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Review article

Leadership and Neonatal Transport in Saudi Arabia: A Comparative Health Systems Analysis

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Abstract

Background: Neonatal transport links initial stabilization with definitive neonatal intensive care, yet Saudi Arabia lacks a unified national framework. Regional variation in resources, staffing, equipment, and transfer coordination may contribute to inequitable access and inconsistent care. This study examined neonatal transport in Saudi Arabia from a health leadership perspective and compared the current system with international models to identify governance gaps and reform priorities. **Methods:** A qualitative, comparative, policy-oriented review was conducted using peer-reviewed literature, government reports, and institutional documents published between 2000 and 2024. Evidence from Saudi Arabia was compared with neonatal transport systems in the United Kingdom, Australia, Canada, and the United States. The analysis focused on governance, accountability, workforce capacity, system integration, quality standards, data monitoring, telemedicine, and equity. **Results:** The Saudi system was characterized by decentralized coordination, concentration of neonatal intensive care resources in major regions, reliance on general emergency medical services in peripheral areas, and absence of a national transport registry. International models consistently demonstrated centralized dispatch, specialized teams, standardized protocols, accreditation, continuous monitoring, and mechanisms supporting rural access. A phased pilot centered at King Saud Medical City was proposed to test coordination, training, digital communication, and performance monitoring. **Conclusion:** Leadership-driven national coordination, standardized training, telemedicine integration, and systematic data collection could strengthen neonatal transport, reduce regional disparities, and support Saudi Vision 2030 priorities.

Keywords: Neonatal transport; health leadership; healthcare governance; Saudi Arabia; neonatal intensive care; health equity; telemedicine; emergency medical services.

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Introduction

Neonatal transport constitutes a critical dimension of perinatal care systems, serving as the vital link between initial stabilization and definitive treatment in tertiary neonatal intensive care units (NICUs). The survival of critically ill and preterm neonates is strongly influenced by the availability of timely and specialized transport, as delays or inadequate transfer capacity are associated with higher morbidity and mortality (1,2). Safe and effective neonatal transport requires not only advanced equipment and trained personnel but also robust leadership, governance, and integration into broader health system structures (3). Leadership, in this context, refers to the capacity of health systems to establish coordinated, equitable, and accountable services that ensure neonates receive appropriate care irrespective of place of birth (4).

In Saudi Arabia, neonatal health has improved markedly over the past two decades, reflected in a national neonatal mortality rate that has declined from 11.2 per 1,000 live births in 2000 to 5.9 per 1,000 live births in 2021 (5). However, these gains mask regional disparities in access to NICUs and specialized transport services. The Saudi Ministry of Health (6) reports that Riyadh, Makkah, and the Eastern Province account for approximately two-thirds of NICU capacity, while peripheral regions such as Najran, Al-Jouf, and the Northern Borders remain under-resourced. Neonates born in these regions are frequently dependent on general emergency medical services (EMS) for transfer, with limited neonatal expertise, inadequate incubator-equipped ambulances, and variable standards of stabilization during transport (7). This

fragmentation exacerbates inequities, as neonates in remote areas face longer transfer times, greater risk of deterioration, and poorer outcomes compared with those born near tertiary centers.

The absence of a national neonatal transport framework in Saudi Arabia underscores a broader governance challenge. Unlike high-performing international systems, neonatal transfers in the Kingdom are often managed on an ad hoc regional basis, with little coordination between hospitals, variable training among staff, and no national registry to monitor outcomes or quality indicators (8). This lack of structured leadership in transport services contrasts with the broader aspirations of Vision 2030, which prioritizes equity, efficiency, and integration within the Saudi health system (9). Addressing these leadership and governance gaps is essential if neonatal transport is to be transformed from a fragmented service into a cohesive national program aligned with best practices.

Several international models provide instructive benchmarks. In the United Kingdom, neonatal transport is organized through Operational Delivery Networks under the National Health Service (NHS). These networks coordinate specialized teams, 24-hour dispatch systems, and standardized clinical protocols, ensuring equity of access across diverse geographic regions (2). In Australia, the Newborn and Paediatric Emergency Transport Service (NETS NSW) operates across New South Wales, integrating telemedicine, centralized communication, and dedicated neonatal retrieval teams to cover large geographic areas efficiently (1). Similarly, the province of Ontario in Canada has developed a provincial neonatal transport program

that combines academic hospitals, provincial oversight, and standardized protocols, ensuring equitable access to specialized care irrespective of region (10). These systems are distinguished not only by clinical capacity but also by the leadership frameworks that embed neonatal transport into national or state-level health governance.

