

Perinatal Infections And Their Impact On Neonatal Morbidity And Mortality In Developing Countries

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Abstract

Background: Perinatal infections are a significant source of neonatal morbidity and mortality, especially in developing countries where access to healthcare and screening of mothers, as well as control of the infection, has very little. These infections such as sepsis, pneumonia and meningitis have a great impact on survivability and longtime health outcomes of neonatal births. **Objective:** To determine prevalence, spreading trends and consequences of perinatal infections on morbidity and mortality among the neonatal age in developing nations and determine the risk factors and outcomes in relation to perinatal infection **Methodology:** Narrative review and a secondary data review were performed using published global health agency reports, and peer-reviewed studies. Statistical data related to prevalence of infections; outcomes of newborns and regional differences were combined to recognize trends and correlations. **Findings:** The occurrence of perinatal infections results to about 30 to 40 per cent. neonatal mortality in developing countries. The most prevalent of them was found to be early-onset sepsis, and they were more likely to occur due to maternal infections, low levels of hygiene, and inappropriate access to skilled birth care. Infants with perinatal infections exhibited higher morbidity rates of low birth weights, respiratory disabilities, and retarded neurological development. **Conclusion:** Perinatal infections are considered to be a major public health issue in developing countries as they have a high rate of morbidity and mortality rates of infants. To reduce neonatal mortality and improve outcomes, the practices of infection prevention, strengthening of antenatal care and the subsequent recognition of infections as well as treatment is necessary.

Keywords: perinatal infection, neonatal mortality, neonatal morbidity, developing countries, sepsis, maternal health, preventing infections.

1. Introduction

Perinatal period can be referred to as the period between 22 completed gestation weeks and seven completed days postnatal period, which is an important period in maternal and neonatal health outcomes. At this stage, the mother and the neonate are very susceptible to problems especially infection which may have a severe impact on survival and development over the long run [1]. This stage remains the biggest contributor to world mortality regardless of better obstetric and neonatal services; particularly in low- and middle-income countries (LMICs). Neonatal mortality has been the popular public health issue of global concern whereby as many as 2.4 million deaths (neonatal deaths) are estimated to take place every year; this makes an almost half of all deaths that occur under five years old [2]. Disproportionate concentration of the burden is in the developing world like Sub-Saharan Africa and south Asia where health systems tend to be constrained by their infrastructures, lack of resources and bias in accessing quality maternal and neonatal care [3]. Global neonatal mortality rates have dropped in the last 10 years, although at a slower rate than post-neonatal reduction in child mortality, there is a need to focus on reducing neonatal mortality levels during the perinatal stage [4]. Neonatal morbidity and mortality mostly involve infections, with reports showing this rate to be at 30-40 percent of neonatal deaths in all parts of the world [5]. The top-ranking infectious causes are neonatal sepsis, pneumonia and meningitis; all of which may develop as a result of both vertical (mother to child through pregnancy, labor or birth) and horizontal (environment of the newborn) infections [6]. The infections that are contracted during early infancy, usually in the first 72 hours of life, may be linked to the maternal risk factors, which include episodic rupture of membranes, the maternal infection that is untreated and lacks the hygiene of the

intrapartum type [7]. Late-onset infections on the other hand, are often closely related to healthcare-related exposures as well as inappropriate practices of neonatal care [8]. The consequences of these infections are not limited to immediate death, but have long-term morbidity, such as neurodevelopmental impairment, chronic respiratory diseases, and sensory impairment [9]. The delayed diagnosis and lab capacity, as well as the insufficient access to effective antimicrobial therapies, contribute to these consequences in developing countries [10]. Moreover, the socio-economic factors like poverty, lower maternal education, cultural beliefs related to childbirth also heighten the vulnerability to the infections and unfavorable outcomes [11]. The problem of perinatal infections in the developing countries is thus of utmost importance. Enhancement of antenatal care, skilled birth attendance, promotion of hygienic practices of birth and enhanced early neonatal care could go a long way in the reduction of mortality as a result of infections. Also, increasing surveillance measures and access to affordable diagnostic and treatment services are essential measures toward better child birth outcomes and attainment of global child health targets.

