of 2.3%, and low birth weight of 1.9%.

Study of Alghamdi et al. (2023), entitled "Perceived treatment of respectful maternity care among pregnant women at healthcare facilities in the Kingdom of Saudi Arabia: A cross-sectional study." The study examined the respectful maternity care received by pregnant women and found a generally positive attitude toward the services provided by hospitals, while noting that experiences differed between government and private settings.

Study of Narapureddy et al. (2024), entitled "Examining the prevalence of congenital anomalies in newborns: A cross-sectional study at a tertiary care maternity hospital in Saudi Arabia." The study reported a congenital anomaly prevalence of 3.21% over five years, underscoring the need for further research and intervention.

Study of Al-Nafeesah and Alnafeesah (2025), entitled "Analysis of under-five mortality rate in Saudi Arabia: 1973 to 2022." The study documented a marked decline in under-five mortality, from 44.3 deaths per 1,000 live births in 1990 to 7.0 in 2020, a level that remained low through 2022.

Study of Al-Shahrani et al. (2024), entitled "Critical analysis of midwives' impact on maternal and neonatal health in Saudi Arabia." The study highlighted the contribution of midwives to early detection, routine care, and labor support, while pointing to limited training in advanced emergency care.

Study of Webber et al. (2022), entitled "Improving health care facility birth rates in Rorya District, Tanzania: A multiple baseline trial." The study showed that community health worker education, birth kit distribution, and transport subsidies increased women's attendance for facility births.

Study of Sumankuuro et al. (2018), entitled "Perceived barriers to maternal and newborn health services delivery: A qualitative study of health workers and community members in low and middle-income settings." The study identified the absence of medical equipment, a shortage of skilled workforce, and high informal costs of required medicines as challenges that reduced the quality of care in rural communities.

Study of Okonofua et al. (2018), entitled "Association of the client-provider ratio with the risk of maternal mortality in referral hospitals: A multi-site study in Nigeria." The study linked the client-to-

provider ratio in referral hospitals with the risk of maternal mortality, pointing to the importance of sufficient staffing for emergency obstetric care.

Study of Russo et al. (2019), entitled "Primary care physicians and infant mortality: Evidence from Brazil." The study found that each additional primary care physician per 10,000 inhabitants was associated with 7.08 fewer infant deaths per 10,000 live births, with the effect relevant in both the neonatal and post-neonatal stages.

Study of Masaba et al. (2022), entitled "The healthcare system and client failures contributing to maternal mortality in rural Kenya." The study examined healthcare system failures contributing to maternal mortality, including limited access to emergency care and quality problems in antenatal care.

Commentary on Previous Studies:

The previous studies show clear interest in the role of healthcare resources, whether skilled providers, specialized facilities, or supporting infrastructure, in shaping maternal and neonatal outcomes. The current study agrees with them in treating the availability of obstetricians, midwives, pediatricians, and hospital capacity as key determinants of birth outcomes, and in relying on quantitative approaches.

It differs from them in several respects. Many previous studies were conducted outside Saudi Arabia, such as in Tanzania, Ghana, Nigeria, Kenya, and Brazil. Others were descriptive, qualitative, or review-based, or examined single outcomes or single regions in Saudi Arabia, such as Jeddah and Jazan. In contrast, the current study uses national secondary data from official Saudi health sources for the period 2017–2023 and tests the relationship between five resources (OB/GYN physicians, midwives, pediatricians, specialized hospitals, and hospital beds) and distinct birth outcomes (normal and abnormal deliveries, maternal mortality, pregnancy and childbirth complications, and infant mortality).

The study is distinguished by its focus on the Saudi context and by linking each healthcare resource to a specific outcome within one research model. This provides a more specific treatment of the relationship between healthcare resources and birth outcomes and helps fill the gap in empirical evidence on this topic in Saudi Arabia.

Third: Study Methodology and Procedures

1. Study Design:

This study adopted a quantitative approach using a secondary data design. Numerical data were obtained from existing official sources rather than collected directly from participants (Bell et al., 2022). Neither questionnaires nor interviews were used, because the study relies on existing datasets (Sekaran & Bougie, 2016). The study uses documentary analysis of archival government records, which means using existing official records for analytical purposes (Saunders, 2014).