One exemplary model is the Pediatric and Neonatal Doernbecher Transport (PANDA) program at Oregon Health & Science University in the United States. PANDA demonstrates the impact of leadership in designing and sustaining an effective neonatal transport system. The program completes more than 800 transports annually, deploying within 15 minutes of request, and is staffed by nurses, respiratory therapists, and emergency medical technicians with specialized neonatal training. It is accredited by the Commission on Accreditation of Medical Transport Systems (CAMTS), operates a centralized emergency communications system, and integrates telemedicine (TeleNICU, TelePICU) to support stabilization before and after transfer (11). Importantly, PANDA ensures equitable access by extending high-quality transport services to rural and underserved areas, thereby reducing disparities in outcomes. The model illustrates how governance, leadership, and accountability can transform neonatal transport into a system-level asset rather than a fragmented service.

What unifies successful systems such as PANDA, NETS NSW, and NHS neonatal networks is the central role of leadership in shaping governance structures, embedding accountability, and ensuring that equity is a core principle of neonatal transport. These systems demonstrate that specialized neonatal transport is not dependent

solely on geography or financial resources but rather on coherent leadership strategies that prioritize integration, standardization, and continuous improvement (3). Leadership ensures that neonatal transport is conceptualized not as an ancillary service but as a critical component of neonatal health systems, aligned with national goals for equity and efficiency.

By contrast, the Saudi neonatal transport landscape illustrates the risks of fragmented leadership. Without a centralized authority, standardized training, or national registry, the Kingdom faces persistent regional disparities and inefficiencies in neonatal transfers. As Saudi Arabia advances its health sector reforms under Vision 2030, neonatal transport represents both a challenge and an opportunity. With strong leadership, Saudi Arabia could establish a national neonatal transport authority, develop regional hubs staffed by specialized teams, implement national protocols, and leverage telemedicine to support peripheral hospitals. Such reforms would not only align with international best practices but also advance Vision 2030's mandate for equitable, high-quality care across all regions.

This paper therefore examines neonatal transport in Saudi Arabia through the lens of health leadership. By comparing Saudi Arabia's current system with international benchmarks such as PANDA, the NHS, and NETS NSW, it highlights governance gaps, leadership challenges, and opportunities for reform. It argues that leadership—not geography—is the decisive factor in transforming neonatal transport into an equitable, efficient, and life-saving service for all newborns in the Kingdom.

Methodology

This study adopts a qualitative, comparative, and policy-oriented research design to examine neonatal transport in Saudi Arabia through the lens of health leadership. The central aim is to analyze the governance structures, leadership strategies, and systemic organization of neonatal transport in the Kingdom, and to compare these with internationally recognized models of best practice. By relying on secondary data, policy documents, and peer-reviewed literature, this research avoids primary data collection methods such as interviews or surveys, while maintaining academic rigor and relevance to health systems leadership.

The methodological framework is grounded in health systems research and comparative case study analysis. A review of national and international literature was conducted to identify scholarly publications, government reports, and organizational documents related to neonatal transport systems. Within the Saudi Arabian context, the analysis drew upon annual statistical yearbooks published by the Ministry of Health, reports from the Saudi Vision 2030 Health Sector Transformation Program, and published studies addressing neonatal outcomes and transport challenges. For international comparisons, benchmark systems were selected from countries and institutions with well-documented neonatal transport frameworks, including the NHS in the United Kingdom, the Newborn and Paediatric Emergency Transport Service (NETS) in Australia, the provincial system in Ontario, Canada, and the Pediatric and Neonatal Doernbecher Transport (PANDA) program in the United States.

The comparative analysis was structured around key dimensions of health leadership, including governance and accountability, capacity and workforce development, system integration and communication, quality and accreditation standards, and equity of access. By organizing the review along these dimensions, the study aimed to highlight how leadership influences both structural design and operational outcomes in neonatal transport systems. Data were extracted from published case studies, official program websites, accreditation reports, and peer-reviewed journals, and synthesized to generate thematic insights.

To ensure rigor and reliability, only peer-reviewed articles and official government or institutional publications were included in the core analysis. Grey literature, such as policy briefs and conference proceedings, was considered where it provided unique contextual insights, but it was evaluated critically to account for potential bias. The search strategy employed academic databases including PubMed, Scopus, and Web of Science, supplemented by targeted searches of organizational websites such as those of the Saudi Ministry of Health, NHS England, NETS NSW, and OHSU.

