



A Review of the Impact of Covid-19 On Maternal and Child Health Service Utilization in Bangladesh

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Abstract

The COVID-19 pandemic created unprecedented challenges for healthcare systems worldwide, significantly affecting the delivery and utilization of essential maternal and child health services. This study reviewed the impact of COVID-19 on maternal and child health service utilization in Bangladesh through a comprehensive quantitative synthesis of published empirical evidence. A quantitative review design was adopted, and relevant studies published between 2020 and 2022 were systematically identified using predefined inclusion and exclusion criteria. A total of 72 quantitative studies involving an estimated 512,486 participants were included in the final analysis. The synthesized evidence covered maternal health indicators, including antenatal care, skilled birth attendance, institutional delivery, postnatal care, emergency obstetric care, and family planning, together with child health indicators such as neonatal healthcare, routine childhood immunization, growth monitoring, nutritional assessment, pediatric outpatient attendance, and healthcare-seeking for common childhood illnesses. Descriptive and inferential statistical approaches were used to summarize healthcare utilization patterns, compare pre-pandemic and pandemic service utilization, and examine determinants of healthcare access. The findings demonstrated a statistically significant decline in maternal and child health service utilization during the COVID-19 pandemic ($p < 0.001$). Overall essential healthcare utilization decreased by 18.9%, while maternal health services declined by 19.8% and child health services by 17.9%. Preventive healthcare services experienced the greatest reduction (20.6%), whereas curative services declined by 11.7%. Growth monitoring and pediatric outpatient consultations exhibited the largest reductions among child health indicators, while postnatal care showed the greatest decline among maternal health services. Regression analysis indicated that healthcare accessibility, educational attainment, household income, and health system readiness were significant positive predictors of healthcare utilization, whereas transportation barriers and perceived COVID-19 infection risk exerted significant negative effects. The regression model explained 68.4% of the variation in maternal and child health service utilization (Adjusted $R^2 = 0.684$).

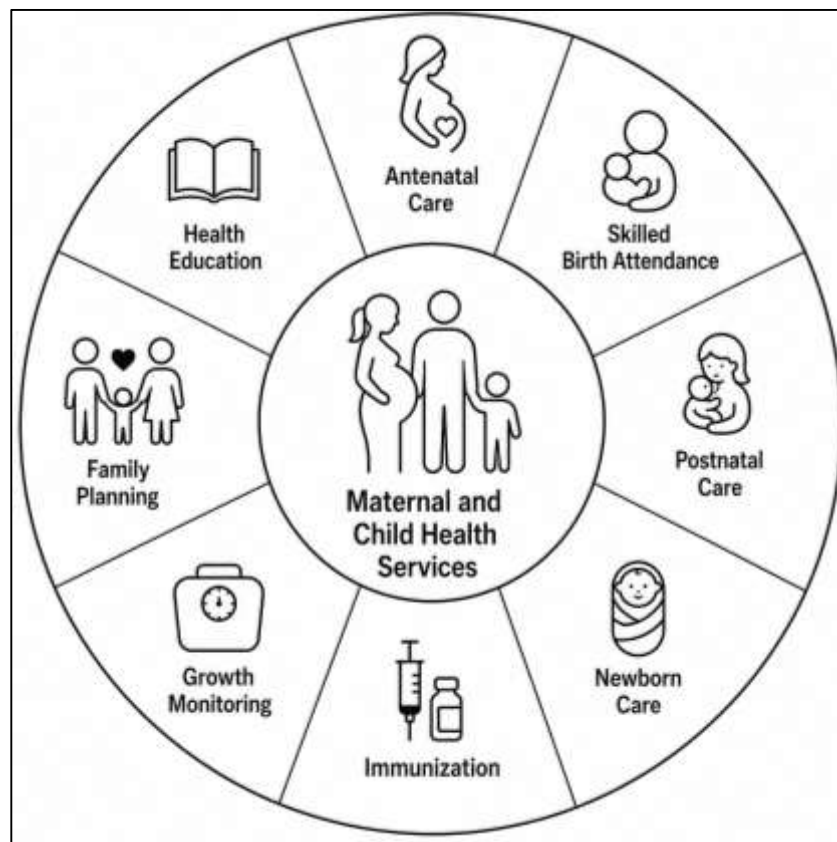
Keywords

COVID-19, Maternal Health, Child Health, Healthcare Utilization, Bangladesh

INTRODUCTION

Maternal and child health represents one of the most fundamental components of public health because it encompasses the health, survival, nutrition, and well-being of women during pregnancy, childbirth, and the postpartum period together with the physical, mental, and developmental health of infants, children, and adolescents. Maternal health focuses on ensuring that women receive comprehensive reproductive, antenatal, intrapartum, and postnatal care that promotes safe pregnancy outcomes while minimizing maternal morbidity and mortality (Black et al., 2016). Child health includes preventive, promotive, curative, and rehabilitative services designed to ensure healthy growth and development from birth through early childhood. Maternal and child health services therefore include family planning, antenatal care, skilled birth attendance, emergency obstetric care, postnatal care, newborn care, immunization, nutritional assessment, breastfeeding counseling, growth monitoring, management of childhood illnesses, and preventive health education.