This design suits the study for four reasons:

- It examines associations between national healthcare variables and health outcomes, which is large-scale health systems research (Bell et al., 2022).
- The data come from national health reporting systems that ensure accuracy and consistency across years.
- It is time-efficient and cost-effective when systematically compiled data are available from an authoritative source (Sekaran & Bougie, 2016).
- It supports regression analysis and statistical modeling.

2. Study Hypotheses:

The study tested four hypotheses:

- **H1:** The number of OB/GYN physicians significantly affects newborn births (normal and abnormal deliveries) in Saudi Arabia.
- **H2:** The number of OB/GYN-specialized hospitals and hospital beds significantly impacts maternal mortality in Saudi Arabia.
- **H3:** There is a potential relationship between the number of midwives and complications of pregnancy and childbirth in Saudi Arabia.
- **H4:** The number of pediatricians significantly impacts infant mortality in Saudi Arabia.

3. Study Model and Variables:

The study model links healthcare resources, as independent variables, to birth outcomes, as dependent variables. Healthcare resources include infrastructure, medical equipment, skilled staff, hospital beds, and specialized units available for maternal and newborn care (Alghamdi et al., 2023). Birth outcomes refer to the health status of the newborn and the mother at birth (Alruwaili et al., 2024).

Table (1). Study variables and measurement

Independent variable	Dependent variable	Analysis technique
Number of OB/GYN physicians	Newborn birth outcomes (normal and abnormal deliveries)	Multiple linear regression
Number of OB/GYN-specialized hospitals and hospital beds	Maternal mortality	Linear regression
Number of midwives	Pregnancy and childbirth complications	Linear regression
Number of pediatricians	Infant mortality	Linear regression

Definitions of the dependent variables:

- **Normal and abnormal deliveries:** Normal delivery is a spontaneous vaginal birth without complications to the mother or infant. Abnormal deliveries deviate from this process and include

preterm deliveries, breech presentations, cesarean deliveries, and deliveries with complications such as fetal distress (Alruwaili et al., 2024; Altaweli et al., 2014).

- **Maternal mortality:** The death of a woman during pregnancy, delivery, or within 42 days of the end of pregnancy, due to causes related to or aggravated by the pregnancy or its management (Alharbi et al., 2024).
- **Pregnancy and childbirth complications:** Conditions such as hemorrhage, preeclampsia, preterm labor, and infection that can jeopardize the health of the mother or baby (Reddy et al., 2009).
- **Infant mortality:** Death before one year of age, covering the neonatal (0–27 days) and post-neonatal (28–364 days) stages (Reddy et al., 2009).

Definitions of the independent variables:

- **OB/GYN physicians:** Specialists in women's reproductive health, pregnancy, and childbirth (Mousa et al., 2024).
- **Specialized hospitals and beds:** Hospitals and beds available for obstetric and gynecological cases, which indicate the readiness of the infrastructure to handle routine and emergency maternal cases.
- **Midwives:** Trained professionals who provide care during pregnancy, childbirth, and the postpartum period.
- **Pediatricians:** Specialists in the care of children from the neonatal stage onward, whose services include early diagnosis, vaccination, parental guidance, and emergency care of newborns (Narapureddy et al., 2024).

4. Data Source and Data Collection:

The data were obtained from the annual Statistical Yearbooks of the Ministry of Health (MOH) in Saudi Arabia, covering the period 2017–2023. These are official publications that summarize standardized national statistics on:

- the numbers of OB/GYN physicians, pediatricians, and midwives;
- hospital types and hospital beds;
- key health outcomes such as maternal mortality, infant mortality, and delivery outcomes.

The data are annual, national-level, and cover public and private hospitals in the Kingdom. For each research question, the relevant indicators were located in the MOH data. Examples include the number of OB/GYN physicians working in public and private hospitals, the number of normal and abnormal deliveries, and the infant mortality rate.