Doernbecher. Keywords included “neonatal transport,” “leadership in healthcare,” “neonatal intensive care Saudi Arabia,” “health systems governance,” and “neonatal retrieval services.” The time frame for literature inclusion was restricted to publications from 2000 to 2024 in order to capture contemporary developments in neonatal transport medicine while providing sufficient historical depth for contextualization.

The analysis employed a thematic synthesis approach, wherein findings from different systems

were compared to identify convergences, divergences, and transferable lessons for Saudi Arabia. Rather than attempting to quantify differences in outcomes, the study focused on leadership structures and governance mechanisms that underpin successful neonatal transport systems. This approach was particularly suited to the research objective, which is less concerned with clinical metrics alone and more concerned with system-level leadership insights.

Finally, the study recognizes certain methodological limitations inherent to secondary research. The reliance on published and publicly available data means that findings are constrained by the scope, quality, and availability of existing literature. Moreover, international comparisons may be influenced by differences in health financing, population density, and sociopolitical context, which cannot be entirely controlled for. Nevertheless, the chosen methodology provides a robust and academically valid means of examining neonatal transport in Saudi Arabia within a leadership framework, while drawing on global best practices to inform recommendations for reform.

Results

The analysis of Saudi Arabia's neonatal transport system reveals significant disparities in governance, organization, and equity of access when compared with international benchmarks (3,8). The findings demonstrate that the absence of centralized leadership in the Kingdom's transport system has produced fragmentation and regional inequities (8).

I. Fragmentation and Data-Driven Deficiencies in Saudi Arabia

In Saudi Arabia, neonatal transport is not centrally managed but remains largely de-centralised and

overseen at the regional level (6,8). Because each region manages its own transport arrangements, this structure leads directly to uneven distribution of resources, with some regions having better-equipped, more timely neonatal transport services than others. Some of the contributing factors are:

a. **Data on Resource Concentration:** NICU capacity is heavily concentrated in metropolitan regions. The Ministry of Health reports that Riyadh, Makkah, and the Eastern Province collectively account for nearly two-thirds of neonatal intensive care beds (6). This imbalance, which would be visible in a comparative graphic (See figure 1 below), leaves peripheral regions such as Najran, Al-Jouf, and the Northern Borders critically under-resourced (6).

Distribution of NICU Capacity in Saudi Arabia by Region

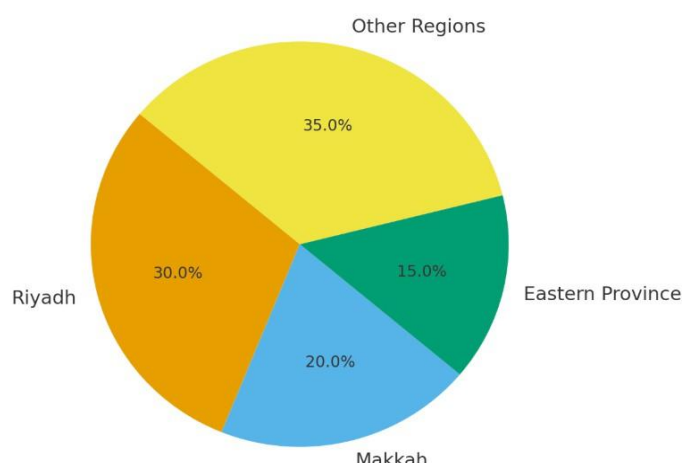


Figure 1. a **visual pie chart** showing the approximate distribution of NICU capacity in Saudi Arabia, highlighting how resources are concentrated in Riyadh, Makkah, and the Eastern Province compared to the rest of the Kingdom.

Operational Deficits in Peripheral Regions: Neonates in these peripheral areas are frequently dependent on general emergency medical services (EMS) for transfer (7).

These general ambulances often lack critical neonatal-specific equipment, such as transport incubators and ventilators, and the staff may not have specialized training in neonatal stabilization, contributing to greater risk of deterioration during transfer (7). **Absence of Accountability Infrastructure:** A major governance challenge is the absence of a national neonatal transport registry (8). This systemic lack of data collection means there is no comprehensive mechanism to monitor essential quality indicators, such as transport times, clinical deterioration en route, or mortality outcomes, which severely limits opportunities for quality assurance and leadership accountability (8).

II. International Benchmarks: Leadership-Driven

Structure and Performance Data By contrast, high-performing neonatal transport systems internationally consistently highlight the value of centralized coordination, unified clinical protocols, and strong system-level accountability mechanisms (3). These elements help ensure that every infant—regardless of location—receives timely, standardized, and quality-assured transport care, reducing regional variability and improving overall system performance.

a. Structured Governance and Accountability (UK and Canada):

- The United Kingdom's NHS neonatal transport system is a model of structured governance, with transport services embedded within regional Operational Delivery Networks (2). These networks ensure that transport capacity is distributed equitably and is monitored systematically, as they are accountable to national standards and reporting mechanisms (2).