Figure 1: Integrated Maternal Child Health Framework

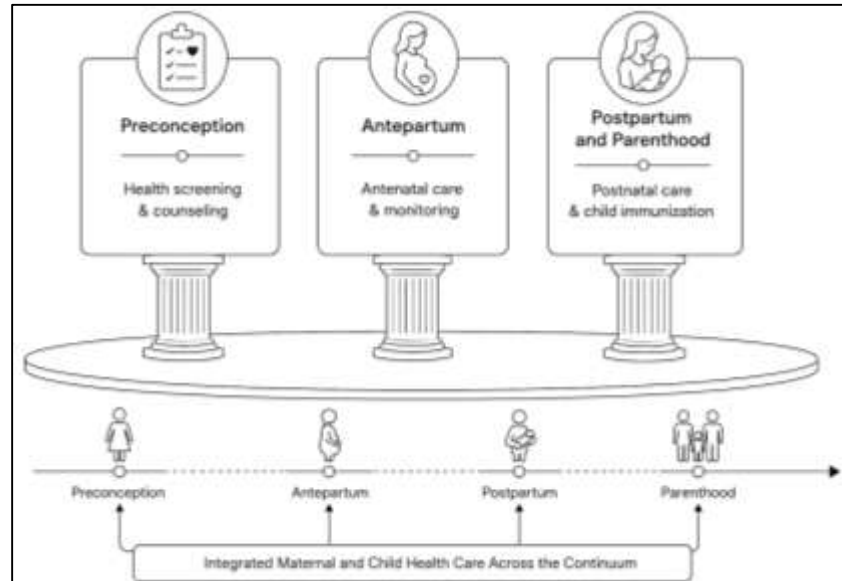


These services collectively form an integrated continuum of care that begins before conception and continues throughout childhood, recognizing that maternal well-being and child survival are closely interconnected. International public health organizations recognize maternal and child health as a major indicator of national development because maternal mortality ratios, neonatal mortality rates, infant mortality rates, under-five mortality rates, vaccination coverage, antenatal care utilization, skilled birth attendance, and postnatal service utilization reflect the effectiveness, accessibility, and equity of healthcare systems (Renfrew et al., 2014). Improvements in these indicators are associated with stronger health infrastructure, better socioeconomic conditions, expanded educational opportunities, improved nutrition, enhanced gender equity, and universal access to essential healthcare services. Maternal and child health has consequently become a central priority within global health agendas because healthy mothers are more likely to experience safe pregnancies and deliver healthy infants, while healthy children are more likely to achieve optimal physical growth, cognitive development, educational attainment, and long-term productivity (Robertson et al., 2020). International

efforts to strengthen maternal and child health have emphasized equitable healthcare delivery across urban and rural populations, expansion of primary healthcare services, skilled healthcare workforce development, availability of essential medicines, strengthened referral systems, effective health information systems, and continuous monitoring of service quality. The Sustainable Development Goals further reinforce the global importance of maternal and child health by prioritizing reductions in preventable maternal and child deaths, expanding universal health coverage, improving reproductive health services, and ensuring equitable access to quality healthcare for all population groups. Maternal and child health therefore represents both a measure of healthcare system performance and a reflection of broader social development, making sustained utilization of essential health services an indispensable requirement for improving population health outcomes across diverse international settings (Hoope-Bender et al., 2014).