5. Validity and Reliability:

Because the study relies on secondary data, no questionnaire reliability test was required. Instead, the methodological quality of the study rests on the following points:

- **External validity:** This is supported by the use of nationally published and representative MOH data. The study variables, including maternal mortality, infant mortality, and healthcare staffing, are standardized indicators widely used in public health research. This improves the generalizability of the findings (Bell et al., 2022).
- **Reliability:** This is supported by the MOH's uniform annual reporting procedures. The same sources and indicators are used across years, and the variables are reported and classified consistently (Saunders, 2014). Regression analysis then provides a uniform assessment of the relationships among variables.

6. Statistical Analysis:

Data were organized and analyzed using Microsoft Excel and IBM SPSS. The analysis included two stages:

1. **Descriptive statistics:** Measures of central tendency and dispersion (mean, median, mode, and standard deviation) were used to summarize the distribution of the variables.
2. **Inferential statistics:** Correlation and linear regression analyses were used to test the study hypotheses. Regression coefficients, the coefficient of determination (R^2), the ANOVA F-test, and t-tests were used to assess the strength and significance of the relationships. The significance level was set at 0.05.

7. Ethical Considerations and Data Security:

The study used publicly available, aggregated, and anonymized MOH data and involved no direct participation of human subjects. This removes concerns about confidentiality, informed consent, and privacy. The study followed the principles of data integrity by conducting the analyses transparently and without bias, and by crediting the Ministry of Health and other bodies as the original data sources. Since the data are national-level aggregates containing no personally identifiable information, privacy risks are minimal. All digital records and analysis files were stored on password-protected devices.

Fourth: Presentation and Analysis of Study Results

Introduction:

This section presents the results of the statistical analysis of the study data, in light of the study questions and hypotheses. It begins with descriptive statistics for the study variables, then reports the regression results for each research question. It ends with a summary of the hypothesis tests and the answers to the study questions. The analysis used data from the Ministry of Health Statistical Yearbooks for 2017–2023, processed with Excel and SPSS. A relationship was considered statistically significant at $p < 0.05$.

First: Descriptive Statistics:

Table (1). Descriptive statistics of the study variables (2017–2023)

Variable	Observations (years)	Mean	Median	Std. deviation
OB/GYN physicians	7	6,661.00	6,469.00	605.39
Normal deliveries	7	217,130.57	213,412.00	24,960.94
Abnormal deliveries	7	115,114.00	115,514.00	5,144.96
OB/GYN-specialized hospitals	7	21.00	19.00	4.12
OB/GYN-specialized hospital beds	7	10,469.43	11,023.00	2,355.83
Maternal mortality (per 100,000 live births)	7	11.33	11.90	3.02
Midwives	5*	4,594.20	4,671.00	325.87
Pregnancy and childbirth complications	7	60,363.14	60,665.00	5,921.53
Pediatricians	7	8,908.86	8,590.00	1,214.91
Infant mortality (per 1,000 live births)	7	6.77	6.30	1.11

*Midwife data were not available for 2017 and 2018.

The descriptive results show that the number of OB/GYN physicians rose from 5,949 in 2017 to 7,689 in 2023, while normal deliveries fell from 245,879 to 183,530 over the same period. Abnormal deliveries were relatively stable, with a small standard deviation (5,144.96). The number of OB/GYN-specialized hospitals and beds rose steadily, from 17 hospitals and 6,408 beds in 2017 to 26 hospitals and 12,676 beds in 2023. Maternal mortality fluctuated over the period, from 6.00 in 2019 to 15.90 in 2023. In 2023, the year with the most specialized hospitals, maternal mortality was at its highest. The number of midwives was relatively stable, while pregnancy and childbirth complications fluctuated, ranging from 52,508 to 69,475. The number of pediatricians rose from 7,699 to 10,875, and infant mortality ranged between 6.00 and 9.01 per 1,000 live births.

