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Short title	Qualitative Data on the Health Care Ecosystem for Vulnerable Newborns in Low-to-Middle Income Countries
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Precis	Focusing attention on support for the caregiver-parent interaction can help to identify and prioritize factors for mitigating the effects of pervasive turbulence and tension in the setting.

Abstract

Objective: To critically assess and synthesize qualitative findings regarding the health care ecosystem for vulnerable (low-birthweight or sick) neonates in low-to-middle-income countries (LMICs).

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Data Sources: Between May 4 and June 2, 2020, we searched four databases (Medline [PubMed], SCOPUS, PsycINFO, and Web of Science) for articles published from 2010-2020. Inclusion criteria were peer-reviewed reports of original studies focused on the health care ecosystem for vulnerable neonates in LMICs. We also searched the websites of several international development agencies and included findings from primary data collected between May and July 2019 at a tertiary hospital in Kenya. We excluded studies and reports if the focus was on healthy neonates or high-income countries, if they contained only quantitative data, were written in a language other than English, or were published before 2010.

Study Selection: One of the primary authors conducted an initial review of titles and abstracts (N = 102) and excluded studies that were not consistent with the purpose of the review (n = 60). The two primary authors used a qualitative appraisal checklist to assess the validity of the remaining studies (n = 42) and reached agreement on the final 13 articles.

Data Extraction: The two primary authors independently conducted open and axial coding of the data. We incorporated data from studies with different units of analysis, types of methodology, research topics, participant types, and analytical frameworks in an emergent conceptual development process according to critical interpretive synthesis methodology.

Synthesis Results: We synthesized our findings into one overarching theme, *Pervasive Turbulence is a Defining Characteristic of the Health Care Ecosystem in LMICs*, and two subthemes: *Pervasive Turbulence May Cause Tension Between the Setting and the Caregiver* and *Pervasive Turbulence May Result in a Loss of Synergy in the Caregiver-Parent Relationship*.

Conclusion: Because pervasive turbulence characterizes the health care ecosystems in LMICs, interventions are needed to support the caregiver-parent interaction to mitigate the effects of tension in the setting.

Keywords: Infant, Newborn; Developing Countries; Caregivers; Checklist; Kenya; Birth Weight; Qualitative research; Critical Interpretive Synthesis

Call outs

1. The number of preventable newborn deaths that occur each year is a global health crisis that disproportionately affects low-to-middle-income countries.
2. Pervasive turbulence is a defining factor that affects the health care ecosystem for vulnerable neonates in low-to-middle-income countries.
3. Support for the caregiver-parent interaction should aim to mitigate the effects of tension in the health care setting.

Globally, 6.3 million children die within their first five years of life, and 47% of these deaths occur in the neonatal period, i.e., the first 28 days of life (World Health Organization [WHO], n.d.). Neonatal deaths are most often caused by complications of preterm birth, intrapartum events, and neonatal sepsis (Liu et al., 2015) and disproportionately affect neonates in low-to-middle-income countries (LMICs), which are defined by the WHO (2017) based on a classification of world economies.

The United Nations Sustainable Development Goals included goals to end preventable newborn deaths by 2030 and to reduce the average neonatal mortality rate (number of deaths in the first 28 days of life per 1,000 live births) in each country to 12/1000 live births (WHO, 2016). Because the reasons for high rates of neonatal mortality are complex, many LMICs struggle to make progress toward this ambitious goal. The Three Delays Model was originally

developed by maternal health practitioners to explain delays in access to life-saving care for obstetric complications, which in turn can lead to unacceptably high rates of maternal morbidity and mortality (Thaddeus & Maine, 1994). The Three Delays Model is also used to better understand factors that can lead to high levels of newborn and child mortality in LMICs (Ocholla et al., 2020). In the model, the first delay is in the decision to seek care. For newborns, this could mean that parents do not recognize signs of illness (Bee et al., 2018; Steele et al., 2019), do not trust health care providers (Ocholla et al., 2020), cannot afford access to care (Johri et al., 2014), or have social/cultural norms or traditions that interfere with health care seeking behavior or evidence-based prevention (Bee et al., 2018; Raman et al., 2016). The second delay is in reaching appropriate care, perhaps due to difficult terrain, long distances, poor roadways, or lack of transportation (Barnea et al., 2020; Karmegaraj et al., 2020). The third delay is defined by the inability to access adequate care once a health facility has been reached (Kaselitz et al., 2021) due to a lack of equipment or medications (Ayah et al., 2020; King et al., 2020), inadequately trained staff or lack of health care providers (Gathara et al., 2018; Gathara et al., 2020), or inefficient referral systems (Murphy et al., 2018).

The Three Delays Model provides a robust framework for studying factors associated with poor neonatal health outcomes in LMICs. Quantitative studies based on the model are needed to monitor, evaluate, and inform interventions, but the complexity of the patient experience from the onset of illness to the moment the patient receives adequate treatment cannot be fully captured by clinical indicators (Kalter et al., 2020). By focusing only on quantified variables, researchers may miss rich details that can illuminate the complex relationship between patients and their settings (Koffi et al., 2015; Nyikuri et al., 2020). Comprehensive interpretation and synthesis of existing qualitative research can contribute to our understanding of the real-

world implications of policy and management, among other factors, to guide appropriate interventions. In this study, we aimed to critically interpret qualitative data regarding the health care ecosystem, defined as the interconnected, complex network of human and physical interactions, for vulnerable (low-birthweight or sick) neonates in LMICs. As a multidisciplinary, multinational group of practitioner-researchers, we aimed to illuminate the complexities of the health care ecosystem for vulnerable neonates in LMICs to identify salient areas for intervention that target improved health outcomes. The overall purpose of our review was to critically assess and synthesize qualitative findings regarding the health care ecosystem for vulnerable (low-birthweight or sick) neonates in LMICs. Specifically, we asked, "What are the defining features of LMIC health care ecosystems that may contribute to poor health outcomes for vulnerable neonates?" Secondly, we asked, "Of the features, which are the most proximal and salient to tertiary-level hospitals?" Our results may be used to propose and consider further quantitative studies and targeted interventions for improving neonatal outcomes at various levels in the health care systems in LMICs.

Methods

We used critical interpretive synthesis (CIS) as an approach to our review of qualitative research related to the health care ecosystem for vulnerable newborns in LMICs. This method differs from qualitative metasynthesis in that the aim in CIS is not to "account for all important similarities and differences in language, concepts, images, and other ideas around a target experience" or to preserve the integrity of the individual studies (Sandelowski et al., 1997, p. 369). Dixon-Woods et al. (2006), through their reflexive account of using CIS to analyze evidence on equity of health care access by vulnerable groups, provided justification for CIS methods. These methods include iterative conceptual development of the research question and

incorporation of data from studies with different methodologies, units of analysis, types of language, topics, and frameworks. We considered the distinction between CIS and metasynthesis important based on our desire to explore the data without using a highly structured protocol that might exclude studies based on pre-determined eligibility criteria (Sinnott et al., 2020). In addition, we used the findings from primary data, collected after institutional review board approval (#1901294575) and verbal consent from participants (Wisnewski, 2019); however, we did not access the raw data set. Because we used secondary data, the study was exempt from institutional human subjects or ethics review.