- Ontario, Canada, maintains a provincial neonatal transport program that integrates academic hospital expertise with provincial health authority oversight (10). This leadership structure ensures consistent clinical protocols, data monitoring, and equity of access, preventing peripheral hospitals from relying solely on general EMS (10).

b. Operational Excellence and Accreditation (PANDA and NETS NSW):

- The Pediatric and Neonatal Doernbecher Transport (PANDA) program in the US showcases specialized operational performance: the program completes over 800 transports annually and deploys rapidly, launching within 15 minutes of a request (11).

PANDA holds accreditation from the Commission on Accreditation of Medical Transport Systems (CAMTS), reflecting a commitment to standardized quality, and maintains continuous physician oversight during transfer (11).

◦ Australia's NETS NSW illustrates how centralized leadership can successfully overcome vast geographic challenges (1). By integrating telemedicine and dedicated retrieval teams, NETS NSW ensures that neonates in rural areas receive high-quality care comparable to that available in urban centers (1).

III. Convergent Themes and Systemic Gaps

Three consistent, leadership-driven themes distinguish the successful international models (3):

a. System-Level Recognition: Neonatal transport is universally conceptualized and managed as a critical system-level service, not merely a peripheral or region-specific function (3).

b. Centralized Leadership: Leadership ensures centralized coordination, accountability, and continuous monitoring through systematic registries and accreditation (2,3,11).

c. Prioritized Equity: Mechanisms are consistently prioritized to ensure that rural and underserved populations receive transport services of the same high standard as urban populations (1,11). (See figure 2 below)

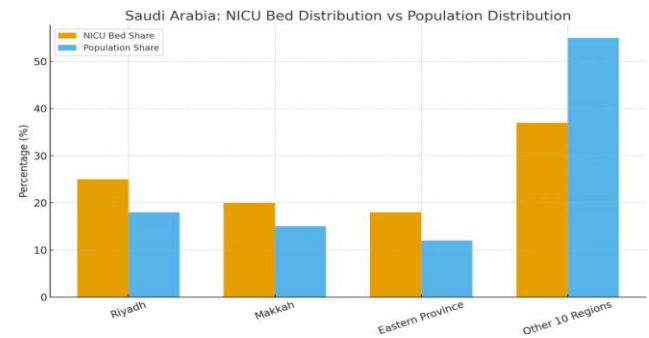


Figure 2. A graph shows that Riyadh, Makkah, and Eastern Province hold a disproportionately high share of NICU beds compared to their population size, while the remaining 10 regions are underserved.

The findings confirm that the Saudi system fundamentally lacks these leadership-driven elements, resulting in variable quality and inequitable access (7,8). The absence of centralized governance, standardized protocols, and systematic data collection limits both transparency and opportunities for necessary improvement. Therefore, leadership reforms—such as establishing a national neonatal transport authority, implementing standardized training, and creating a national registry—are necessary to align the Kingdom with international best practices and fulfill the mandate for equitable, high-quality care outlined in Vision 2030 (9).

Discussion

The findings of this study underscore the pivotal role of leadership in shaping neonatal transport systems and ensuring equity of access for vulnerable populations. While Saudi Arabia has achieved notable progress in neonatal survival and NICU capacity, the absence of centralized leadership and governance in neonatal transport

has resulted in systemic fragmentation, regional inequities, and variable quality of care. In contrast, international benchmarks such as the NHS in the United Kingdom, NETS in Australia, Ontario's provincial system in Canada, and the PANDA program in the United States demonstrate that leadership-driven models can overcome geographic, demographic, and infrastructural challenges to deliver equitable neonatal transport.

A central theme emerging from the comparison is the distinction between fragmented regional management and integrated system-level leadership. In Saudi Arabia, neonatal transport continues to be organized largely on an ad hoc regional basis, often dependent on the availability of general emergency medical services rather than specialized neonatal teams (7). This results in variability in training, equipment, and clinical protocols, which in turn contributes to delays and poorer outcomes for neonates in peripheral regions. By contrast, international models illustrate that leadership in the form of centralized governance structures provides accountability, consistency, and the ability to embed neonatal transport within broader health system objectives. From a leadership perspective, neonatal transport in Saudi Arabia represents a missed opportunity to align with the principles of equity and integration articulated in the Health Sector Transformation Program under Vision 2030. The concentration of NICU capacity in metropolitan areas such as Riyadh and Makkah reflects an urban bias in resource allocation, leaving rural regions underserved (6). Strong leadership could address this imbalance not only by expanding NICU capacity in peripheral regions but also by establishing a national neonatal transport authority that ensures timely and specialized transfer irrespective of geography. Such

an authority would provide strategic oversight, allocate resources equitably, and enforce standardized protocols—functions that are currently absent.