2. Literature review

Recent reports (2022-2026) point out that perinatal infections continue to be a prominent and avoidable cause of morbidity and mortality of newborns, especially in low- and middle-income countries (LMICs). Currently, according to updated world estimates, neonatal infections such as sepsis, pneumonia and meningitis remain to be the primary causes of death in neonates of almost a third of them, particularly in Sub-Saharan Africa and South Asia [1]. Substantial progress in epidemiological modelling has enhanced the knowledge of disparities in the region and making it clear that the lack of access to skilled birth attendants and insufficient measures to prevent the infection are the primary determinants [2]. Other researchers have indicated maternal health as an important factor in determining the outcome of newborns. Cases of maternal infection like syphilis, urinary tract infections and COVID-19 complications have been known to cause higher chances of preterm birth and sepsis in the newborn [3]. Moreover, the issue of antimicrobial resistance (AMR) is increasingly becoming a problem and resistant pathogens are greatly undermining the utility of conventional neonatal care in the resource-restricted contexts [4]. The role of the early diagnosis and community-based interventions is also highlighted by recent research. At-point-of-care detection instruments and simplified antibiotic regimes have demonstrated potential in enhancing the survival of infants as scarce access to hospitals is presented [5]. More so, combined maternal-newborn health initiatives such as the antenatal screening as well as postnatal home visits have shown a quantifiable decrease in the mortality rates caused by infections [6]. The new information shows that the impact of neonatal infections on long terms may lead to neurodevelopmental disability and greater susceptibility to chronic illnesses [7]. The results will support the pressing need to enhance health care systems, enhance their surveillance of infections, and to create a fair access to quality maternal and neonatal care services.

3. Epidemiology of Perinatal Infections

3.1 Global and Regional Burden

Neonatal infections (perinatal infections) remain a significant cause of neonatal morbidity and mortality globally with higher morbidity and mortality being disproportionately experienced in low- and middle-income areas. The highest rates of neonatal deaths are found in Sub-Saharan Africa and South Asia and they are mostly due to infectious diseases like sepsis, pneumonia and meningitis. The aggregate number of these regions is over 70% of the neonatal mortality in the world, showing enduring disparities in healthcare access and quality [19].