Development of the Questions for the Review

For the development of the questions, we started with findings from a primary data set describing the barriers and delays to treating vulnerable neonates from the perspective of health care workers at a tertiary hospital in Kenya (N = 21) collected from face-to-face interviews with physicians (n = 2), interns (n = 3), nurses from the antenatal, postpartum, labor, and newborn wards (n = 15), and a hospital administrator (n = 1; Wisniewski, 2019). The findings described the unpredictability associated with the identification, referral, and transport of sick and vulnerable neonates in a poorly resourced health system. We developed the research questions to provide a more complex understanding of these findings by including multiple perspectives and various LMIC settings.

Literature Search

We searched four databases, including Medline (PubMed), SCOPUS, PsycINFO, and Web of Science, between May 4 and June 2, 2020 to retrieve potential articles. Articles were eligible for inclusion if they were peer-reviewed reports of original studies focused on the health care ecosystem for vulnerable neonates in LMICs. We included studies that focused on low-

birthweight, sick, and/or premature neonates (up to 28 days old). Articles were excluded if the study focused exclusively on healthy neonates or infants (over 28 days old), health care systems in high-income-countries, private health care systems, contained only quantitative data, were reported in a language other than English, or were published before 2010. After testing several search strategies, we used the following in PubMed: ((("neonatal"[Title/Abstract] OR "neonatal transport"[Title/Abstract]) OR "neonatal referral"[Title/Abstract]) AND "qualitative"[Title/Abstract]) AND "low and middle income"[All Fields]. We adapted the search strategy according to the database functions (Table S1). Based on recommendations within our research team, we also searched websites of organizations with known repositories of gray literature regarding newborn health and reviewed the reference lists from studies retrieved in our search for additional qualitative literature. We saved the results using reference management software for initial screening. The full-text articles were then uploaded and appraised within a systematic review management platform (Veritas Health Innovation, 2013).

Quality Appraisal

One of the primary authors (HR) initially screened titles and abstracts. Studies that included qualitative methods, such as in-depth and semi-structured interviews or focus group discussions with content regarding one or more aspects of the health ecosystem for vulnerable neonates, were eligible for inclusion. The two primary authors (HR and KS) trained in qualitative research independently appraised the full texts of the remaining articles. We did not exclude studies based on strict criteria for quality if the data and findings were worthwhile despite methodological weaknesses (Sandelowski et al., 1997). Therefore, we used an established appraisal checklist for qualitative studies to consider the validity and rigor of the studies, but we did not dismiss studies outright based on a predetermined score (Critical Appraisal Skills

Program, n.d.). We reached consensus on the studies included in the final analysis through multiple discussions.

Data Extraction, Interpretation, and Synthesis

We uploaded the articles to NVivo v.12 (QSR International, 2018) to organize the data analysis. We assigned classification descriptions for each study that included the author, year, title, country, study approach, and unit of analysis. Next, we coded the information regarding the study aims, data collection, number and description of participants, and key findings. Following the methods described by Dixon-Woods et al. (2006), we approached open coding of the studies much like a primary analysis of qualitative data, whereby the two primary authors (HR and KS) interpreted, named, and described emergent concepts across studies. During the iterative axial coding process, the same two authors conducted independent coding and continuously discussed the emerging patterns and relationships among concepts. Rather than summarizing the data as in a meta-analysis, we used a critical approach to interpret the emergent concepts and continually checked agreement during the coding process using the Kappa value calculated from the NVivo project file (final Kappa value was >.40 for all nodes). However, an acceptable Kappa value for each node was not pre-defined (Kim et al., 2016). Finally, our multidisciplinary team of authors – including clinical practitioners in newborn care from a tertiary hospital in Kenya (JK and JR), an expert in maternal health (MA), and an implementation science researcher (SB) – provided a robust review of the critical interpretation and synthesis of the findings to confirm the most relevant concepts.

Results

The preliminary data set consisted of 103 studies, including the findings from our primary data set. Of those, one duplicate was removed. From the remaining 102 studies, one of

the primary authors (HR) excluded 60 studies because they were not consistent with the purpose of the review after screening the titles and abstracts. In total, the two primary authors (HR and KS) assessed 42 full-text articles for eligibility and excluded 29 articles for methodological reasons or inapplicable data for the questions of our review. The final critical interpretive synthesis sample set included 13 qualitative studies related to the health care ecosystem for vulnerable neonates in LMICs (Figure 1). The qualitative approaches included case study ($n = 3$, Brault et al. [2017], Brault et al. [2018], and Horwood et al. [2019]), ethnography ($n = 1$, Nzinga et al. [2019]), grounded theory ($n = 1$, Wisnewski [2019]), narrative ($n = 2$, Aruldas et al. [2017] and Mbwele et al. [2013]), and thematic analysis ($n = 6$, Koenraads et al. [2017], Macdonald et al. [2019], Mahwasane et al [2020], Nabiwemba et al. [2014], Nisha et al. [2019], and Sumankuuro et al. [2018]). Eleven of the 13 studies were conducted in sub-Saharan Africa (Kenya, $n = 3$, Brault et al. [2017], Nzinga et al. [2019], Wisnewski [2019]; Liberia, $n = 1$, Brault et al. [2018]; South Africa, $n = 2$, Horwood et al. [2019], Mahwasane et al. [2020]; Malawi, $n = 1$, Koenraads et al. [2017]; Tanzania, $n = 2$, Macdonald et al. [2019], Mbwele et al. [2013]; Uganda, $n = 1$, Nabiwemba et al. [2014]; and Ghana, $n = 1$, Sumankuuro et al. [2018]) and two were conducted in Southeast Asia (India, $n = 1$, Aruldas et al. [2017] and Bangladesh, $n = 1$, Nisha et al. [2019]). The units of analysis included country, tertiary care center, regional health care system/public hospitals, district health facilities, community, households, and individuals, which we later summarized as national, regional, family and community, and individual categories during emergent coding. Participants included mothers, families (husbands and mothers-in-law), health care workers, as well as various key stakeholders (for example, partner donor organizations and community leaders) participating in focus groups, in-depth individual interviews, and semi-structured individual interviews (Table S2).

Synthesized Findings

We synthesized our findings based on input from all authors after conceptualizing the ecosystem during axial coding (Table S3). This resulted in one overarching theme, *Pervasive Turbulence is a Defining Characteristic of the Health Care Ecosystem in LMICs*, and two subthemes, *Pervasive Turbulence May Cause Tension Between the Setting and the Caregiver* and *Pervasive Turbulence May Result in a Loss of Synergy in the Caregiver-Parent Relationship* (Table 1).

Overarching Theme: *Pervasive Turbulence is a Defining Characteristic of the Health Care Ecosystem in LMICs*

We conceptualized the underlying uncertainty that affects the health care ecosystem in LMICs as "pervasive turbulence," a term used in ecology to describe something that is usually unwanted yet widespread and persistent. Described elsewhere as chronic uncertainty or environmental turbulence, pervasive turbulence in the health care ecosystem affects those who seek and provide care (Han et al., 2011; Thaddeus & Maine, 1994).

Within the health care ecosystem, national resource allocation, leadership, policies, and governance strategies were strongly associated with the level of uncertainty regarding access to care and provision of high-quality services at the local level (Brault et al., 2018; Brault et al., 2017). For example, robust funding to implement programs for maternal, neonatal, and child health (MNCH) in post-war Liberia contributed to a reduction of under-five mortality rates by 73% between the years of 2000 and 2015 (Brault et al., 2018; World Bank, 2015). One strength in Liberia's MNCH strategy recognized by key informants was the removal of user fees for patients (Brault et al., 2018). This was made possible through strong donor funding and

government commitment to using financial resources for MNCH, which many key informants and mothers felt led to increased utilization of services (Brault et al., 2018).