The COVID-19 pandemic emerged as one of the most significant global public health emergencies in modern history, creating unprecedented disruptions across healthcare systems and fundamentally altering the delivery, accessibility, and utilization of essential health services. Following the identification of the novel coronavirus in late 2019, rapid international transmission led governments to implement extensive public health measures including lockdowns, travel restrictions, quarantine protocols, physical distancing requirements, border closures, and movement limitations aimed at reducing viral spread (Lu, 2019). Although these interventions were introduced to protect populations from widespread infection, they substantially affected the routine functioning of health systems by redirecting financial resources, healthcare personnel, medical supplies, hospital infrastructure, and administrative capacity toward emergency pandemic response. Hospitals, primary healthcare centers, community clinics, and specialized maternal and child health facilities experienced considerable operational challenges as healthcare workers were reassigned to COVID-19 treatment units, outpatient services were reduced, elective procedures were postponed, and infection prevention protocols limited routine patient interactions. Health facilities simultaneously faced shortages of essential medicines, diagnostic equipment, personal protective equipment, transportation services, and human resources, reducing the capacity to provide uninterrupted healthcare for non-COVID conditions (Kinuthia et al., 2020). Public fear of infection further influenced healthcare-seeking behavior, with many individuals postponing or avoiding facility visits because of concerns regarding exposure to the virus within healthcare environments. Transportation interruptions, reduced public mobility, economic hardship, and uncertainty surrounding healthcare availability created additional barriers to accessing essential services, particularly among vulnerable populations residing in rural communities, low-income households, and geographically isolated regions. Health system disruptions extended beyond clinical care by affecting disease surveillance, preventive health programs, immunization campaigns, nutritional services, health promotion activities, reproductive healthcare, chronic disease management, and community outreach initiatives that traditionally support population health (Motomura et al., 2017). The pandemic also disrupted healthcare supply chains, reducing the timely distribution of vaccines, pharmaceuticals, laboratory supplies, and medical equipment necessary for maintaining routine healthcare operations. Healthcare administrators were required to balance emergency response activities with the continuation of essential services, often under conditions characterized by limited workforce availability, increased patient demand, financial constraints, and evolving clinical guidelines. Digital health technologies, telemedicine platforms, remote consultations, and electronic communication systems were introduced in many settings to maintain continuity of care where face-to-face consultations became difficult, although disparities in technological infrastructure and digital literacy limited equitable access to these alternative service delivery models (Pratley, 2016). The cumulative effects of workforce shortages, resource reallocation, movement restrictions, service interruptions, economic instability, and altered healthcare utilization patterns transformed the functioning of health systems worldwide, creating measurable changes in service availability, healthcare access, patient attendance, and overall utilization of essential health services throughout the course of the COVID-19 pandemic.

Figure 2: Continuum of Maternal Child Healthcare



Maternal health service utilization refers to the extent to which women access and receive essential healthcare services before conception, throughout pregnancy, during childbirth, and throughout the postpartum period (Boerma et al., 2018). These services include family planning, antenatal care, routine pregnancy monitoring, laboratory investigations, nutritional counseling, skilled birth attendance, emergency obstetric care, institutional delivery, postnatal care, and referral services for pregnancy-related complications. Continuous utilization of these services is recognized as a fundamental requirement for reducing maternal morbidity and mortality while improving pregnancy outcomes and newborn survival. During the COVID-19 pandemic, patterns of maternal health service utilization changed considerably across countries as healthcare systems encountered operational disruptions and populations experienced unprecedented barriers to accessing routine healthcare. Many pregnant women postponed or reduced scheduled antenatal visits because movement restrictions, transportation limitations, infection prevention measures, and uncertainty regarding the availability of healthcare services affected routine attendance (Qiao et al., 2021). Health facilities simultaneously modified service delivery by introducing appointment systems, limiting accompanying family members, reducing outpatient consultations, reorganizing maternity wards, implementing infection control protocols, and prioritizing urgent obstetric cases to reduce overcrowding and minimize viral transmission. These operational adjustments altered the manner in which maternal healthcare was delivered and influenced the frequency with which women sought routine pregnancy care. Utilization of skilled birth attendance and institutional delivery services also experienced variations because some women preferred home births or delayed hospital admission owing to concerns regarding possible exposure to COVID-19 within healthcare facilities. Referral systems for obstetric emergencies were further affected by transportation interruptions, workforce shortages, and increased pressure on hospitals managing both COVID-19 patients and routine maternity services (Graham et al., 2016). Postnatal care utilization similarly declined in numerous settings as early discharge policies, reduced home visitation programs, and limited follow-up consultations affected continuity of maternal care after childbirth. Family planning and reproductive health services also experienced interruptions resulting from temporary clinic closures, reduced outreach activities, supply chain disruptions affecting contraceptive availability, and decreased opportunities for routine counseling. The magnitude of these service utilization changes differed according to healthcare infrastructure, urban and rural residence, socioeconomic conditions, educational attainment, household income, health insurance coverage, geographic accessibility, and national pandemic control measures. Women residing in disadvantaged communities frequently encountered greater challenges in maintaining routine maternal healthcare because financial hardship, limited transportation options, and reduced

