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EDITORIAL COMMENTARY

Transforming Neonatal Care Through Remote Support: A Critical Appraisal of a Hybrid Model Based on Telemedicine and Quality Improvement

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Tele-NICU models help address the shortage of specialist doctors and neonatal intensive care facilities in peripheral centers, which often leads to the need for transferring high-risk neonates to tertiary hospitals—an approach that carries both clinical and logistical risks. In the Tele-NICU model, a central tertiary NICU ('hub') is digitally linked with multiple peripheral units ('spokes') *via* internet-based platforms, enabling real-time virtual rounds, consultations, guided resuscitations, and training. This facilitates standardized, evidence-based care and has been shown to reduce transfers, improve outcomes, and lower costs, especially in underserved regions [1]. The hub-and-spoke model of Tele-NICU has emerged as a practical and scalable solution to bridge critical gaps in neonatal care in India [2].

The article by Agarwal et al. published in the journal, introduces a similar simple and effective intervention aimed at addressing neonatal health disparities in the underserved regions of Chhattisgarh [3]. By combining telemedicine with structured quality improvement (QI) strategies, the authors present a hybrid model that offers an innovative and contextually relevant approach to enhancing neonatal intensive care delivery in resource-constrained settings.

The Indian state of Chhattisgarh, with its high neonatal mortality, geographic isolation, and shortage of pediatric specialists, represents a region in urgent need of scalable healthcare solutions. The hybrid model—featuring daily tele-rounds *via* Skype or WhatsApp, monthly in-person mentoring, real-time consultations, and QI project promotion—demonstrates a pragmatic and well-integrated response. This blend of virtual support and in-person supervision has enhanced local accountability, improved clinical practices, and strengthened adherence to national guidelines.

The reported outcomes are notable. Significant reductions were observed in the rates of clinical neonatal sepsis, intravenous fluid use, antibiotic usage, oxygen administration, referrals, and mortality. Importantly, Kangaroo Mother Care (KMC) coverage rose markedly from 55.5% to 93.8%, underscoring a shift toward family-centered and evidence-based care. These improvements, seen across ten Special Newborn Care Units (SNCUs) and over 2800 neonates, lend strong support to the intervention's effectiveness.

However, several methodological limitations must be simultaneously acknowledged. The before-and-after observational design limits causal inference. Although retrospective control data were used, unmeasured confounding factors—such as lack of uniform treatment protocols, seasonal illness trends, administrative changes, or concurrent health initiatives—may have influenced outcomes. Additionally, nearly half of the enrolled neonates were excluded due to staggered implementation, need for advanced care, or incomplete exposure to the hybrid model, introducing significant selection bias. The baseline characteristics and outcomes of these excluded cases are not discussed, which could impact the generalizability of the findings.

The diagnostic criteria for clinical sepsis were broad, including culture-negative cases, which may reduce diagnostic specificity—especially in centers lacking in-house microbiology testing. Although blood cultures were processed at a central facility, the logistics of transport and result reporting could have affected accuracy. The study also does not evaluate patient or caregiver satisfaction, a key metric in assessing telemedicine's acceptability. The absence of a cost-effectiveness analysis limits the model's applicability for health system planning and scalability. Variation in

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intervention duration across sites further complicates interpretation. Some SNCUs received year-long hybrid support, while others joined later, potentially affecting comparability. A stratified analysis by duration of exposure would have added depth to the evaluation.

Despite these caveats, the study presents a promising and context-sensitive model that aligns with India's public health infrastructure. It highlights the value of technology-enabled mentorship paired with locally driven QI efforts. Prior research has shown that standardized training modules, including video and hands-on formats, significantly enhance skill acquisition in peripheral centers [4, 5]. This model empowers frontline healthcare providers—particularly nurses and promotes sustainable, system-wide improvements.

To build on this work, future studies should incorporate cluster-randomized designs to minimize bias, include economic evaluations, and assess caregiver satisfaction. Tracking long-term health and developmental outcomes in neonates managed through hybrid models would further strengthen the evidence base. This study offers encouraging early evidence for the feasibility and impact of a hybrid telemedicine-QI approach in improving neonatal outcomes in underserved areas. It represents a critical advancement toward equitable access to specialist neonatal care. However, further rigorous studies, economic assessments, and patient-centered evaluations are essential to guide wider policy adoption and scale-up.

Declarations

Conflict of Interest None.

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