Second: Results of Regression Analysis:

Table(2). Simple linear regression results

Independent variable → Dependent variable	R	R ²	Adj. R ²	F	Sig.	B	Beta	t
OB/GYN physicians → Normal deliveries	0.948	0.898	0.878	44.242	0.001	-39.082	-0.948	-6.651
OB/GYN physicians → Abnormal deliveries	0.084	0.007	-0.191	0.036	0.857	0.718	0.084	0.190
Specialized hospitals → Maternal mortality	0.380	0.145	-0.026	0.846	0.400	0.279	0.380	0.920
Specialized hospital beds → Maternal mortality	0.198	0.039	-0.153	0.205	0.670	0.000	0.198	0.452
Midwives → Pregnancy and childbirth complications	0.490	0.240	-0.013	0.947	0.402	-7.845	-0.490	-0.973
Pediatricians → Infant mortality	0.917	0.841	0.809	26.409	0.004	0.001	0.917	5.139

1. OB/GYN physicians and newborn births (H1).

- Normal deliveries: The model was statistically significant ($F = 44.242$, $p = 0.001$). The number of OB/GYN physicians explained 89.8% of the variance in normal deliveries ($R^2 = 0.898$). The relationship was inverse and strong ($B = -39.082$, $Beta = -0.948$, $t = -6.651$, $p = 0.001$).
- Abnormal deliveries: The model was not statistically significant ($F = 0.036$, $p = 0.857$). The number of OB/GYN physicians explained only 0.7% of the variance ($R^2 = 0.007$, $Beta = 0.084$), which indicates no meaningful effect.

2. OB/GYN-specialized hospitals and hospital beds and maternal mortality (H2).

- Hospitals: They explained 14.5% of the variance in maternal mortality ($R^2 = 0.145$). The effect was weak and not significant ($F = 0.846$, $p = 0.400$; $B = 0.279$).
- Beds: They explained 3.9% of the variance ($R^2 = 0.039$). The effect was not significant ($F = 0.205$, $p = 0.670$).
- The Adjusted R^2 was negative for both models, which indicates a poor fit.

3. Midwives and pregnancy and childbirth complications (H3).

The number of midwives explained 24.0% of the variance in complications ($R^2 = 0.240$). The relationship was negative but not statistically significant ($F = 0.947$, $p = 0.402$; $Beta = -0.490$). The model was based on five observations because midwife data were unavailable for two years.

4. Pediatricians and infant mortality (H4).

The model was statistically significant ($F = 26.409$, $p = 0.004$). The number of pediatricians explained 84.1% of the variance in infant mortality ($R^2 = 0.841$; Adjusted $R^2 = 0.809$), with a small standard error of the estimate (0.487). The unstandardized coefficient was small ($B = 0.001$) and positive, and the standardized coefficient was strong ($Beta = 0.917$, $t = 5.139$, $p = 0.004$). The positive sign indicates that the two series moved in the same direction over the study period.

Third: Summary of Hypothesis Testing:

Table (3). Summary of hypothesis testing results

Hypothesis	Result	Decision
H1: OB/GYN physicians → newborn births	Significant for normal deliveries ($R^2 = 0.898$, $p = 0.001$); not significant for abnormal deliveries ($R^2 = 0.007$, $p = 0.857$)	Partially accepted
H2: Specialized hospitals and beds → maternal mortality	Hospitals: $R^2 = 0.145$, $p = 0.400$; beds: $R^2 = 0.039$, $p = 0.670$	Rejected
H3: Midwives → pregnancy and childbirth complications	$R^2 = 0.240$, $p = 0.402$	Rejected
H4: Pediatricians → infant mortality	$R^2 = 0.841$, $p = 0.004$	Accepted

Fourth: Answers to the Study Questions:

1. **How does the number of OB/GYN physicians affect newborn births?** The number of OB/GYN physicians had a statistically significant, strong inverse relationship with normal deliveries ($R^2 = 0.898$). It had no significant effect on abnormal deliveries ($R^2 = 0.007$).
2. **How does the number of OB/GYN-specialized hospitals and hospital beds affect maternal mortality?** The effect was weak and not significant for hospitals ($R^2 = 0.145$) or beds ($R^2 = 0.039$).
3. **What is the relationship between the number of midwives and pregnancy and childbirth complications?** The relationship was negative but weak and not significant ($R^2 = 0.240$, $p = 0.402$).
4. **How does the number of pediatricians affect infant mortality?** The relationship was strong and statistically significant ($R^2 = 0.841$, $p = 0.004$), and its direction was positive ($B = 0.001$, $Beta = 0.917$).