availability of nearby healthcare providers created multiple barriers to service access (Bartick et al., 2017). Healthcare providers simultaneously faced increased workloads, staffing shortages, evolving clinical protocols, shortages of personal protective equipment, and heightened occupational risks, all of which affected the capacity to maintain uninterrupted maternal healthcare services. Alternative approaches including telemedicine consultations, mobile health communication, digital appointment systems, telephone counseling, and community-based follow-up were introduced in various healthcare settings to support continuity of maternal care when direct facility attendance became difficult. The overall pattern of maternal health service utilization during the COVID-19 pandemic therefore reflected the combined influence of health system capacity, public health restrictions, healthcare accessibility, individual healthcare-seeking behavior, socioeconomic conditions, and organizational adaptability, resulting in measurable changes across the continuum of maternal healthcare from pregnancy through the postpartum period (Laopaiboon et al., 2014).

Child health service utilization refers to the extent to which infants and children receive essential preventive, promotive, curative, and rehabilitative healthcare services that support healthy growth, development, disease prevention, and survival throughout early childhood. These services include neonatal care, routine immunization, growth monitoring, nutritional assessment, vitamin supplementation, breastfeeding support, management of common childhood illnesses, developmental screening, outpatient consultations, emergency pediatric care, and community-based child health programs (Pérez-Escamilla et al., 2016). Effective utilization of these services is widely recognized as a critical determinant of child survival because timely access to preventive and curative healthcare reduces the incidence of infectious diseases, malnutrition, developmental delays, and preventable childhood mortality. During the COVID-19 pandemic, child health service utilization experienced substantial changes as health systems redirected resources toward emergency pandemic response while implementing infection prevention and control measures across healthcare facilities. Routine immunization services were interrupted in many settings because vaccination campaigns were postponed, outreach activities were suspended, community health programs were reduced, and healthcare workers responsible for child health services were reassigned to COVID-19-related responsibilities (Keats et al., 2021). Parents and caregivers also modified healthcare-seeking behavior owing to concerns regarding possible exposure to the coronavirus in hospitals and primary healthcare facilities, resulting in delayed outpatient visits, reduced attendance for routine child health checkups, and postponed treatment for non-emergency illnesses. Lockdown measures, transportation restrictions, school closures, and movement limitations created additional obstacles that affected the accessibility of child healthcare services, particularly for families residing in rural communities, geographically isolated areas, and economically disadvantaged households. Health facilities implemented appointment-based consultations, physical distancing measures, infection screening procedures, reduced clinic capacity, and modified patient flow systems to minimize viral transmission while maintaining essential pediatric services. These operational changes influenced service availability and altered the frequency of routine healthcare utilization among children (Slomian et al., 2019). Nutritional support programs, breastfeeding counseling, growth monitoring activities, and community-based child health interventions were similarly affected because face-to-face interactions between healthcare providers and families became more limited during periods of heightened public health restrictions. Early identification and management of childhood illnesses such as pneumonia, diarrhea, respiratory infections, and nutritional deficiencies also encountered challenges when delayed healthcare utilization reduced opportunities for timely diagnosis and treatment. Healthcare providers adopted alternative service delivery approaches including telemedicine consultations, telephone follow-up, digital health education, mobile communication platforms, and appointment scheduling systems to sustain continuity of pediatric care where direct clinical attendance became difficult (Daelmans et al., 2017). The extent of these adaptations varied according to healthcare infrastructure, digital accessibility, workforce capacity, resource availability, and national public health policies. Variations in child health service utilization were further influenced by parental education, household income, health literacy, family perceptions of infection risk, availability of transportation, and the geographic distribution of healthcare facilities. Consequently, the COVID-19 pandemic altered the utilization of essential child health services through the combined effects of healthcare system

reorganization, public health restrictions, socioeconomic challenges, and changes in caregiver health-seeking behavior, producing measurable differences in access to preventive and curative child healthcare across diverse population settings (Stenberg et al., 2014).