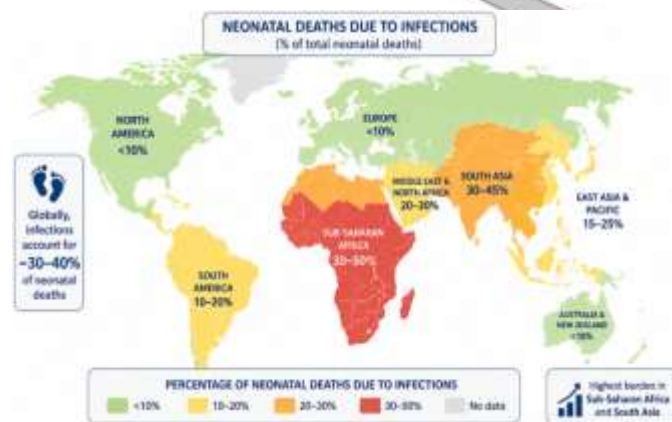


Figure.1. Global Burden of Neonatal Mortality Due to Infections

The graph 1 shows the worldwide prevalence of neonatal mortality by infection and there is a major regional variation. The highest burden is in sub-Saharan Africa and South Asia (30-50% and 30-45%), with less than 10 in the developed regions. This is an indication of disparities in health care access and maternal care and infection prevention. Infections cause around 30-40 percent of deaths in newborns all over the globe, which explains the existence of a pressing necessity to have specific measures implemented in low-resource locations [12][13]. The prevalence of perinatal infections is extremely high in such settings which is closely connected to the lack of access to vital maternal and neonatal healthcare services. Lots of births are in a home setting or in a facility which is not well equipped with sterile procedures and with skilled birth attendants. Poor antenatal care is also a factor complicating the issue, since the maternal infections are usually not diagnosed or treated leading to the risk of vertical infection to the newborn [20]. Critical determinants are also poor maternal health and a poor state of sanitation. Immune deficiency of a mother and baby due to future maternal malnutrition, anemia, and co-existing infections puts mother and child at risk of contracting infections. Also, the exposure to inadequate clean water, hygiene routines, and unsafe delivery environments are crucial contributors to the increased risk of the neonatal infection, especially posing a threat to rural and underserved populations [21]. Conversely, developed nations have registered great improvement in neonatal deaths owing to well-developed healthcare systems, regular antenatal checkups, immunization services as well as advanced neonatal intensive care services. Such differences underscore the pressing urgency of specific application of public health measures within the high-burden areas to eliminate neonatal death causes that are preventable.

Table 1: Global Burden of Neonatal Mortality Due to Infections

Region	Neonatal Mortality Rate (per 1000)	% Due to Infections
Sub-Saharan Africa	27	35-40%
South Asia	25	30-35%
Developed Countries	3	<10%

4. Types of Perinatal Infections

Perinatal infections are a broad subject of maternal and neonatal diseases that take place in pregnancy, labour, delivery or in the postnatal period. The infections could be vertically transmitted between mother and fetus or postnatal acquired and has a major outcome on the health of neonates.

4.1 Maternal Infections

Prenatal infections are of great importance in transmitting the pathogens to the fetus, and are closely linked to the occurrence of undesirable pregnancies like preterm birth, low birth weight, birth anomalies, and neonatal death. TORCH infections of greatest clinical importance include Toxoplasmosis, Rubella, Cytomegalovirus (CMV) and Herpes simplex virus (HSV). In most cases, the mother has no symptoms but the infections can lead to serious fetal complications, such as neurological damage, congenital malformations and intrauterine growth restriction. Besides the TORCH infections, other maternal diseases like human immunodeficiency virus (HIV), syphilis and malaria are the leading causes of neonatal morbidity and mortality conditions especially in developing nations. Inaccessibility of

antiretroviral therapy in regions; vertical transmission of HIV is a serious issue still outstanding. On the same note, untreated maternal syphilis is associated with stillbirths and congenital infections, whereas malaria in pregnancy predisposes the mother to be anaemic, placentally infected and of low birth weight. The impact of these infections is compounded by poor treatment and screening of ante-natal care in resource constrained places.

4.2 Neonatal Infections

There are simplified categorizations of neonatal infections, which are determined by when they are acquired and their origin. Early-onset sepsis (EOS) is an acute sepsis that develops due to the pathogens that are transmitted to the infant during labor and childbirth, during the first 72 hours of life. Risk factors are considered to be normal when rupture of membranes is prolonged, maternal fever and poor intrapartum hygienic conditions. EOS contributes significantly to the mortality of neonatal units as it evolves very fast and has no specific clinical manifestation. Late-onset infections (LOS) happen when the infant, after 72 hours of birth, is at risk of contracting the infections and these infections are usually associated with exposure to environmental factors such as contact with the caregivers or exposure to an infected environment. These are more likely to occur among preterm babies and infants who have to spend a lot of time in the hospital. Hospital-acquired (nosocomial) infections are a great problem in an intensive care unit of the neonatal intensive care unit (NICU), especially in less-developed countries with possibly poor practices on infection control. They are often linked with invasive practices like catheterization, mechanical ventilation, and protracted treatment with antibiotics, and are becoming more and more complicated by antimicrobial resistance. It is crucial to know the classification and causes of perinatal infections to implement specific preventive and management measures that will help to reduce the morbidity and mortality of the newborn.

5. Transmission Pathways

Knowledge of the routes of perinatal infection transmission is crucial to detecting key areas of intervention and address neonatal morbidity and mortality. The main routes of transmission of these infections are the vertical (including mother-to-child) and horizontal (including the environment and external) ones.