Conclusion: Study Results and Recommendations

First: Study Results:

In light of the statistical analysis of the study data for 2017–2023, the study reached the following results:

1. **OB/GYN physicians and normal deliveries:** The number of OB/GYN physicians had a statistically significant effect on normal deliveries ($R^2 = 0.898$, $p = 0.001$). The relationship was inverse ($B = -39.082$, $Beta = -0.948$), as normal deliveries declined over the period while the number of physicians increased.
2. **OB/GYN physicians and abnormal deliveries:** The number of OB/GYN physicians had no statistically significant effect on abnormal deliveries ($R^2 = 0.007$, $p = 0.857$). This suggests that abnormal deliveries are shaped by other factors, such as maternal conditions, healthcare infrastructure, and access to emergency care.
3. **Specialized hospitals and hospital beds:** The number of OB/GYN-specialized hospitals ($R^2 = 0.145$, $p = 0.400$) and hospital beds ($R^2 = 0.039$, $p = 0.670$) had a weak and statistically insignificant effect on maternal mortality. Maternal mortality fluctuated over the period despite the steady expansion of facilities, and it was highest (15.90 per 100,000 live births) in 2023, the year with the largest number of specialized hospitals (26).
4. **Midwives and pregnancy and childbirth complications:** The relationship between the number of midwives and complications was negative but weak and statistically insignificant ($R^2 = 0.240$, $p = 0.402$; $Beta = -0.490$). This result is based on five annual observations because midwife data were unavailable for two years.

5. **Pediatricians and infant mortality:** The number of pediatricians had a strong and statistically significant relationship with infant mortality ($R^2 = 0.841$, $p = 0.004$; Beta = 0.917). The direction of the relationship was positive, as both indicators rose over the study period, while infant mortality remained low overall (mean = 6.77 per 1,000 live births).
6. **Hypothesis testing:** H1 was partially accepted (significant for normal deliveries only), H2 and H3 were rejected, and H4 was accepted.
7. **General finding:** The availability of healthcare resources, measured by numbers of providers, hospitals, and beds, does not by itself explain variation in most birth outcomes in Saudi Arabia. The results indicate that service quality, staff training, emergency obstetric care, and referral systems may matter more than quantity alone.

Second: Study Recommendations

In light of these results, the researcher recommends the following:

1. **Improve the quality of care in specialized hospitals.** Since the expansion of OB/GYN-specialized hospitals and beds was not significantly associated with lower maternal mortality, policymakers should invest in service quality alongside infrastructure. This includes trained staff, Comprehensive Emergency Obstetric Care (CEmOC), timely interventions, and regular maternal mortality audits.
2. **Strengthen midwife training and emergency care skills.** Because the number of midwives was not significantly associated with complications, continuous professional development programs should focus on antenatal risk detection and emergency obstetric procedures, such as hemorrhage management, preeclampsia recognition, and Advanced Life Support.
3. **Strengthen pediatric services and early infant care.** The significant relationship between the number of pediatricians and infant mortality supports continued attention to pediatric services, particularly in rural and underserved areas. This includes scheduling early first well-baby visits and strengthening neonatal follow-up systems. The positive direction of the relationship should be examined in further analysis before a causal role is assumed.
4. **Link the distribution of OB/GYN physicians to system capacity.** The results indicate that expanding the OB/GYN workforce alone is not sufficient to improve delivery outcomes. Workforce expansion should be accompanied by stronger infrastructure, better emergency response systems, and improved maternal health interventions.
5. **Adopt an integrated maternal and neonatal health strategy.** Planning should address the multifactorial causes of abnormal deliveries, complications, and mortality, and should align with the health objectives of Saudi Vision 2030.