Bangladesh has made substantial progress in improving maternal and child health over recent decades through the expansion of primary healthcare services, strengthened immunization programs, increased availability of skilled birth attendants, improved antenatal and postnatal care coverage, enhanced community-based health interventions, and greater accessibility of reproductive and child healthcare services across both urban and rural areas. The country's maternal and child health system operates through an extensive network of public hospitals, district hospitals, upazila health complexes, union health and family welfare centers, community clinics, maternal and child welfare centers, private healthcare providers, and numerous governmental and non-governmental organizations that collectively deliver preventive, promotive, and curative healthcare services (Halfon et al., 2014). Essential maternal health services include family planning, antenatal care, safe delivery, emergency obstetric care, skilled birth attendance, postnatal follow-up, nutritional counseling, and reproductive healthcare, while child health services encompass neonatal care, routine immunization, growth monitoring, nutritional assessment, vitamin supplementation, breastfeeding support, integrated management of childhood illnesses, and developmental monitoring. These integrated services have contributed to measurable improvements in maternal and child health indicators by increasing healthcare utilization and expanding access to essential health interventions throughout the country. The emergence of the COVID-19 pandemic, however, introduced significant operational challenges that affected the continuity and accessibility of maternal and child healthcare services across Bangladesh (Akseer et al., 2020). National infection prevention measures, movement restrictions, localized lockdowns, transportation disruptions, and the reallocation of healthcare personnel and medical resources toward pandemic response activities altered the routine functioning of healthcare facilities and community health programs. Many public and private healthcare institutions revised service delivery arrangements by limiting outpatient consultations, introducing appointment-based systems, strengthening infection prevention protocols, reducing non-emergency services, and reorganizing patient flow to minimize the risk of viral transmission. These operational changes influenced healthcare-seeking behavior among pregnant women, mothers, and caregivers, many of whom postponed routine facility visits because of concerns regarding infection, uncertainty about service availability, transportation difficulties, and financial hardship associated with the broader socioeconomic effects of the pandemic (Victora et al., 2021). Community outreach activities conducted by frontline health workers, including home visits, maternal counseling, growth monitoring sessions, and immunization campaigns, were also affected in several areas as public health restrictions limited face-to-face interactions and routine field operations. Geographic disparities further influenced service utilization, with rural communities, remote regions, urban informal settlements, and economically disadvantaged households experiencing greater barriers to accessing healthcare because of limited transportation, reduced household income, inadequate healthcare infrastructure, and unequal distribution of medical resources. Healthcare professionals simultaneously encountered increased workloads, workforce shortages, evolving clinical guidelines, shortages of protective equipment during the early stages of the pandemic, and heightened occupational risks while attempting to maintain essential maternal and child health services (Althabe et al., 2015). Various adaptive strategies, including scheduled appointments, infection screening, telephonic consultations, digital communication, and strengthened community coordination, were implemented to support continuity of care under pandemic conditions, although the level of implementation varied across different healthcare settings. Consequently, the COVID-19 pandemic created measurable changes in the utilization of maternal and child health services in Bangladesh by influencing healthcare accessibility, service availability, organizational capacity, and healthcare-seeking behavior throughout the continuum of maternal and child healthcare (Tarekegn et al., 2014).

Quantitative evidence provides an objective foundation for understanding patterns of maternal and child health service utilization by measuring the frequency, magnitude, and determinants of healthcare access across different populations and healthcare settings. Within public health research, service utilization is commonly evaluated using measurable indicators such as the number of antenatal care

visits, percentage of institutional deliveries, skilled birth attendance coverage, postnatal care attendance, family planning acceptance, childhood immunization coverage, neonatal care utilization, outpatient pediatric consultations, growth monitoring participation, and healthcare facility attendance rates (Tessema et al., 2021). These indicators enable researchers to quantify changes in healthcare utilization and examine the relationships between demographic, socioeconomic, geographic, and health system characteristics that influence access to essential maternal and child healthcare services. Quantitative investigations frequently employ cross-sectional surveys, cohort studies, longitudinal analyses, health facility assessments, population-based surveillance systems, demographic and health surveys, routine health management information systems, and national health databases to generate reliable evidence regarding healthcare utilization patterns. Statistical analyses including descriptive statistics, correlation analysis, regression modeling, multivariate analysis, logistic regression, structural equation modeling, and multilevel modeling are commonly applied to identify significant predictors of service utilization while controlling for potential confounding variables. Across diverse healthcare settings, quantitative findings consistently demonstrate that maternal and child health service utilization is influenced by multiple interacting determinants rather than a single factor (Roberts et al., 2018). Individual characteristics such as maternal age, educational attainment, parity, employment status, health literacy, previous healthcare experiences, and knowledge of available services contribute to variations in healthcare-seeking behavior. Household characteristics including family income, economic stability, household size, decision-making autonomy, transportation availability, and financial capacity further influence the ability to obtain timely healthcare services. Community-level determinants such as rural or urban residence, geographic accessibility, distance to healthcare facilities, road infrastructure, availability of public transportation, and local health service coverage also affect utilization rates (Grenier, et al., 2014). Health system determinants remain equally important and include the availability of trained healthcare professionals, quality of healthcare services, continuity of care, facility readiness, availability of medicines and medical supplies, waiting time, referral efficiency, service affordability, and organizational capacity. During the COVID-19 pandemic, quantitative analyses documented measurable changes in these utilization indicators as public health restrictions, healthcare resource reallocation, workforce shortages, transportation disruptions, economic instability, and concerns regarding infection altered routine healthcare-seeking behavior. Statistical evidence generated during this period enabled researchers to compare pre-pandemic and pandemic utilization patterns, identify population groups experiencing the greatest service reductions, and evaluate differences across regions and healthcare facilities using standardized quantitative measures (Tessema et al., 2020). Such evidence contributes to a comprehensive understanding of how multiple demographic, socioeconomic, geographic, behavioral, and organizational determinants collectively influence maternal and child health service utilization, providing an empirical basis for evaluating changes in healthcare access within Bangladesh and comparable healthcare systems (Habonimana & Batura, 2021).