While the elimination or reduction of user fees may increase initial access to health care services, it must also be met with increased resources for infrastructure. In a study by Brault et al. (2017), participants attributed the poor health care worker retention rates in the more rural areas of Kenya to the lack of investment in infrastructure. One 44-year-old female health care worker stated, “If you are staying in areas…where security, infrastructure, [and] water is an issue…there are very few human resources. [The health care workers] are not motivated enough to stay there, they are posted there, they work, and then they leave” (para. 18).

When national policies are not supported by the distribution of resources, it causes uncertainty throughout the system and may affect the relationship between those delivering and seeking care. For example, in Tanzania, the government touted free health care for mothers and children without addressing the shortage of resources needed to provide the care. One obstetrician practicing in Tanzania described the burden this placed on the caregiver-parent interaction:

> The community is confused because the Government is saying that the care of mother and child [is free]…But if you come here, it is not so. Mothers are told to buy some of the things. At that point, the community is confused and if they are told to buy [supplies], [they] might say this is corrupt…so that politics now has been included in our profession. (Macdonald et al., 2019, p. e396)

The confusion caused by inconsistent messaging and uneven implementation of policy can lead to stress on the health care workers, who must navigate the rationing of scarce resources under the heightened demand for services.

The successful distribution of resources requires government commitment in the form of sound policy and leadership. Key informants in Liberia cited their President's leadership as a strength: "If you have anybody dying from giving birth, they have [an] audit and this particular team reports directly to the President of Liberia" (Brault et al., 2018; para. 25). In addition, we found evidence from several studies that strong leadership at the highest level of a country's health care system reduced uncertainty by clarifying issues of importance, strengthening the chain of command, and supporting accountability, all of which can reduce the system turbulence which may cause tension between the setting and the caregiver (Brault et al., 2018; Macdonald et al, 2019; Mahwasane et al., 2020; Wisniewski, 2019).

Subtheme 1: ***Pervasive Turbulence May Cause Tension Between the Setting and the Caregiver***

We synthesized the units of analysis from the included studies to incorporate the complex network of human and physical interactions in the health care ecosystem. Focusing on the caregiver in light of the influences from the setting, we recognized health care seeking behaviors, physical resources, organizational culture, personal skills, and well-being as factors associated with tension between the setting and caregiver.

Health Care Seeking Behavior

Patient demand includes the number of patients who need treatment and the severity of the presenting condition/illness, which affects the level of patient dependence on the medical staff (Coetzee & Laschinger, 2018). According to Thaddeus & Maine (1994), the severity of disease and the resulting level of dependence are directly affected by delays in care. In several studies, the decision-making capacity of mothers helped or hindered how fast neonates were attended by trained medical professionals (Aruldas et al., 2017; Mbwele et al. 2013; Nabiwemba

et al., 2014). However, in some settings, the familial decision-making power outweighed the mother's position and led to delayed or inadequate care. As one mother stated:

> For the treatment of my weak newborn, sometimes my husband and sometimes my mother-in-law went to the doctors. They decided when to go to the doctor for my baby. But this does not help always because I am the only person at home who takes care of my baby. When my husband came back home from the hospital, he did not say the things in detail which needed to be done for my weak baby. (Nisha et al., 2019, para. 34)

A delay in care or the inability to act on the advice of physicians can worsen the severity of an illness. This had a cumulative effect at secondary- and tertiary-level facilities, where the severity and number of patients was influenced by the uncertainty that existed at the lower-level institutions:

> The referral system is [uni-]directional and…some referrals are inappropriate. For example…a premature baby struggling to breastfeed because of inability to latch was referred to [the tertiary-level hospital], yet the referring facility had the capability of caring for the baby. Although the referral was inappropriate, any baby that shows up or is inappropriately referred must be admitted. Wisniewski (2019, p. 30)

Training for community health care workers may reduce the strain on local and upper-level facilities within the referral system by encouraging mothers and families to access preventative care and recognize signs of illness. Following the implementation of Kenya's National Community Strategy, one community partner remarked:

> At least at the community level, we have community health workers who are being trained on prevention at the household level…then mothers can access information from

> those health workers…there are also programs [that] target the community level to give them information. (Brault et al., 2017, para. 29)

Physical Resources

We considered physical resources as those objects with a physical presence in the health care setting, including necessary medical supplies or staff (Coetzee & Laschinger, 2018; Hobfoll, 1989). When resources are adequate, caregivers may experience less tension because they can rely on the availability of physical supplies needed to deliver appropriate care. This is often not the case in LMICs, however. Except for two studies (Aruldas et al., 2017; Nabiwemba et al., 2014), each study in our sample contained at least one mention of shortages in vital equipment, vaccines, infrastructure (e.g., beds, water, and electricity), transportation, and/or staff. These shortages created tension in the setting, which can increase with an influx in patient demand. As one nurse-midwife remarked, “as long as there [is] only one woman and neonate at a time, [I can] cope with [my] work” (Macdonald et al., 2019, p. e394).

While formal triage procedures may help to prioritize patients with certain health conditions, added uncertainty associated with resource scarcity forced caregivers to participate in informal triage; they assessed the balance between their available resources, including time and ability, and patient demands (Coetzee & Laschinger, 2018). This “subconscious triage” was described by Nzinga et al. (2019, para. 18). as the need to “[continually] make decisions about allocating limited resources while under extreme pressure” on the part of the health care worker.

Organizational Culture

The organizational culture of a health care system includes the intangible and tangible conditions associated with workforce well-being (Coetzee & Laschinger, 2018; Hobfoll, 1989). Examples of positive organizational influences included triage protocols, clear workplace

expectations, accountability, and mentoring (Shanafelt & Noseworthy, 2017). The effects of task-shifting, the delegation of tasks from senior nurses to more novice nurses, students, or other staff, were more complicated to discern (Mahwasane et al., 2020; Nzinga et al. 2019; Sumankuuro et al., 2018). Nzinga et al. (2019) found that nurses with seniority were able to relieve some stress by allowing another worker to take on their responsibilities, but this increased uncertainty for those without seniority and lead to unsafe practices:

> Where nurses considered some tasks simple and therefore "safe" to delegate, the important aspects of the logic behind such tasks were often lost to those it was delegated to. For example…while the cleaners ensured everything looked clean, they were often found to be wiping down surfaces with dirty cloths, unaware that surfaces may look clean while harboring infection. (p. 6)

Therefore, the harmful effects of pervasive turbulence may be mitigated by seniority through control over one's time; however, this can create more tension for those who have less control and less training.

Personal Skills

The personal skills of health care workers are those acquired through modeling, learning, and role adoption (Coetzee & Laschinger, 2018; Hobfoll, 1989). Personal skills are valuable because of their potential to increase self-esteem and confidence in times of uncertainty. For example, training for lower-level nurses can mitigate tension in the health care setting caused by informal task-shifting as mentioned previously. Macdonald et al. (2019, p. e394) found that the nurses were "grateful to collaborate with other educated health care professionals [*sic*] yet recognized that there were not enough [of them to provide mentorship]."

Participants from the same study stated that "the number and composition of staff, with the right skills and knowledge, was not sufficient for the number and health needs of women and neonates who required care" (Macdonald et al., 2019, e394). However, shortages in staff made it difficult for nurses to attend training opportunities. In some settings, there were not enough specialized workers with skills for intensive care of neonates, which resulted in treatment that was "improvised and compromised" (Mahwasane, 2020, p. 5).