Directions for Future Research

1. Use qualitative approaches, such as interviews with healthcare providers and patients, to understand why expanding infrastructure and staff was not significantly associated with lower maternal mortality and complications.
2. Examine the effect of healthcare service quality, including clinical competency, emergency transport, infection control, and blood transfusion services, on maternal and neonatal outcomes.
3. Use longer time series or regional and hospital-level data, since the annual national data cover only a short period and limit statistical power.

Reference

- Al Khashan, H., Abogazalah, F., Alomary, S., Nahhas, M., Alwadey, A., Al-Khudhair, B., ... & Hassanein, M. (2021). Primary health care reform in Saudi Arabia: Progress, challenges and prospects. *Eastern Mediterranean Health Journal*, 27(10), 1016–1026.
- Alanazy, W., & Brown, A. (2020). Individual and healthcare system factors influencing antenatal care attendance in Saudi Arabia. *BMC Health Services Research*, 20, 1–11.
- Alghamdi, R. S., Perra, O., Boyle, B., & Stockdale, J. (2023). Perceived treatment of respectful maternity care among pregnant women at healthcare facilities in the Kingdom of Saudi Arabia: A cross-sectional study. *Midwifery*, 123, 103714.
- Alharbi, H. G., Alsaydalani, M. J. N., Al-Matrafi, F. A., Alsadi, F. A., Ahmed, E. M., Almutairi, M. H., ... & Aljohani, R. S. (2024). Maternal and neonatal mortality in Saudi Arabia: A depth review study, progress, challenges and strategic interventions. *Evolutionary Studies in Imaginative Culture*, 1079–1095.
- Al-Nafeesah, A., & Alnafeesah, A. (2025). Analysis of under-five mortality rate in Saudi Arabia: 1973 to 2022. *Cureus*, 17(1).
- Alnasser, Y. S., Alabdali, A. F., Alshabri, R. I., & Albatati, S. M. (2022). Practice of general pediatrics in Saudi Arabia: Current status, challenges, and opportunities. *BMC Pediatrics*, 22(1), 621.
- Al-Shahrani, H. N. F., Alshahrani, H. D., Al-Masaad, N. M. M., Almusaad, T. M. M., Al-Musaad, H. M. M., Dakam, F. A. M., ... & Fawaz, A. H. N. (2024). Critical analysis of midwives' impact on maternal and neonatal health in Saudi Arabia. *Journal of Ecohumanism*, 3(8), 2349–2357.
- Altaweli, R. F., McCourt, C., & Baron, M. (2014). Childbirth care practices in public sector facilities in Jeddah, Saudi Arabia: A descriptive study. *Midwifery*, 30(7), 899–909.
- Berhe, A. K., Tinsae, F., & Gebreegziabher, G. (2017). Knowledge and practice of immediate newborn care among health care providers in eastern zone public health facilities, Tigray, Ethiopia, 2016. *BMC Pediatrics*, 17, 1–9.