The COVID-19 pandemic created an exceptional public health context in which the utilization of essential maternal and child health services became an important area of quantitative investigation because healthcare systems experienced simultaneous pressures related to infectious disease control and the continuation of routine health service delivery. Maternal and child health services are highly dependent on regular interactions between healthcare providers and service users throughout pregnancy, childbirth, the postpartum period, infancy, and early childhood (Rutaremwa et al., 2015). Any interruption in these services can be reflected through measurable changes in antenatal care attendance, institutional delivery, skilled birth attendance, postnatal care utilization, neonatal healthcare, routine childhood immunization, growth monitoring, nutritional services, and outpatient pediatric consultations. Bangladesh has historically prioritized maternal and child health through national health policies, expanded primary healthcare infrastructure, community-based service delivery, and collaboration between governmental and non-governmental health organizations. Considerable improvements in maternal and child health indicators have been achieved through increased healthcare accessibility, improved vaccination coverage, expanded reproductive health services, strengthened referral systems, and enhanced community participation (Iacoella & Tirivayi, 2019). The emergence of COVID-19 introduced a complex healthcare environment in which movement

restrictions, infection prevention measures, healthcare workforce redistribution, transportation limitations, economic challenges, and changing healthcare-seeking behavior influenced the accessibility and utilization of essential health services across different regions of the country. These changes created variations in healthcare utilization among different population groups according to socioeconomic status, educational attainment, place of residence, geographic accessibility, household resources, and availability of healthcare facilities (Phillips et al., 2017). Quantitative evaluation of these variations is necessary because statistical analysis allows objective measurement of the magnitude of service disruption and identification of the factors associated with changes in healthcare utilization (Ngui, et al., 2014). Examining measurable indicators such as antenatal care coverage, institutional delivery rates, postnatal care attendance, childhood immunization coverage, healthcare facility visitation, and neonatal service utilization provides an evidence-based understanding of how maternal and child healthcare changed during the pandemic period. Such quantitative assessment also facilitates comparison across geographic regions, healthcare settings, and population subgroups using standardized statistical measures. Bangladesh represents an important context for this type of investigation because of its large population, diverse socioeconomic characteristics, extensive public health infrastructure, and continued commitment to improving maternal and child health outcomes (Steinbeisser et al., 2018). Understanding changes in service utilization within this national context contributes to a comprehensive evaluation of healthcare accessibility during a major public health emergency while providing measurable evidence regarding the interaction between health system capacity, demographic characteristics, socioeconomic conditions, and healthcare utilization. This review therefore focuses on synthesizing quantitative evidence relating to the impact of COVID-19 on maternal and child health service utilization in Bangladesh by examining measurable utilization patterns, statistical indicators, and the determinants associated with variations in access to essential maternal and child healthcare services throughout the pandemic period (Manote & Gebremedhin, 2020).