Caregiver Well-Being

Health care workers must manage stressors and provide care to the best of their abilities. As mentioned earlier, formal triage can mitigate stress through clearly articulated prioritization of certain health conditions and can affect the health care worker's well-being by helping to reduce uncertainty. Conversely, evidence from the included studies indicated that continuous tension from poorly articulated priorities and conflicting urgent priorities caused intense emotional stress among health care workers. For example, Macdonald et al. (2019) noted that the health care workers were forced to make difficult decisions and reported that "it was stressful and ethically disconcerting to have to work against their beliefs, and the guidelines of the institution, discharging women and neonates earlier than expected due to the lack of space" (p. e394).

It is important for health care workers to have a sense of work satisfaction, despite stressful conditions. One nurse-midwife in Tanzania stated, "it was the urgent needs of the women and neonates that keep[s] her going" (Macdonald et al., 2019, p. e395). For others, the pervasive turbulence and tension in the setting may create a "perfect storm" for compassion fatigue to occur (English et al., 2020). Compassion fatigue is the negative response to continuous exposure to uncertainty in the workplace. As others have noted, constant unease and morally

taxing situations put health care workers at risk of progressing through compassion discomfort, stress, and fatigue (Coetzee & Klopper, 2010). Environmental turbulence has been described as a potential stressor in the nursing field that can lead to adverse psychological reactions and feelings of burnout (Vaismoradi et al., 2011).

Subtheme 2: ***Pervasive Turbulence May Result in a Loss of Synergy in the Caregiver-Parent Relationship***

The pervasive turbulence in LMIC health care systems may lead to a loss of synergy, or sense of partnership, between the caregiver and parent. The pervasive turbulence in the setting, in addition to the following interconnected factors, may affect the caregiver-parent relationship by undermining the communication and trust necessary to achieve treatment goals, despite the "shared value of supportive and timely perinatal care" (Macdonald et al., 2019, e394).

Cultural Dissonance Between the Setting and Parent

Each clinical setting has a culture of its own, which has significant effects on the health worker attitudes, practices, and emotions; however, the culture is largely unfamiliar to the parent of a vulnerable neonate. Mothers in particular may feel intimidated by the power dynamics in the setting and confused by unspoken expectations. Evidence has also indicated that the health care setting may be intimidating for mothers due to their lack of knowledge about how to care for their infants (Enlow et al., 2017). As a mother from South Africa explained, "[I] don't feel free [at peace] because they do not explain exactly why you should only change the baby's nappy and not do anything [else]" (Horwood et al., 2019, p. 8).

The behavior of mothers can be misunderstood by health care workers. For example, in their study of hospitals in South Africa, Horwood et al. (2019) noted that, "nurses expected mothers to ask about their baby's health from the doctor to demonstrate their interest in the

health of the baby, but mothers appeared unaware of this expectation" (p. 9). It may also be frustrating for health care workers to see mothers who do not adhere to their advice and sometimes put the infant more at-risk for negative outcomes: "We do advise them, but once they go in the community, they start listening to their fellow mothers on what to do with their babies and they forget what the doctors advised them" (Koenraads et al. 2017, p. 5). From the same study based in Malawi, one health care worker believed that "most of the [mothers] have not gone far with their school, so because of their education they don't understand what we are telling them" (p. 5).

Data from Horwood et al. (2019) also showed the contrast in mothers' satisfaction with their infants' care when they were informed of procedures. One mother expressed that "it's really hard if someone does something to your baby without notifying you" (p. 9) while another mother appreciated when the health care worker told her what was expected of her: "I like the way they are telling [me] how to behave, how to take care of [my baby]" (p. 8).

Energy/Time

A health care worker's lack of energy or time may result from shortages in physical resources, lack of training, or poor organizational culture and compound the effects of other sources of tension (Coetzee & Laschinger, 2018; Hobfoll, 1989). In the included studies, nurses described the need to follow a routine set of tasks during their shifts, regardless of the number or severity of patients and staff resources. This made it difficult to address issues such as communication with mothers on how to care for their vulnerable newborns. As the authors observed in Nzinga et al. (2019), some nurses had time for personal, direct care only when they needed to perform "more technically difficult clinical tasks…thus, there was tension between the nursing role as providing holistic care versus provision of the more technical, clinical tasks

considered ‘crucial’” (para. 21). The mother of a vulnerable neonate may not fully understand the constraints on the health care worker, as evidenced in the study by Aruldas et al. (2017) when a mother stated, “nurses in government facilities do checkup as their duty, but do not take care of patients. They will come when they feel like coming, not when we ask them to come and see our patient” (p. 31).

Mistrust

Since the caregiver is the most visible and frequent touchpoint between the health care system and the patient, the parents of vulnerable newborns may associate uncertainty in the system with caregivers themselves. Macdonald et al. (2019) reported that health care workers spoke about “how they were placed in awkward positions of having to negotiate and explain why there was a lack of resources…[and] felt the families blamed them for the situation” (p. e394). In Macdonald et al. (2019), health care workers were left to explain the shortage of supplies and equipment to parents, even though this was largely beyond the health care worker’s control. In addition, staff shortages and lack of training reduced trust when health care workers were not able to provide proper care in a timely manner (Brault et al., 2017; Horwood et al., 2019; Mbwele et al., 2013; Nzinga et al., 2019; Sumankuuro et al., 2018).

While trust might not be fully possible until the health care system becomes more reliable, it is important to focus on ways to strengthen the caregiver-parent interaction. However, without also providing meaningful, strategic support for the health care worker, some well-meaning interventions may lead to additional tension.

Discussion

Our findings emphasize the presence of pervasive turbulence as part of the health care ecosystem in LMICs, creating tension between the setting and health care worker which may

affect the caregiver-parent relationship. Turbulence at the local level may result in higher caseloads at the secondary- and tertiary-level of the health care system (Murphy et al., 2017). For example, the lack of drugs, equipment, space, and trained staff in lower-level facilities was associated with unnecessary referrals to hospitals that were the endpoints for referrals in the systems (Ocholla et al., 2020; Wisniewski, 2019).

Thoughtful, strategic, and well-resourced systems-level changes must be considered to alleviate the environmental turbulence that affects the facility, health care provider, and patient (English et al., 2020; Gathara et al., 2020; Keats et al., 2018; Kollar & Buyx, 2013; Murphy et al., 2018). Since the COVID-19 pandemic is a major disruption for health systems in all countries, it may present the opportunity for population and government remobilization and economic reconstruction. Following the civil war in Liberia, major health care system restructuring led to the country's reduction of under-five mortality by 73% (Brault et al., 2018). Similarly, Rwanda has shown tremendous gains in health systems strengthening for MNCH over the past two decades (Hategeka et al., 2020; Sayinzoga et al., 2019). In the coming years, the global and national efforts and resources may focus on strengthening health care systems in the wake of COVID-19, leading to more stability. While physical resource distribution is highly connected to decisions outside of the health facility's direct influence, support for mitigating tension in the setting and improving the caregiver-parent relationship may, perhaps, have more proximal solutions. For example, standardizing the identification criteria for vulnerable neonates, improving training for hospital staff, and improving infrastructure to accommodate evidence-based care may ease tension in the setting for the caregiver (Wisniewski, 2019, Table S4). Strategies such as pastoral support may also strengthen the synergy between the caregiver and mothers through relationship-building and education on caring for newborns, ultimately

improving patient outcomes (Rialem et al., 2020). These types of supportive, proximal interventions may transform the caregiver-parent relationship. As one mother in the study by Horwood et al. (2019) stated, “so they speak nice, they explain to [me that] the baby has jaundice, it is something that will end. I must make sure that I feed him and make sure that the umbilical cord is clean all the time” (para. 29).