Another critical dimension is data-driven leadership. The absence of a national neonatal transport registry in Saudi Arabia represents a significant gap in governance. Without systematic data collection, it is not possible to monitor performance indicators such as response times, in-transit deterioration, or transport-related mortality. International models demonstrate that registries and accreditation systems, such as CAMTS in the United States or NHS performance dashboards in the UK, are powerful tools for leadership accountability and continuous improvement (2,11). For Saudi Arabia, establishing a transport registry would not only support transparency but also provide the evidence base required for policy reforms and resource allocation.

The integration of telemedicine into neonatal transport emerges as another leadership-driven strategy with significant potential for Saudi Arabia. Programs such as PANDA and NETS demonstrate that telemedicine allows for remote stabilization and ongoing communication with referring hospitals, thereby reducing preventable deterioration during transfer. Saudi Arabia has already invested heavily in telehealth infrastructure under Vision 2030, suggesting that with appropriate leadership, telemedicine could be readily integrated into neonatal transport protocols to bridge the urban–rural divide (9).

Equity is the final and perhaps most important leadership principle highlighted by the findings. International benchmarks consistently prioritize the

principle that neonates should have access to specialized care regardless of place of birth. PANDA's outreach to rural Oregon, NETS' coverage of remote New South Wales, and the NHS's embedded regional networks each illustrate how leadership can institutionalize equity in transport systems. By contrast, in Saudi Arabia, neonates born in peripheral regions such as Najran or the Northern Borders face significantly higher risks of adverse outcomes due to transport delays and limited expertise. Addressing this inequity requires leadership that frames neonatal transport not as a technical or logistical challenge, but as a matter of social justice and health rights.

In summary, the discussion highlights that Saudi Arabia's neonatal transport system is constrained less by geography or financial resources than by a lack of leadership-driven governance and integration. International models provide compelling evidence that leadership can transform neonatal transport into an equitable, accountable, and system-wide service. For Saudi Arabia, reform opportunities include the creation of a national neonatal transport authority, the establishment of a comprehensive transport registry, the integration of telemedicine into transfer protocols, and the development of standardized training and accreditation for transport teams. These measures would not only enhance neonatal outcomes but also align directly with Vision 2030's objectives of equity, efficiency, and high-quality healthcare delivery.

A Practical Approach to Establishing a Neonatal Transport System

Neonatal transport is a critical dimension of perinatal care, serving as the vital link between initial stabilization and definitive tertiary treatment

in Neonatal Intensive Care Units (NICUs). In Saudi Arabia, however, the system faces significant challenges due to the absence of centralized leadership and a national framework. This lack of structured governance results in the system being largely decentralized and managed on an ad hoc regional basis, creating systemic fragmentation and regional disparities (8). Approximately two-thirds of NICU capacity is heavily concentrated in Riyadh, Makkah, and the Eastern Province, leaving peripheral regions critically under-resourced (6).

Consequently, neonates in these underserved areas often rely on general Emergency Medical Services (EMS) for transfer, which typically lack specialized neonatal expertise and necessary equipment, leading to variable quality of care and avoidable morbidity (7,12). This current fragmented approach results in a substantial annual economic burden, estimated to exceed SAR 33 million due to delayed transfers, extended NICU stays, and preventable complications.

To address these systemic gaps and align with Saudi Vision 2030's principles of equity, efficiency, and quality, a practical approach emphasizing feasibility, incremental development, and adaptive learning through piloting is imperative. Drawing on lessons from successful international systems—such as the NHS in the UK, NETS NSW in Australia, and PANDA in the US (11,13,14)—the strategy recognizes that centralized leadership, standardized protocols, and systematic data collection are critical determinants of equitable access. These international models illustrate that specialized neonatal transport must be conceptualized and managed as a critical system-level service, ensuring centralized coordination, systematic monitoring, and prioritization of equity for rural and underserved populations. Leadership, not geography or resources alone, determines

whether neonatal transport achieves its full potential as a life-saving service.