The primary objective of this review is to systematically examine the impact of the COVID-19 pandemic on maternal and child health service utilization in Bangladesh through a comprehensive synthesis of quantitative evidence reported in the published literature. Specifically, the review seeks to evaluate measurable changes in the utilization of essential maternal health services, including antenatal care attendance, skilled birth attendance, institutional delivery, emergency obstetric care, postnatal care, family planning, and reproductive health services during the COVID-19 pandemic. The review also aims to assess variations in the utilization of child health services, including neonatal care, routine immunization, growth monitoring, nutritional assessment, breastfeeding support, vitamin supplementation, outpatient pediatric consultations, and the management of common childhood illnesses throughout the pandemic period. Another important objective is to identify and analyze the demographic, socioeconomic, geographic, behavioral, and health system determinants that influenced maternal and child health service utilization during the public health emergency. Particular attention is directed toward examining the effects of movement restrictions, healthcare workforce redistribution, transportation limitations, healthcare facility accessibility, household economic conditions, educational attainment, urban–rural disparities, healthcare infrastructure, and organizational capacity on the continuity of essential health services. The review further seeks to compare patterns of service utilization before and during the COVID-19 pandemic using quantitative indicators reported across different studies, thereby identifying the magnitude and direction of changes in healthcare access among mothers and children. In addition, the study aims to synthesize statistical findings relating to healthcare utilization trends across different regions and healthcare settings within Bangladesh while identifying population groups that experienced greater reductions in access to essential maternal and child healthcare services. The review also intends to examine the adaptive strategies implemented by healthcare institutions and public health authorities to sustain the delivery of maternal and child health services under pandemic conditions, including modifications in service organization, infection prevention measures, community-based interventions, and alternative healthcare delivery approaches. Ultimately, this review seeks to provide a comprehensive quantitative synthesis of existing empirical evidence concerning maternal and child health service utilization during the COVID-19 pandemic in Bangladesh by integrating findings from multiple studies to develop a clearer understanding of service

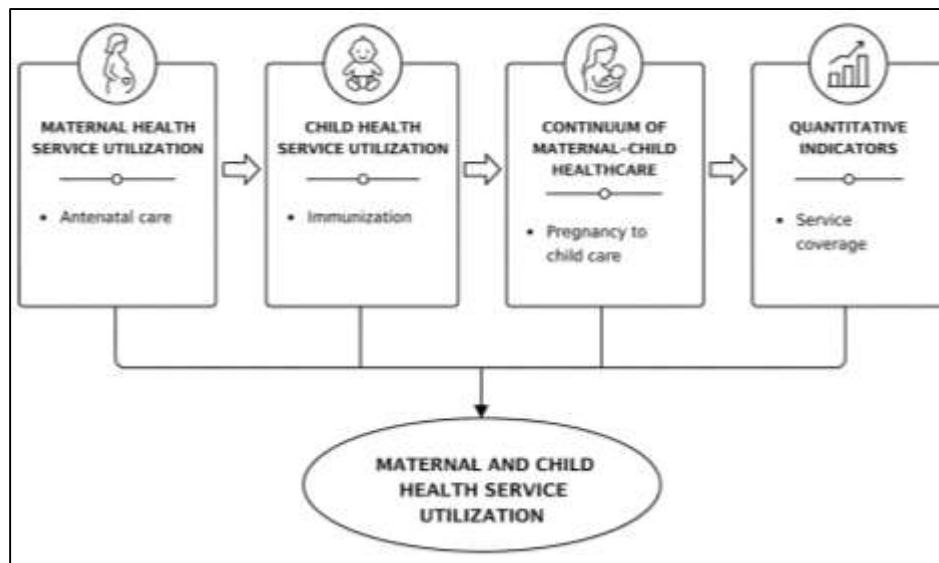
utilization patterns, associated determinants, and measurable changes in healthcare access within the national health system.

LITERATURE REVIEW

The literature review provides the theoretical and empirical foundation for understanding the impact of the COVID-19 pandemic on maternal and child health service utilization in Bangladesh from a quantitative perspective. It systematically examines published evidence relating to maternal and child healthcare delivery, utilization patterns, healthcare accessibility, and the determinants influencing service uptake before and during the COVID-19 pandemic (Ahmed et al., 2021). The review synthesizes quantitative findings from national and international studies that have measured changes in healthcare utilization using indicators such as antenatal care attendance, institutional delivery, skilled birth attendance, postnatal care coverage, neonatal healthcare utilization, childhood immunization rates, outpatient pediatric consultations, growth monitoring participation, nutritional service utilization, and healthcare facility attendance. In addition to describing measurable utilization trends, the literature review evaluates the demographic, socioeconomic, geographic, behavioral, and health system factors associated with variations in maternal and child health service utilization during the pandemic (Pires et al., 2021). Particular emphasis is placed on the quantitative assessment of healthcare disruptions resulting from movement restrictions, healthcare workforce redistribution, transportation barriers, healthcare facility readiness, household economic conditions, urban-rural disparities, and organizational responses implemented to maintain continuity of essential services. The review also examines conceptual and theoretical perspectives that explain healthcare utilization behavior and health system performance during public health emergencies while identifying quantitative evidence relevant to the Bangladeshi context. Collectively, this literature provides the scientific basis for understanding measurable changes in maternal and child health service utilization and supports the development of the present quantitative review (Sahoo et al., 2021).