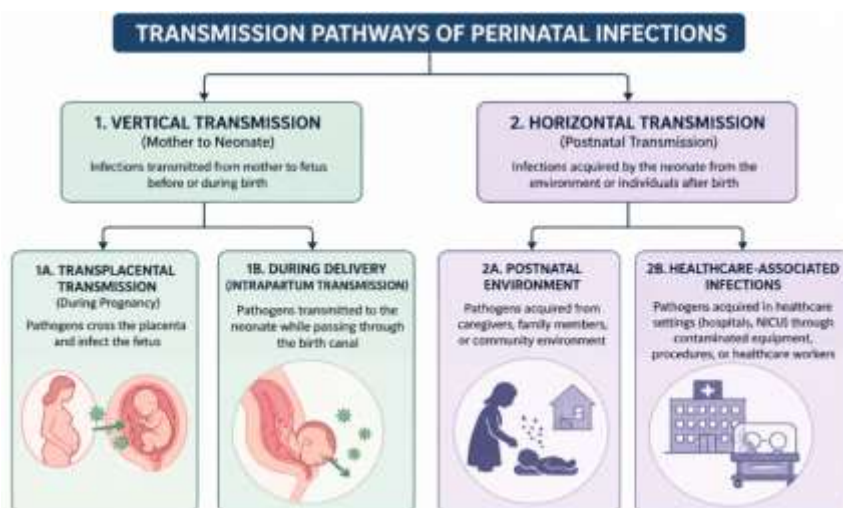


Figure .2. Transmission Pathways of Perinatal Infections

The figure 2 represents the two major ways in which the newborn becomes infected by the perinatal infection. Transmission between mother and fetus goes on vertically (transplacental), during delivery by exposure to maternal fluids with infected women. Horizontal transmission occurs at a post-natal stage with the infections being acquired by the neonate occupying the local terrain or health facility. This involves being in contact with caregivers, infected surfaces or equipment. The figure underscores the roles of both maternal and environmental conditions in increasing the risk of infection, and how preventive measures in antenatal, intrapartum and postnatal stages should be employed.

4.1 Vertical Transmission

Vertical transmission is the transmission of infectious things between the mother and the fetus or the newborn during the pregnancy, labor or birth. This treatment is a significant economic cause of early neonatal infections.

Transplacental transmission:

During pregnancy, the fetus in the womb becomes infected by the pathogens that get across the placenta. The common ones are the TORCH infections like toxoplasmosis, rubella, cytomegalovirus and herpes simplex virus. As a result of these infections, congenital anomalies, intrauterine growth retardation and fetal death may occur.

Transmission during delivery:

Infection- It is possible in the case when the neonate is exposed to the maternal blood and vaginal secretions under the birth canal where the exposure of the neonate to pathogens can be encountered. Infections like maternal HIV, Group B streptococcus and / herpes simplex virus are usually caught at this level.

4.2 Horizontal Transmission

Horizontal transmission is after birth and it entails contact with the external environment infection in the immediate surroundings or outside. This is a route of great importance especially in facilities where there is poor infection control.

Postnatal environment:

Infants can be infected by coming into contact with their caregivers, contaminated surfaces or by unhygienic procedures like poor cord care and feeding habits. Poor Sanitation and Overcrowding: Risk of exposure is still increased.

Healthcare-associated infections:

In healthcare facilities, they can also be referred to as nosocomial infections particularly in the neonatal intensive care units (NICUs). Intravenous catheterization, mechanical ventilation and a lengthy hospital stay are types of invasive procedures that cause high susceptibility. This risk is intensified in the developing countries where there are limited resources and challenges in infection control. Preventing perinatal infections effectively means focusing on both transmission pathways by developing better maternal care practices, delivering as hygienically as possible and enhancing infection prevention and control techniques in the healthcare facility.

5. Risk Factors in Developing Countries

The causes of perinatal infections in developing countries are a complex interaction between maternal and environmental factors and other factors related to healthcare. Such risks typically go together with poverty, poor healthcare facilities and ignorance and cause higher vulnerability of the neonates to serious infections and poor outcomes.