- Bhatia, A., Krieger, N., & Subramanian, S. V. (2019). Learning from history about reducing infant mortality: Contrasting the centrality of structural interventions to early 20th-century successes in the United States to their neglect in current global initiatives. *The Milbank Quarterly*, 97(1), 285–345.
- Birhanu, B. G., & Mathibe-Neke, J. M. (2022). Interventions to enhance newborn care in north-west Ethiopia: The experiences of health care professionals. *BMC Pregnancy and Childbirth*, 22(1), 328.
- Dallak, F. H., Gosadi, I. M., Haidar, W. N., Durayb, A. A., Alomaish, A. R., Alshamakhi, A. H., ... & Alibrahim, M. A. (2022). Prevalence of adverse birth outcomes and associated factors in Jazan, Saudi Arabia: A cross-sectional study. *Medicine*, 101(41), e31119.
- Mahmood, M. A., Mufidah, I., Scroggs, S., Siddiqui, A. R., Raheel, H., Wibdarminto, K., ... & Wahabi, H. A. (2018). Root-cause analysis of persistently high maternal mortality in a rural district of Indonesia: Role of clinical care quality and health services organizational factors. *BioMed Research International*, 2018(1), 3673265.
- Masaba, B. B., Mmusi-Phetoe, R., Rono, B., Moraa, D., Moturi, J. K., Kabo, J. W., ... & Taiswa, J. (2022). The healthcare system and client failures contributing to maternal mortality in rural Kenya. *BMC Pregnancy and Childbirth*, 22(1), 903.
- Miller, T., & Smith, H. (2017). Establishing partnership with traditional birth attendants for improved maternal and newborn health: A review of factors influencing implementation. *BMC Pregnancy and Childbirth*, 17, 1–10.
- Millington, S., Magarey, J., Dekker, G. A., & Clark, R. A. (2019). Cardiac conditions in pregnancy and the role of midwives: A discussion paper. *Nursing Open*, 6(3), 722–732.
- Mousa, O., Salameh, B., Alqahtani, M., David, M., Almefarfesh, A. A., Duhilan, D. A., ... & Alsandal, Z. M. A. (2024). Women's attitudes, prevalence, related factors, and perceived barriers of birth companionship in Saudi Arabia. *Women's Health*, 20, 17455057231224553.
- Narapureddy, B. R., Zahrani, Y., Alqahtani, H. E. M., Mugaiahgari, B. K. M., Reddy, L. K. V., Mohammed Asif, S., ... & Dawria, A. (2024). Examining the prevalence of congenital anomalies in newborns: A cross-sectional study at a tertiary care maternity hospital in Saudi Arabia. *Children*, 11(2), 188.
- Nassif, M., Bissen, T., Alotaibi, Y. K., Alnowaiser, N., Alzahrani, A., & Wang, M. (2022). Collaborative improvement project to decrease maternal mortality rate across five hospitals in Saudi Arabia. *BMJ Open Quality*, 11(4), e002024.
- Okonofua, F., Ntoimo, L., Ogu, R., Galadanci, H., Abdus-Salam, R., Gana, M., ... & WHARC WHO FMOH MNCH Implementation Research Study Team. (2018). Association of the client-

provider ratio with the risk of maternal mortality in referral hospitals: A multi-site study in Nigeria. *Reproductive Health*, 15, 1–9.

- Rahman, R., & Alsharqi, O. Z. (2019). What drove the health system reforms in the Kingdom of Saudi Arabia? An analysis. *The International Journal of Health Planning and Management*, 34(1), 100–110.
- Rizkianti, A., Saptarini, I., & Rachmalina, R. (2021). Perceived barriers in accessing health care and the risk of pregnancy complications in Indonesia. *International Journal of Women's Health*, 761–772.
- Russo, L. X., Scott, A., Sivey, P., & Dias, J. (2019). Primary care physicians and infant mortality: Evidence from Brazil. *PLoS One*, 14(5), e0217614.
- Saudi MOH. (2021). Maternal health & child immunization – World health survey. <https://www.moh.gov.sa/en/Ministry/Statistics/Indicator/Documents/Maternal-Health-Child-Immunization.pdf>.
- Serra, G., Giuffrè, M., Piro, E., & Corsello, G. (2021). The social role of pediatrics in the past and present times. *Italian Journal of Pediatrics*, 47, 1–10.
- Srivastava, A., Avan, B. I., Rajbangshi, P., & Bhattacharyya, S. (2015). Determinants of women's satisfaction with maternal health care: A review of literature from developing countries. *BMC Pregnancy and Childbirth*, 15, 1–12.
- Stabnick, A., Yeboah, M., Arthur-Komeh, J., Ankobea, F., Moyer, C. A., & Lawrence, E. R. (2022). "Once you get one maternal death, it's like the whole world is dropping on you": Experiences of managing maternal mortality amongst obstetric care providers in Ghana. *BMC Pregnancy and Childbirth*, 22(1), 206.
- Sumankuuro, J., Crockett, J., & Wang, S. (2018). Perceived barriers to maternal and newborn health services delivery: A qualitative study of health workers and community members in low and middle-income settings. *BMJ Open*, 8(11), e021223.
- Webber, G., Chirangi, B., Magatti, N., Mallick, R., & Taljaard, M. (2022). Improving health care facility birth rates in Rorya District, Tanzania: A multiple baseline trial. *BMC Pregnancy and Childbirth*, 22(1), 74.