To provide support for health care workers in LMICs, our findings indicate that it may be useful to accept the presence of pervasive turbulence for the near future and focus on prioritizing health care worker needs. The Revised Nursing Work Index quantifies aspects of the health care environment by asking health care workers to evaluate which resources are available to them in their current position (Aiken et al., 1994; Aiken & Patrician, 2000). Applying this index can help stakeholders identify which resource domains are most impactful to address the effects of local environmental turbulence. In addition, administering the Professional Quality of Life assessment may help prioritize interventions to reduce the likelihood of burnout and compassion fatigue and increase worker satisfaction (Baek et al., 2020).

Limitations

Our review only focused on qualitative assessments of neonatal care in LMICs. Because of this, the quality of care was informally assessed through the perspectives of key stakeholders without quantification using standardized indicators. Additionally, our search terms were limited to titles and articles that directly applied to neonatal care. This excluded articles that focused on maternal and perinatal health outcomes, which are intrinsically tied to neonatal outcomes. Further, our institutional access did not include CINAHL, which is typically used for discovering nursing literature and the original focus of the literature search did not include sources that

directly addressed compassion fatigue and environmental turbulence in the space of neonatal care in LMICs.

Conclusion

Our findings suggest that pervasive turbulence in the health care system contributes to tension in the setting and may affect the caregiver-parent interaction. There are evidence-based examples of successful interventions to provide stability in the system, but these large-scale efforts require significant resource allocation and complex interactions among multiple stakeholders at the national and local levels. Our analysis suggests that thoughtful, locally led efforts to provide more proximal solutions to soothe the effects of turbulence may be helpful. Thus, we recommend that stakeholders, while advocating for wide-scale change, also explore investing in facility-based support mechanisms to strengthen caregiver work satisfaction and the caregiver-parent relationship.

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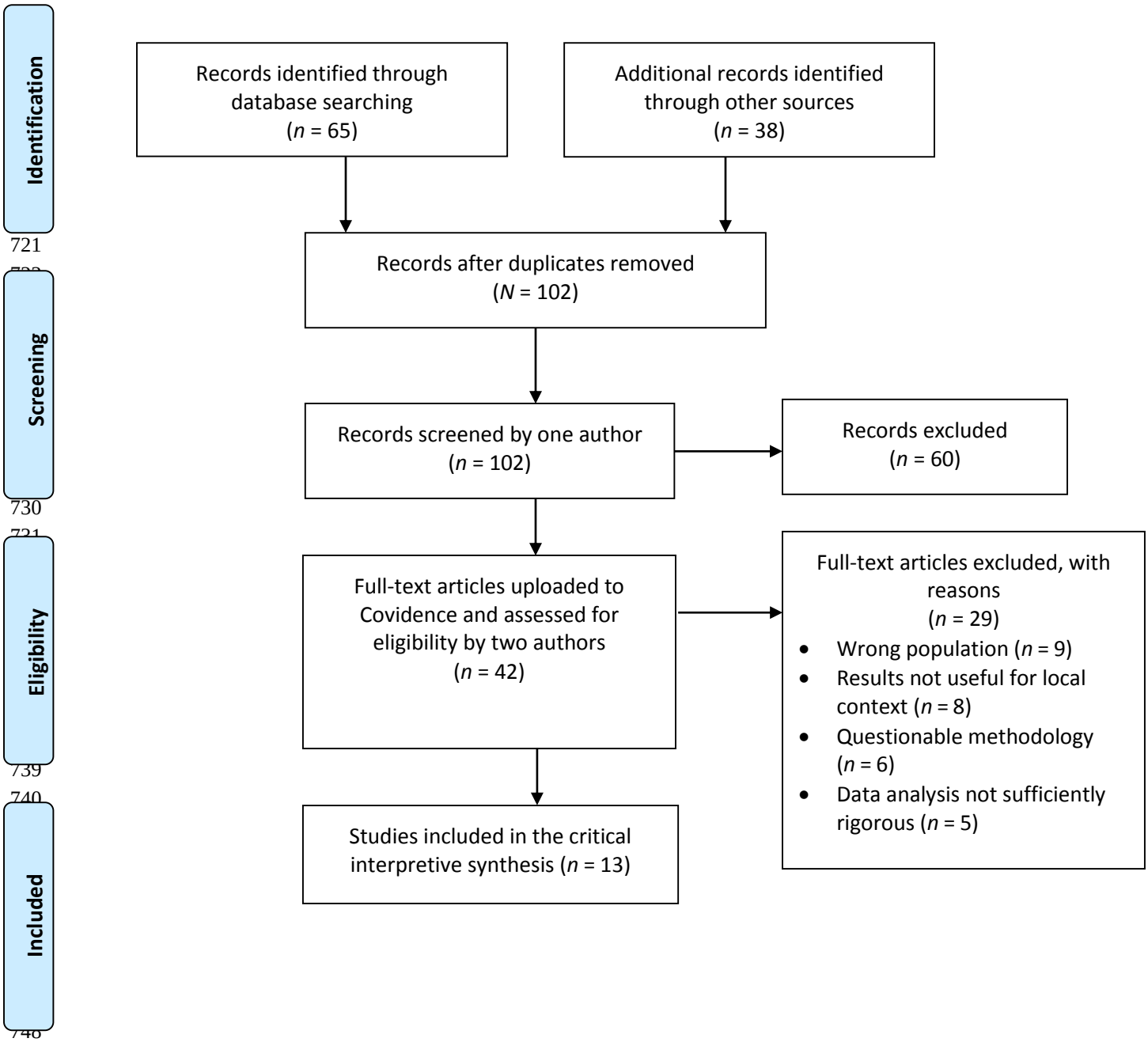

Figure 1 Study selection flow diagram.

Table S1

Critical Interpretive Synthesis Search Strategy

Source	Search Term	Limit	Result
PubMed	((("neonatal"[Title/Abstract] OR "neonatal transport"[Title/Abstract]) OR "neonatal referral"[Title/Abstract]) AND "qualitative"[Title/Abstract]) AND "low and middle income"[All Fields]	Full text, published in the last 10 years, English	n=20
Scopus	TITLE-ABS-KEY (neonatal OR neonatal AND transport OR neonatal AND referral OR preterm) AND TITLE-ABS-KEY (qualitative) AND ALL (low AND income AND countries OR middle AND income AND countries) AND PUBYEAR > 2009	open access, articles (not reviews), English	n=32
PsycInfo	((ti(neonatal) OR ti (preterm infants)) AND ab ("low income countries") OR ab ("middle income countries")) AND ab(qualitative)	Date: After 2009 Record type: Peer Reviewed Journal Methodology: Focus Group, Interview, Qualitative Study Language: English Age group: Neonatal (birth-1 Mo)	n=5
Web of Science	TITLE: (neonate*) AND TOPIC: (qualitative) AND LANGUAGE: (English) Timespan: 2010-2020. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.	Open access, article (not review or conference proceeding), refined to countries considered low or middle income (by World Bank)	n=8