Figure 3: Predisposing Factors that lead to Perinatal Infections.

The figure 3 presents the most significant groups of risk factors that lead to perinatal infections, divided into maternal,

intrapartum and environmental factors. The maternal factors are poor health and inadequate antenatal care whereas the intrapartum factors are the unsafe ways of delivering. Poor hygiene and low socioeconomic conditions are also some of the environmental aspects that contribute to the risk. The combination of these causes results in an increase of the chances of developing neonatal infections, which causes high morbidity and mortality eventually in developing countries.

6.1 Maternal Factors

The health of mothers is very important in influencing the births of infants. The perinatal infections are highly put at risk by few maternal conditions:

Malnutrition:

Malnutrition in the mother compromises the immune system and this is more vulnerable to infection during the pregnancy. It can also be related with intrauterine growth restriction and low birth weight which contributes to both exposing babies to infections.

Lack of antenatal care:

Poor or no antenatal care inhibits the early diagnosis and treatment of maternal infections like syphilis, HIV and UTI. It enhances chances of vertical transmission and difficulty in delivery.

Untreated infections:

The maternal infections that may not be treated during pregnancy may have a direct impact on the fetus either through transplacental transmission or during delivery. These infections play a huge role in the early neonatal sepsis and deaths.

6.2 Environmental Factors

Additional problems with the environmental and healthcare systems make the burden of perinatal infections in developing countries even more serious:

Poor sanitation:

The absence of clean water, bad body hygiene and dirty living conditions expose people to infectious diseases. This is especially important when giving birth and in the infancy of the child.

Unsafe delivery practices:

There is a high percentage of home births or births with poorly equipped facilities that do not have well trained birth attendants. Lack of sterility of instruments and unhygienic environment increase the chance of infecting both the mother and newborn.

Limited neonatal intensive care:

Most health care centers do not have properly equipped neonatal intensive care units (NICUs), well-trained staff and necessary medical resources. This restricts the possibility of effectively managing complications like sepsis, respiratory distress and prematurity.

Table 2: Key Risk Factors and Their Effects

Risk Factor	Impact on Neonate
Maternal malnutrition	Low birth weight, weak immunity
Home deliveries	Increased infection exposure
Poor hygiene	Sepsis, umbilical infections

These risk factors need to be dealt with in a complex manner involving enhancing the strength of maternal nutrition programs, improving access to antenatal services, fostering institutional deliveries, and improving healthcare services to minimize the neonatal morbidity and mortality rates due to infections.

7. Clinical Manifestations and Outcomes

The perinatal infections have a broad range of clinical manifestations in neonates, and they tend to progress at a rapid pace because of the immaturity of neonatal immune system. Early diagnosis is difficult since the symptoms are often nonspecific, but late diagnosis and treatment will cause serious consequences of death and disability over the long run.

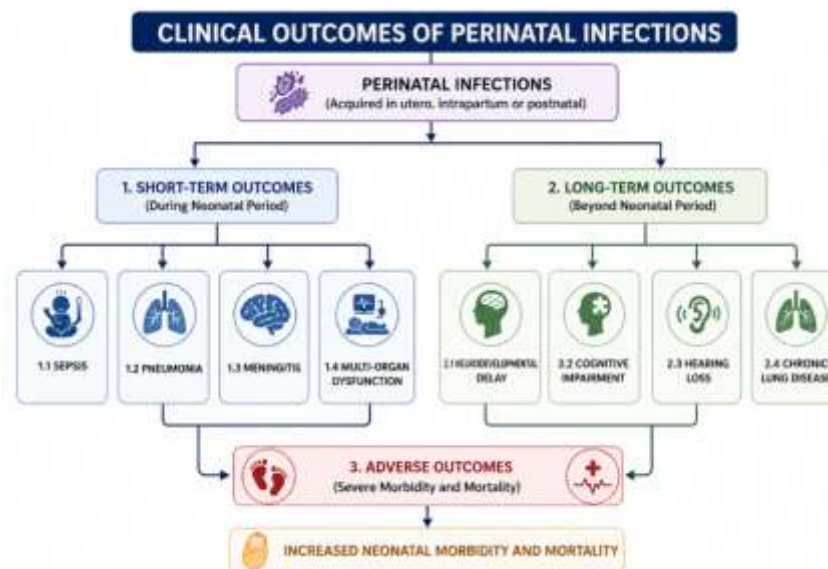


Figure.4 It is a journal devoted to clinical outcomes of perinatal infections.