The Saudi strategy will begin with a focused, resource-mapped pilot within a contained cluster. The Pilot Neonatal Transport System will be established within Riyadh Health Cluster 1, where tertiary referral centers coexist with peripheral hospitals of varying capacities. This controlled ecosystem enables structured testing of logistics, communication, and team competencies before national expansion. Saudi Arabia's cluster-based healthcare model provides an ideal administrative platform for adopting a governance framework similar to the United Kingdom's Neonatal Transport Network, which relies on robust regional leadership and consistent communication between referring and receiving units to reduce transfer times (13). The practical foundation of the system lies in building essential infrastructure, including ambulances equipped with neonatal life support technology, trained personnel, and an integrated communication hub. The central call center functions as the operational nucleus, mirroring the dispatch system used in Canada's Provincial Transport Services, which enhances efficiency and enables data collection for ongoing quality improvement (10).

Another hallmark of this practical approach is progressive problem identification and resolution, ensuring interventions are guided by real data rather than assumptions. The diagnostic phase, which focuses on mapping resource gaps and operational bottlenecks across peripheral hospitals, aligns with the Plan-Do-Study-Act (PDSA) methodology widely employed in healthcare quality improvement (15). The roadmap defines SMART goals (Specific, Measurable, Achievable,

Relevant, Time-bound) to ensure clarity of purpose and accountability. These metrics include achieving operational readiness within three months, reducing referral-to-dispatch time by 20%, and ensuring all transport personnel are certified in neonatal life support. Success relies not on technology and equipment alone, but on the systemic integration of people, process, and policy, which necessitates establishing standardized training pathways—potentially under the Saudi Commission for Health Specialties (SCFHS)—to ensure uniform competencies.

The Pilot Neonatal Transport System will be anchored at King Saud Medical City (KSMC), which will serve as the regional referral hub, coordinating a structured, safe, and sustainable transfer pathway across 14 peripheral hospitals. The pilot phase is scheduled to run for eight months, serving as a prototype for cluster-based neonatal transport across the Kingdom. This controlled implementation is crucial for generating the essential real-world operational, financial, and clinical data needed to inform the national rollout and long-term integration. The financial model projects that by optimizing resource utilization and reducing preventable mortality, the initiative is expected to achieve a financial break-even point by Year 3 and yield cumulative savings exceeding SAR 100 million over a decade. The initiative is led by myself as the Head of NICU in Imam Abdulrahman Alfaisal Hospital, who serves as the Operational Hub Lead. The execution follows a phased timeline:

Assessment, Protocol Development, and Training (Months 1–4): I will initiate the project by visiting all 14 peripheral hospitals to conduct a comprehensive Site Assessment and Gap Analysis based on criteria like communication readiness

and equipment availability. I will then draft the neonatal transport algorithm and Standard Operating Procedures (SOPs) and develop the specialized training curriculum in direct contact with the SCFHS Representative (Accreditation Partner) to ensure standardization and accreditation.

Infrastructure and Operational Hub Establishment

(Month 3): The central call coordination center is established within KSMC, the regional referral hub. This centralization involves working with the Cluster IT/Telehealth Director (Digital Integration Lead) to procure necessary equipment (like incubators and monitors) and implement the digital infrastructure and daily performance dashboards.

Execution and Quality Assurance (Months 5–8):

The Pilot Launch begins live transport operations, coordinated closely with the SRCA Riyadh Regional Director (EMS Partner) to utilize specialized ambulances and trained paramedics. I will monitor adherence to stabilization protocols and key performance indicators (KPIs) and work with the Cluster Quality and Safety Officer (Audit & Quality Lead) to ensure zero preventable transport-related deaths and 100% data submission compliance.

Upon successful completion of the eight-month pilot, the project proceeds into the Evaluation and Reporting stage, where analyzed data and performance indicators will be used to generate a proposed scaling plan. Leveraging the existing cluster-based healthcare model as an ideal administrative platform, other clusters will be guided to replicate the model. For these subsequent cluster pilots, the oversight of daily transport operations and training should be assigned to each cluster's neonatal lead, mirroring the role played by the Operational Hub Lead in the

initial Riyadh pilot. This practical, phased approach allows for risk-managed innovation, generates local data, and builds stakeholder trust before full national rollout, offering a sustainable pathway toward equitable neonatal care access across the Kingdom.