USAID: Development experience clearinghouse; advanced search of documents	(Documents.Document_Title:(newborn)) AND (Documents.Class= ("Maternal child health care" OR "Health facilities" OR "Health delivery" OR "Health care")) AND (Documents.Descriptors_Geographic= ("Middle East" OR "Latin America" OR "Asia" OR "Africa")) AND (Documents.Language_of_Text=("English"))' *search using neonate, neonatal, preterm, infant did not yield any relevant results		n=11
Sida: publication search	"Newborn" *searching infant, neonate, neonatal yielded no results	Year range: 2010-2020 Language: English	n=1
Jhpiego	-Title "newborn" -Technical area one of: postnatal care, newborn health, essential newborn care, kangaroo mother care, newborn infection, newborn resuscitation, preterm birth -all programmatic approaches -all countries -years greater than 2010		n=6
References from excluded grey literature		Any titles not related to neonatal care, referral, or transport. Any studies prior to 2010. Any titles that were clearly not qualitative methods. Any duplicates.	n=4

References from included articles	Any titles not related to neonatal care, referral, or transport. Any studies prior to 2010. Any titles that were clearly not qualitative methods. Any duplicates.	n=15
Findings from self-collected data		n=1

Table S2

Summary Characteristics of the Sample Set

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Aruldas et al., 2017	Care-seeking behaviors for maternal and newborn illnesses among self-help group (SHG) households in Uttar Pradesh, India	To understand the processes of recognition and care-seeking for maternal and newborn illnesses, the sequence of actions for care-seeking, and the way health interventions using the self-help intervention influence care-seeking	India	Illness narratives with data reduction, data display, and conclusion drawing and verification, following the Miles and Huberman approach	Household	(N = 46) Women, their family members, and other caretakers who were present during the event of illness or death were included in the SSIs. About 14 key informants, mainly frontline health workers, were also interviewed to construct illness narratives.	(1) The perceptions of causes of illness as “supernatural” or “medical” and the timing of onset of illness influence the pathway of care-seeking. (2) For maternal illness, SHG households went to government facilities, and non-SHG households took homebased care. (3) Home-based care was the first step of care for newborn illnesses for both SHG and non-SHG households

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Brault et al., 2017	The introduction of new policies and strategies to reduce inequities and improve child health in Kenya: A country case study on progress in child survival, 2000-2013	To evaluate national policy and strategy documents, quantitative indicator data, and qualitative data to identify barriers and facilitators influencing child survival in Kenya	Kenya	Case study approach using policy document review and thematic analysis of semi-structured key stakeholder interviews, and FGDs with mothers who had experience accessing MNCH services	Country	The qualitative data were collected from 43 SSIs with Kenyan MOH officials, donor partners, community-based organizations involved with MNCH and health care providers. Also, 40 women with experience accessing MNCH services participated in FGDs.	(1) The removal of user fees, the implementation of the Kenyan Essential Package for Health, and the Community Health Strategy have the potential to significantly reduce child mortality. (2) Additional resources and further scale-up of new policies and strategies Kenya can make further progress in child survival.
Brault et al., 2018	Factors influencing rapid progress in child health in post-conflict Liberia: a mixed methods country case study on progress in child survival, 2000–2013	To examine in-depth the specific factors influencing child survival and attainment of Millennium Development Goal 4 in a post-conflict setting in sub-Saharan Africa	Liberia	Case study approach using mixed methods including document review to summarize quantitative indicators, key stakeholder interviews, and FGDs	Country	47 semi-structured key informant interviews with MOH officials, donor organizations, community-based organizations involved in MNCH and health care workers/Four focus group discussions with mothers who had experience accessing MNCH services (n = 37 participants)	Three prominent factors contributed to the reduction in under-five mortality: national prioritization of MNCH after the civil war; implementation of integrated packages of services; and use of outreach campaigns, community health workers and trained traditional midwives to expand access to care and improve referrals

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Horwood et al, 2019	Communication between mothers and health care workers is important for quality of newborn care: a qualitative study in neonatal units in district hospitals in South Africa	To explore mothers and HCWs experiences of care provided in neonatal units in district hospitals to identify opportunities to improve quality of care.	South Africa	Qualitative case study using observational data and SSIs were analyzed for thematic content	Neonatal units at 7 hospitals	20 HCWs working in the neonatal unit (doctors and nurses) and 24 mothers of babies admitted in the neonatal unit during the period of observation were interviewed using SSIs	(1) Positive communication between HCWs and mothers led to empowerment and active participation in care for baby. (2) Poor communication from HCWs was frequently described by mothers, and led to mothers feeling anxious, unwilling to ask questions, and excluded from their baby's care.
Koenraads et al., 2017	Understanding the challenges to caring for low birthweight babies in rural southern Malawi: a qualitative study exploring caregiver and health worker perceptions and experiences	To identify the perceptions and attitudes of caregivers and health workers towards the care of LBW babies both in the community and at rural facility level	Malawi	A qualitative approach was used to generate an in-depth understanding of the participants' perspectives, attitudes and experiences within their social context using IDIs and FGDs to triangulate findings	Rural community and facility	33 IDIs with mothers of LBW babies <2 years old and HCWs; four FGDs with 36 total participants including mothers and fathers of LBW and non-LBW children <2 years old	(1) LBW babies were perceived to be ill and weak, resulting in discrimination and stigma. (2) HCWs described a lack of resources in health facilities, lack of adherence to counselling, and difficulties with continuity of care and follow-up in the community.

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Macdonald et al., 2019	Providing postpartum care with limited resources: Experiences of nurse-midwives and obstetricians in urban Tanzania	To explore the experiences of nurse-midwives and obstetricians in the provision of postpartum care in Tanzania and to better understand how maternity health care services address the health needs, and influence the health outcomes, of mothers, neonates, their families, and their communities.	Tanzania	Qualitative study using feminist poststructuralist analysis of the personal, social, and institutional discourses related to postpartum care.	Personal, social, and institutional	IDIs with 10 nurse-midwives and 3 obstetricians in an urban setting	Health workforce planning needs to be addressed in a comprehensive manner that accounts for context, required resources and systemic challenges
Mahwasane et al., 2020	Provision of Care to Preterm Infants at Resource Limited Health Facilities of Mopani District, South Africa	To describe the challenges encountered by midwives when providing care to preterm infants.	South Africa	A qualitative research approach, using exploratory and descriptive design was used, data were collected using unstructured individual interviews.	District health facility	23 midwives participated in unstructured interviews	Quality of care provision for preterm infants is dependent on the perceptions on the causes of prematurity, the specialized care required, and the availability of resources and trained midwives.

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Mbwele et al., 2013	Quality of neonatal health care in Kilimanjaro region, northeast Tanzania: learning from mothers' experiences	To describe the quality of neonatal care based on mothers' perspectives and experiences in neonatal care to achieve Millennium Development Goal 4.	Tanzania	Cross sectional study using mixed methods. A narrative approach was used to collect and analyze qualitative data	Region	80 mothers of sick infants were interviewed from 13 peripheral facilities and 32 mothers were interviewed at a zonal referral hospital of Kilimanjaro region using SSIs.	Mothers of the neonates play great roles in identifying the illness of the newborn. Mother's awareness of what might be needed during neonatal support strategies to improve neonatal care in both health facilities and the communities.
Nabiwemba et al., 2014	Recognition and home care of low-birthweight neonates: a qualitative study of knowledge, beliefs, and practices of mothers in Iganga-Mayuge Health and Demographic Surveillance Site, Uganda	To explore mothers' knowledge and beliefs in recognizing LBW neonates as well as their home care practices for LBW babies.	Uganda	Qualitative study using IDIs with mothers of LBW babies, with group analysis between mothers who gave birth at a health facility to those who gave birth at home	Individual	IDIs were conducted with 16 mothers with LBW babies	(1) Recognition of LBW and knowledge of associated risks is low. (2) Mothers who delivered in a facility were more likely to recognize danger signs and use recommended care practices than those who delivered at home or at a lower-level facility.