Figure 4 shows clinical consequences of perinatal infections, which are divided into long and short term. Among short-term outcomes, there are severe diseases like sepsis, pneumonia, meningitis, and dysfunction of multiple organs of the neonatal period. The long-term consequences include long-term complications such as neurodevelopmental delay, cognitive impairment, hearing loss and chronic lung disease. All these outcomes result in the high morbidity and risk of neonatal mortality, and it is crucial to intervene preventively and manage the infection.

7.1 Sepsis

The most popular and acute forms of perinatal infection include neonatal sepsis. It is typified by systemic infection that causes symptoms like poor feeding, lethargy, instability in temperature, respiratory distress and compromised circulation. Without immediate attention, sepsis may quickly escalate to a state of septic shock, multi-organ failure and death. Early and late-onset sepsis are contributive factors to neonatal mortality in developing countries.

7.2 Pneumonia

Common signs of neonatal pneumonia are respiratory distress, tachypnea, grunting, chest retractions and cyanosis. It could either be a systemic infection, or local lung infection gained during birth or after birth. Pneumonia is a significant cause of deaths of babies, particularly in an environment where there is no adequate oxygen therapy and provision of advanced respiratory support.

7.3 Meningitis

Neonatal meningitis is a serious central nervous system infection, which frequently has non-obvious symptoms in the form of irritability, feeding difficulties, unstable temperature and seizures. The risk of mortality and irreversible neurological damages is higher because the diagnosis can often be delayed because of the nonspecific symptoms. Meningitis is closely connected with bad long-term outcome.

7.4 Long-Term Complications

Those perinatally infected who survive may have major long term health effects:

Neurodevelopmental delay:

Retarded motor and cognitive development as a result of brain injury in infancy.

Hearing loss:

Frequently connected with the infections in the form of meningitis and viral infections congenital.

Cognitive impairment:

Encompasses learning impairments, slowed cognitive ability and behavior problems. In general, the clinical effects of the perinatal infection can be both acute conditions that may lead to the life-threatening aspect and chronic disabilities. Early diagnosis, timely treatment and better neonatal care is necessary to minimize the short term morbidity and the long term morbidity.

8. Impact on Neonatal Morbidity and Mortality

One of the endemic challenges of neonatal morbidity and mortality in developing countries is perinatal infections which are the key cause of about 30-40 percent of the neonatal mortality. Such a high burden evidences the gaps within maternal health care, insufficient infection control approaches, ineffective access to the diagnostic and treatment on time. The neonates who are affected by infections like sepsis, pneumonia, and meningitis have their immune system that is not yet developed and hence develop at a very rapid rate causing serious complications and such diseases are very fatal. In addition to mortality, perinatal infections also play a major role in the neonatal morbidity. Injured infants often take a long time to get well and need intensive care in hospital that may include mechanical ventilation, intensive use of intravenous antibiotics, and special care. Such prolonged inpatient care is both a significant source of hospital-acquired infections burden and a significant financial strain on already resource constrained health care systems. The effect on families in terms of economy and social aspects is great. In most developing nations, healthcare costs are mostly out-of-pocket which forces families to sink in the disease. Also, the emotional and logistical burden of caring for infants with long-term problems that may have neurodevelopmental disabilities or chronic respiratory disorders may impose emotional and logistical strain on caregivers potentially impacting quality of life and productivity. The influx of neonatal illnesses caused by infections can pose a high burden on the health system at the health system level, since it leads to congestion in the neonatal intensive care units (NICUs), stress on scarce medical resources, overwork of healthcare personnel. This cycle also reduces the ability to deliver good care thus continuing to cause poor outcomes.