Conclusion and Recommendations

This study has examined neonatal transport in Saudi Arabia through a leadership and governance lens, highlighting the gaps in the current system and drawing lessons from international benchmarks. The findings demonstrate that while Saudi Arabia has expanded NICU capacity and improved neonatal outcomes nationally, the absence of centralized leadership in neonatal transport has produced fragmentation, inequities, and variable quality of care. In peripheral regions, neonates continue to depend on general emergency medical services that lack specialized training and equipment, thereby increasing the risk of preventable morbidity and mortality during transfer. In contrast, systems such as the United Kingdom's NHS neonatal transport networks, Australia's NETS NSW, Ontario's provincial program in Canada, and the PANDA service in the United States provide compelling evidence of how leadership can transform neonatal transport into an equitable and accountable service. These models share common features: centralized governance, standardized clinical protocols, integration with telemedicine, robust data registries, and a strong emphasis on equity of access. Importantly, these systems illustrate that leadership—not geography or resources alone—determines whether neonatal transport achieves its full potential as a life-saving service. For Saudi

Arabia, the implications are clear. Vision 2030 emphasizes equity, efficiency, and quality as guiding principles for health sector transformation. Neonatal transport, if strengthened through leadership-driven reforms, can embody these principles and serve as a flagship example of system-wide innovation.

Appendix

Business Case: Pilot Neonatal Transport System – Riyadh Health Cluster 1

Submitted to: Riyadh Health Cluster 1 Executive Board and Ministry of Health Hub
Hospital: King Saud Medical City (KSMC)

Date: November 2025

1. Executive Summary

This business case proposes the establishment of a Pilot Neonatal Transport System within Riyadh Health Cluster 1, anchored at King Saud Medical City (KSMC) as the regional referral hub. The initiative aims to establish a structured, safe, and sustainable neonatal transfer pathway across 14 peripheral hospitals, ensuring timely access to tertiary neonatal intensive care. The project aligns with Saudi

Vision 2030 and the Ministry of Health's transformation goals by improving neonatal survival, optimizing resource utilization, and enhancing health equity between central and peripheral facilities.

The eight-month pilot will generate real-world operational, financial, and clinical data to inform national rollout and long-term integration into cluster-level emergency and neonatal care pathways.

2. Background and Current Gaps

Riyadh Health Cluster 1 currently manages a mix of tertiary, secondary, and primary hospitals with varying neonatal care levels. Transfers are primarily coordinated through informal communication or general EMS channels, leading to inconsistent stabilization, variable transport times, and avoidable morbidity. Without a formal system, the estimated annual economic burden due to delayed transfers, unnecessary tertiary admissions, and extended NICU stays exceeds SAR 33 million (12).

International evidence shows that structured neonatal transport programs reduce mortality by up to 25% and improve long-term neurodevelopmental outcomes (16). Countries such as the UK, Australia, and the USA have long established regional neonatal transfer systems—NHS Neonatal Transfer Service (UK), Queensland Neonatal Transport (Australia), and PANDA Transport (OHSU, USA)—which serve as successful models (11,13,14).

3. Strategic Alignment with Vision 2030 and MOH Priorities

The proposed project directly contributes to the MOH Vision Realization Program under the following pillars:

- Health Transformation: Enhancing quality, access, and patient experience.
- Emergency Care Pathway: Strengthening referral and transfer efficiency.
- Starting Well Domain: Reducing neonatal morbidity and mortality.
- Sustainability: Improving cost-effectiveness through resource optimization.

This initiative will serve as a prototype for cluster-based neonatal transport across the Kingdom.

4. Stakeholder Matrix – Roles and Responsibilities

Stakeholder / Position	Role	Key Deliverable
Cluster CEO	Project Sponsor	Approves budget, monitors overall progress, ensures Vision 2030 alignment
Cluster Medical Director	Chair, Steering Committee	Oversees clinical governance and compliance
HOD NICU in Imam Abdulrahman Alfaisal Hospital	Operational Hub Lead	Manages daily transport operations and training
SRCA Riyadh Regional Director	EMS Partner	Provides ambulances and trained paramedics
SCFHS Representative	Accreditation Partner	Develops neonatal transport training certification
Cluster Finance Head	Financial Controller	Manages budget allocation and reporting
Cluster IT/Telehealth Director	Digital Integration Lead	Implements centralized call system and dashboards
Cluster Quality and Safety Officer	Audit & Quality Lead	Monitors safety, KPIs, and incident reporting
Peripheral Hospital Directors	Local Implementation Leads	Ensure site readiness and data reporting

5. Peripheral and Rural Hospitals under Riyadh Cluster 1

Riyadh Cluster 1 oversees 14 peripheral hospitals across the Riyadh zone. Of these, seven have Level II NICU capability and seven provide only basic newborn care. Each facility will undergo readiness assessment using the following checklist:

1. Availability of neonatal incubator, ventilator, and infusion pumps
2. Trained NICU nurses and pediatricians (NRP-certified)
3. Dedicated stabilization area
4. Communication readiness (direct hotline, telemedicine access)
5. Standardized referral documentation
6. Oxygen and thermal management capacity
7. Transport stretcher and incubator compatibility
8. Power backup and maintenance protocols
9. Emergency medication and consumable stock levels
10. Audit and reporting compliance readiness

6. Stepwise Implementation Plan and Timeline

Month 1 – Site Assessment & Gap Analysis

- Visit all 14 peripheral hospitals to evaluate readiness.
- Finalize baseline indicators and resource map.