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Nisha et al., 2019	Perceptions and practices related to birthweight in rural Bangladesh: Implications for neonatal health programs in low- and middle-income settings	To explore families' perceptions of newborn's birthweight including local meaning and causes of different categories of birthweight in rural Bangladesh.	Bangladesh	Qualitative study using thematic analysis to summarize findings from IDIs and FGDs.	Single community	11 IDIs with pregnant women, 12 with recently delivered women, 4 with husbands whose wives were pregnant or had a recent birth, 5 with mothers-in-law whose daughters-in-law were pregnant or had a recent birth; 2 focus group discussions with husbands and 4 key-informant interviews with community health workers.	(1) Birthweight was not well-understood in the rural community, which highlighted substantial challenges to the prevention and care practices of low-birthweight newborns. (2) Community-level health education is needed to promote awareness related to the recognition of birthweight in rural settings.
Nzinga et al., 2019	Exploring the space for task shifting to support nursing on neonatal wards in Kenyan public hospitals	To understand the nature and practice of neonatal nursing in public hospitals in Nairobi to identify interventions for relieving pressure on nurses	Kenya	An ethnographic approach was used to collect data from 3 newborn units in 3 public hospitals.	Regional public hospitals	32 interviews, over 250 hours of observations, field notes and informal conversations. Data were collected from senior nursing experts in newborn nursing, neonatal nurse in-charges, neonatal nurses, nursing students and support staff.	(1) To cope with difficult work conditions characterized by resource challenges and competing priorities, nurses have developed a ritualized schedule and a form of "subconscious triage." (2) Despite the presence of informal task-shifting, there were concerns about institutionalized task-shifting.

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)
Sumankuuro et al., 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	To identify the perceived barriers to maternal and newborn service delivery in Nadowli–Kaleo and Daffiama–Bussie–Issa Districts of Ghana	Ghana	A semi-structured qualitative design using the monitoring and evaluation frameworks for accessing health facility practices in relation to birth preparedness and readiness was adapted to guide the design, interpretation and reporting of the findings.	Regional health care system	Opinion leaders (n = 80), youth leaders (n = 80), and nonpregnant women with childbirth experiences (n = 80) and 13 HCWs participated in 24 FGDs.	Inadequate medical equipment and essential medicines, infrastructural challenges, shortage of skilled staff, high informal costs of essential medicines and general limited capacities to provide care were obstacles to the delivery of care for rural communities.
Wisniewski, 2019	Mapping the Ecosystem for Neonatal Referral and Transport in Kenya and its Association with Hypothermia	To describe the barriers, enablers, facilitators, and gaps regarding identification of sick and small neonates, and their referral and transport to various health care facilities, including the Riley Mother Baby Hospital, in Eldoret, Kenya.	Kenya	Exploratory grounded theory approach. Data were inductively analyzed for emergent themes.	Single tertiary care center	15 SSIs with HCWs	There is a poorly resourced health system which affects the quality of care, contributing to the underlying barriers to the identification, transport, and referral process for neonates,

Author	Title	Aim	Country	Study approach and data collection method	Level of analysis	No. and description of participants	Key finding(s)

Note. FGD, focus group discussion; HCW, health care worker; IDI, in-depth interview; LBW, low-birthweight; MNCH, maternal, newborn, and child health; SHG, self-help group; SSI, semi-structured interview

Table S3

Axial Coding: Emergent Themes and Constructs

Summary of themes on the identification, referral, and transport of vulnerable neonates at Moi Teaching and Referral Hospital (Wisniewski, 2019).		
Unit of analysis	Construct	Finding
Tertiary hospital system	Communication between health care providers	With health care providers, nurses, doctors, and the administrator have different outlooks of the needs for the hospital and for better quality care for the infants.
	Communication with policy makers and referral centers	When policies change within the hospital, the health care providers are not always identified. Even more, there is a lack of communication between referral facilities or even with transport within the hospital.
	Structural capacity/lack of resources (human, drugs, training, etc.)	The high patient to staff ratio is evident. At times, there are three women sharing a bed in antenatal or postpartum. The lines for admission into delivery are long. Some women will deliver in line or deliver in the antenatal room. Moi Teaching and Referral Hospital is handling the high volumes of patients, but the quality of care may not be the best quality care. It is difficult for the nurses with the low staff to monitor vital signs and clinical status of each sick neonate closely.

Emergent constructs, sample data, and related concepts				
Unit of analysis	Construct	Sample quote	Source	Related concept
National	Financial allocation	"Due to strong donor funding and some government funding, most maternal, newborn, and child services were free during much of the study period, which key informants and community women felt contributed to increased access and utilization."	Brault et al., 2018	Sustainability, effects of investment in one part of the system, uneven distribution
		"The community strategies and home visits are working in a few select places, not in all centers and therefore I cannot say that it works uniformly well in…the whole country. In some places it works quite well where it is supported by private partners, the non-governmental organizations, and other well-wishers. But where its fully government funded, it is not working very well."	Brault et al., 2017	
	Leadership	"In terms of the services, maybe if our government would actually be organized, I guess there could be a possibility (of adequate services and resources). The Government would help us so that everyone gets those services and not (only) mothers in the media or in parliament where they say everything is free while it is not. Yet a care (recipient) might be prescribed medication. I may go around looking for drugs, and find none so I have to go and buy. So, the government should stop politics and help us with these issues and be available."	Macdonald et al., 2019	Shared responsibility (Shanafelt & Noseworthy, 2017)

	Policy	"At least at the community level, we have community health workers who are being trained on prevention at the household level. So at least that one is working well and then mothers, mothers at least can access information from those health workers if they are interested. Then there are also programs which targets community level to give them information. I think that is working well."	Brault et al., 2017	Uncertainty regarding evidence-based policy (Han et al., 2011)
Local	Organizational culture	"[the health care workers should] increase politeness to the mothers. They shouldn't just simply explain to us what to do while not telling the causes of the illnesses."	Mbwele et al., 2013	Insufficient training to recognize risk, mistrust between mother and health care worker, non-standardized referral decisions (Murphy et al., 2018), chronic stress (Hobfoll, 1989) organization factors (Shanafelt & Noseworthy., 2017)
		"[Being asked for permission to perform a medical intervention] makes me happy because it's really hard if someone does something to your baby without notifying you"	Horwood et al., 2019	Informed consent
		"What I would say is that in government hospitals, one can easily jump the queue especially if you happen to know anyone who works there; but a person like me who does not know anyone gets to stay on the queue for long. So, I think they should treat all people as the same."	Brault et al., 2017	Defined procedures and adherence to policy (Murphy et al., 2018)
	Physical resources	"You must tell the reality that, there is no material therefore, what is required to write a prescription to go and buy. And if it happened you have used materials because of an emergency, you tell relative to replace. You prescribe and they replace. We have no option this is our government."	Macdonald et al., 2019	Lack of physical resources (Coetzee & Laschinger, 2018) Chronic environmental stress (Hobfoll, 1989)
		"I came in December 2015, and there was no oxytocin, no Vitamin K_1 still, there is no vitamin K_1 for the newly born babies."	Sumankuuro et al., 2018	
		"There is no side ward to nurse very ill or preterm baby with suspected infectious conditions. When the baby changes condition and requires continuous resuscitation, we do it in front of other mothers; we cannot tell them to go outside because they would still be feeding their babies. There is no privacy… in cases where resuscitation fails,	Mahwasane et al., 2020	