Table 3: Outcomes of Perinatal Infections

Outcome	Short-Term Effects	Long-Term Effects
Sepsis	Organ failure	Developmental delay
Meningitis	Seizures	Cognitive impairment
Pneumonia	Respiratory distress	Chronic lung disease

On the whole, the consequences of perinatal infections have a much greater scope in the long-term health, financial stability and the efficiency of healthcare. To address these challenges integrated measures need to be done which have interest in prevention, early diagnosis and better provision of neonatal care.

9. Challenges in Developing Countries

Perinatal infections are interrelated challenges which are difficult to prevent, diagnose and manage effectively in developing countries. These obstacles considerably provoke the constantly high rates of neonatal morbidity and mortality.

9.1 Limited Healthcare Infrastructure

One of the critical problems is the lack of sufficient healthcare infrastructure, especially rural and underrepresented. Several health institutions do not have the necessary tools to provide health care which include delivery equipment that has been sterilized, laboratory diagnostic test services, good electricity and neonatal intensive care unit (NICUs).

This reduces the possibility of offering timely and suitable care to both the mother and the newborns which predisposes them to complications due to infections and death.

9.2 Shortage of Trained Personnel

Healthcare professionals, such as obstetricians, pediatricians, nurses, and midwives are also in dire need. In most of the settings, the untrained or minimally trained staff is involved in providing care to the birth, resulting in lack of effective infection control measures and complications are not identified immediately. The absence of dedicated professionals in the care of the babies also diminishes the probability of survival of the infected babies.

9.3 Cultural Barriers

It may affect health-seeking behavior and care practices in health during pregnancy and childbirth due to cultural beliefs and traditional practices. Favouring home births, use of traditional birth attendants and late decision making in the need to access medical assistance tend to expose the risk of perinatal infections. The lack of awareness regarding the health of the mother and neonatal health is another barrier to preventative measures, and the misconception that medical interventions may be offered probably reduces the willingness to adopt preventative actions.

9.4 Inadequate Surveillance Systems

Good monitoring and reporting systems will be necessary to monitor trends regarding the infections and inform the general response of health. Nevertheless, in most developing nations there is a lack of well developed surveillance mechanisms, so data is underreported and of poor quality. This restricts the capacity of identifying high-risk groups, implementing effective allocation of resources and evidenced-based policies.

Recommendations

Effective prevention strategies to help resolve the burden of perinatal infections in developing countries must be multi-layered and involve strengthening of the healthcare system, involving the community, and supporting policies.

Strengthening primary healthcare:

To have accessible and quality maternal and neonatal services, it is important to improve the primary healthcare systems. This also involves increased antenatal care coverage, skilled birth attendance as well as the provision of primary health centers with basic facilities of prevention and management of infection.

Community awareness programs:

Awareness campaigns on the community level can also help to decrease the risk of whatsoever to the infection to a large extent. Education needs to be educational on maternal nutrition, hygiene, value of institutional births, early identification of warning signs of neonatal danger, and early healthcare seeking behaviour.

Affordable diagnostic tools:

Low-cost, point-of-care diagnostic technology development and implementation are of crucial importance in the early identification of the infections, especially in resource- constrained environments. Quick diagnostic tests may help to treat and avoid complications in a timely manner.

10. Conclusion

In developing countries, perinatal infections remain a significant issue by themselves, leading to a significant neonatal morbidity and mortality. The high burden is precipitated by avoidable problems like incompetent care of the mother, lack of sanitation and inaccessible healthcare. Tackling these problems needs multidisciplinary healthcare approaches which focus on the prevention, early diagnosis and successful treatment of infections. Enhancing healthcare systems, creation of awareness among communities and creating fair access to quality maternal and neonatal services are needed steps to the reduction of neonatal deaths. The further use of the sustainable policy and further investments in the maternal and child health will play a critical part in enhancing the survival rates and long-term outcomes of neonatal deaths.

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