Month 2 – Protocol and Training Development

- Draft neonatal transport algorithm and SOPs.
- Conduct stakeholder workshops and develop training curriculum.

Month 3 – Equipment and IT Setup

- Procure neonatal transport incubators, monitors, and ambulance retrofits.
- Establish central call coordination center within KSMC.

Month 4 – Training and Simulation

- Train medical and SRCA staff on neonatal

stabilization and safe transfer.

- Conduct simulated runs for validation.

Month 5-7 – Pilot Launch

- Begin live transport operations under supervision.
- Implement daily performance dashboards.

Month 8 – Evaluation and Reporting

- Analyze pilot data, prepare evaluation report, and propose scaling plan.

7. Financial Model and Funding Plan (All Values in SAR)

Funding will be sourced primarily from the Riyadh Cluster 1 operational budget (30%), supplemented by Ministry of Health Vision Realization Program funds (70%), with in-kind operational support from SRCA.

Projected costs and benefits are outlined below:

Cost Category	Current System (Annual)	Pilot Implementation (Year 1)	Full Operation (Year 10)	Cumulative 10-Year Savings
Preventable neonatal deaths & complications	18,000,000	12,000,000	5,000,000	85,000,000
Unnecessary tertiary admissions	6,000,000	3,000,000	2,000,000	22,000,000
Delayed transfer penalties & extended NICU stays	9,000,000	5,000,000	3,000,000	30,000,000
TOTAL	33,000,000	3,200,000	10,000,000	≈100,000,000

This financial table illustrates the substantial economic burden of the current, unstructured neonatal transport system and projects the significant savings achievable through the pilot program. Under the current system, the total annual financial burden associated with delayed transfers, extended NICU stays, and preventable morbidity exceeds SAR 33,000,000. This current cost is comprised of three main categories: costs associated with preventable neonatal deaths and complications (SAR 18,000,000), financial burdens from delayed transfer penalties and extended NICU

stays (SAR 9,000,000), and expenditures on unnecessary tertiary admissions (SAR 6,000,000).

The pilot implementation is estimated to cost SAR 3,200,000 in Year 1, but these investments are expected to yield rapid returns: the overall annual burden across those categories is projected to drop to SAR 10,000,000 by the tenth year of full operation, with the annual cost related to preventable deaths and complications falling to SAR 5,000,000. Crucially, the initiative is expected to achieve a financial break-even point by Year 3 and is projected to result in cumulative savings exceeding SAR 100 million over a decade through the optimization of resource utilization and improved efficiency.

8. Risk and Mitigation Plan

- Procurement Delays → Initiate early tendering; explore local suppliers.
- HR Shortages → Implement cross-training and rotation models.
- Coordination Gaps → Establish dedicated communication channels.
- Policy Misalignment → Regular MOH liaison meetings.
- Sustainability Risks → Embed program within Cluster recurrent funding post-Year 1.

9. Monitoring, Evaluation, and SMART Indicators

Performance monitoring will follow a dashboard model with monthly cluster reviews. Key performance indicators include:

- ≥20% reduction in referral-to-transfer time
- ≥90% adherence to stabilization protocol
- Zero preventable transport-related deaths
- ≥80% satisfaction among referring hospitals

- 100% data submission compliance from peripheral hospitals

10. Sustainability and Scale-Up Roadmap

After the six-month pilot, Riyadh Cluster 1 will integrate the transport system into its permanent operations. Long-term sustainability will rely on embedding cost centers into the annual budget, supported by national training certification through SCFHS. By Year 5, the model can be replicated across other health clusters in the Kingdom with centralized coordination and digital integration.

11. Conclusion and Ministerial Recommendation

This proposal provides a financially sound, operationally feasible, and strategically aligned roadmap to address neonatal transport gaps in Saudi Arabia. Riyadh Cluster 1, led by King Saud Medical City, is well-positioned to pioneer this national initiative. Endorsement and funding approval from the Ministry of Health are requested to initiate the pilot phase in Q1 2026. The project offers a high-impact return—both in neonatal lives saved and financial efficiency realized over the coming decade.

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