		they also see you removing drips and doing other things. This is frustrating for us and as for them they get traumatized by witnessing the death of another preterm baby”		
Family and community	Culture, norms, practices	“I usually do not go outside or to the doctors. For the treatment of my weak newborn, sometimes my husband and sometimes my mother-in-law went to the doctors. They decided when to go to the doctor for my baby. But this does not help always because I am the only person at home who takes care of my baby. When my husband came back home from the hospital, he did not say the things in detail which needed to be done for my weak baby…I had to ask him several times about the doctor’s advice.”	Nisha et al., 2019	Stigma (Koenraads et al, 2017) and psychosocial uncertainty (Hans et al., 2011)
		“Until the ninth day after delivery when nikasan is performed, they (mother and newborn) are vulnerable to ‘evil air’, which may harm them…. so they are kept in one room. We call this period saur. The room should not have windows and have only one door…it should be closed from all four sides so that evil air cannot enter the room….no one can come in or go out…iron objects are kept in the room to ward off evil spirit. Otherwise, it is said that some insect [evil] may come and harm the child.”	Aruldas et al., 2017	
		“When they see us they point fingers at us and say that we don’t eat adequately.”	Koenraads et al., 2017	
Individual (mothers)	Health care-seeking behavior	“What I like the most is that the nurses are always close to the babies, they never lose sight of them and they always tell you should there be any changes on the baby. Even when they were inserting drips, they explained to us that drips do cause swollen skin, but should it happen that it gets swollen, they will be there to take it out. They even explain to us how the drip functions”	Horwood et al., 2019	Recognition of illness (Nabiwemba et al., 2014), communication and informed consent
		“[the health care workers should] increase politeness to the mothers. They shouldn’t just simply explain to us what to do while not telling the causes of the illnesses.”	Mbwele et al., 2013	
Individual (health care worker)	Well-being	“Preterm babies need to be monitored constantly. As midwives, (but not trained as neonatal nurses) we need to be skilled and be alert about the conditions associated with prematurity. This necessitated, the hospital to have sufficient supplies and equipments, however, the shortages affected this goal.”	Mahwasane et al., 2020	Stressors leading to compassion fatigue (Coetzee & Laschinger, 2018; Vaismoradi et al., 2011)
		“This is why I said that we have challenges, because sometimes we have overcrowding. A mother ending up laying down on the floor. Not having enough beds and space. Few experts, so all sections should be improved we cannot meet the need of mothers. We are few doctors and few nurses.”	Macdonald et al., 2019	

Energy/time	"We do not have enough skilled staff. Therefore, the expectations of clients are sometimes not met. As I said earlier, one midwife is unable to explain certain issues clearly for pregnant women to understand because she has limited time to carry out all (the) education and detail[ed] explanations."	Sumankuuro et al., 2018	"Subconscious triage" (Nzinga et al. 2019)
	"When you are so tied up [due to shortages], you could start with the very sick one because we do it at 9 a.m. So, because you're so busy, you do to the very sick ones first. So, make sure they are done at least if the doctor's round is being done, they need to know the vital signs. So, you do those ones. Then these other ones may not be strictly done at 9. You can even do it at 11, 12 when you are a little relaxed now. So, you can always postpone some and do them later."	Nzinga et al., 2019	
Personal skills	"The veins of these babies are very small, and they sometimes disappear and become invisible which makes it hard to collect blood, remember we are not trained as neonatal nurses."	Mahwasane et al., 2020	Inadequate knowledge causing uncertainty (Han et al., 2011); efficiency and resources (Shanafelt & Noseworthy., 2017)

Table 1

Synthesized Findings Describing the Health Care Ecosystem for Vulnerable Neonates in Low-to-Middle-Income Countries (LMICs)

Finding	Summary of Evidence	Source
Overarching Theme: *Pervasive Turbulence is a Defining Characteristic of the Health Care Ecosystem in LMICs*	Unreliable health care system resource allocation, weak chain of command, lack of accountability, unclear messaging regarding shortage of resources, inconsistent implementation of policy	Brault et al., 2018; Brault et al., 2017; Macdonald et al., 2019; Mahwasane et al., 2020; Wisniewski, 2019)
Subtheme*: Pervasive Turbulence May Cause Tension Between the Setting and the Caregiver*	Healthcare seeking behavior (effected by inefficient referral system, insufficient transport services, family decision-making, results in increased patient demand at higher-levels of the system), physical resources (shortages of drugs and/or equipment, understaffing), organizational culture (expectations, accountability, task-shifting), personal skills (insufficient training and mentoring), caregiver well-being (patient demand, resource appraisal)	Aruldas et al., 2017; Brault et al., 2018; Brault et al., 2017; Macdonald et al., 2019; Mahwasane et al., 2020; Mbwele et al., 2013; Nabiwemba et al., 2014; Nisha et al., 2019; Nzinga et al., 2019; Sumankuuro et al., 2018; Wisniewski, 2019
Subtheme: *Pervasive Turbulence May Result in a Loss of Synergy in the Caregiver-Parent Relationship*	Cultural dissonance between the setting and parent, energy/time constraints (may contribute to lack of informed consent for procedures), mistrust (due to miscommunication regarding expectations or lack of informed consent for procedures)	Aruldas et al., 2017; Brault et al., 2017; Horwood et al, 2019; Koenraads et al., 2017; Macdonald et al., 2019; Mbwele et al., 2013; Nzinga et al., 2019; Sumankuuro et al., 2018

Table S4

Proximal Interventions to Mitigate Tension in the Setting at Moi Teaching and Referral Hospital, Kenya

Area of intervention	Description	Reference
Strengthening workforce capacity	Continuation and expansion of several "North-South" academic partnerships specifically organized around strengthening the capacity for the provision of high-quality reproductive services and maternal and newborn care.	Wachira, 2016; Snelgrove et al., 2021
Integration of clinical care, research, and teaching	Construction of a large state-of-the-art mother-baby hospital facility (The Riley Mother-Baby Hospital), with an integrated infrastructure for clinical care, research, teaching, and an on-site maternal hostel	AMPATH[a], 2019
Facilities to promote evidence-based clinical care	Establishment of an 8-bed kangaroo mother care ward to better implement evidence-based care for small, healthy babies.	AMPATH, 2019
Quality improvement and training programs	Implementation of several quality improvement and training initiatives, such as the *Helping Babies Breathe®* neonatal resuscitation training program, implemented to provide continuous medical and nursing educational opportunities for in-service health care providers to increase their ability to enact low-resource, evidence-based care in a timely manner	Singhal et al., 2012; Bang et al., 2016
Spiritual and emotional support for staff and families	Presence of a formal pastoral and spiritual support program to nurture health care worker self-confidence in the face of uncertainty. The ministry program also offers counseling for hospital staff and families to help cope with the stress of caring for sick newborns. The program draws attention to the importance of ongoing support for the emotional well-being of professional and family caretakers to improve health care workers' job satisfaction and patient outcomes.	Rialem et al., 2020

Note. AMPATH = Academic Model Providing Access to Healthcare.