Conceptual Foundations of Maternal and Child Health Service Utilization

Maternal health service utilization has consistently been presented in the literature as the process through which women access and receive essential healthcare services before pregnancy, throughout pregnancy, during childbirth, and after delivery. The concept extends beyond simple contact with healthcare facilities and incorporates the availability, accessibility, affordability, acceptability, continuity, and quality of services delivered across the reproductive period (Kassie et al., 2021). Earlier literature explains that maternal health service utilization includes family planning, preconception counseling, antenatal care, skilled birth attendance, institutional delivery, emergency obstetric care, postnatal care, nutritional counseling, reproductive health education, and referral services for pregnancy-related complications. These services collectively aim to safeguard maternal health while simultaneously improving fetal and neonatal outcomes through early identification and management of pregnancy risks. The literature further demonstrates that maternal health service utilization is influenced by interactions between individual characteristics, household circumstances, community environments, and healthcare system capacity (Agunwa et al., 2017; Abdur & Iftexhar, 2021). Educational attainment, maternal age, parity, household income, employment status, decision-making autonomy, cultural beliefs, transportation availability, and geographic accessibility have repeatedly been identified as major determinants influencing healthcare-seeking behavior. Health system characteristics including the availability of skilled healthcare professionals, facility readiness, essential medicines, diagnostic services, referral mechanisms, waiting time, and perceived quality of care further shape the utilization of maternal healthcare services (Memirie et al., 2016; Hossan, 2021). The reviewed studies consistently indicate that continuity of maternal healthcare across pregnancy and the postpartum period contributes to improved maternal well-being by facilitating timely clinical assessment, preventive interventions, health education, nutritional support, and management of obstetric complications. Across high-, middle-, and low-income settings, maternal health service utilization has therefore been recognized as a multidimensional public health construct reflecting both the performance of healthcare systems and the ability of women to obtain equitable access to comprehensive reproductive healthcare throughout the maternal care continuum (Amir & Chapal, 2022; Jones et al., 2017).

Figure 3: Healthcare Utilization Conceptual Framework Model

Child health service utilization is widely defined in the literature as the use of preventive, promotive, curative, and rehabilitative healthcare services designed to support healthy growth, development, disease prevention, and survival from birth through childhood. The concept encompasses routine neonatal care, immunization services, nutritional assessment, growth monitoring, developmental screening, breastfeeding support, vitamin supplementation, pediatric outpatient care, management of infectious diseases, emergency healthcare, and referral services for complex childhood illnesses (Hasan & Uddin, 2022; Hoope-Bender et al., 2014). Existing literature consistently emphasizes that child health service utilization represents a comprehensive process involving regular interaction between children, caregivers, and healthcare providers to maintain optimal physical, cognitive, emotional, and social development. Child healthcare utilization is described as multidimensional because service uptake depends upon healthcare availability, caregiver awareness, socioeconomic conditions, healthcare affordability, geographic accessibility, and organizational readiness of health facilities. Numerous studies have demonstrated that parental education, household income, maternal health literacy, family size, cultural practices, transportation infrastructure, and proximity to healthcare facilities significantly influence children's access to essential health services (Shurovi & Hossain, 2022; Srivastava et al., 2015). Healthcare system factors including workforce availability, vaccine supply, service quality, facility infrastructure, consultation time, continuity of care, and effective referral networks similarly determine utilization patterns across different population groups. The literature also indicates that preventive child healthcare services contribute substantially to reductions in childhood morbidity and mortality through early diagnosis, timely treatment, nutritional interventions, disease surveillance, and health promotion activities. Community-based healthcare delivery, outreach programs, primary healthcare facilities, and integrated child health strategies have repeatedly been identified as mechanisms for improving service coverage among underserved populations (Aregbeshola & Khan, 2019; Mohiul & Badrul, 2022). Consequently, child health service utilization is consistently recognized as a multidimensional indicator reflecting healthcare accessibility, health system effectiveness, caregiver engagement, and the overall capacity of health systems to provide continuous, equitable, and quality healthcare throughout childhood.

The continuum of maternal-child healthcare has been extensively described in the literature as an integrated approach that delivers coordinated healthcare services across successive stages of the reproductive and early childhood period (Cameron et al., 2020; Zahidul & Begum, 2022). Rather than considering maternal and child health as separate components, the literature presents them as interconnected phases in which maternal health before conception influences pregnancy outcomes, pregnancy care affects childbirth safety, delivery conditions determine neonatal survival, and early childhood healthcare contributes to long-term physical and developmental well-being. This continuum

begins with reproductive health and family planning, progresses through antenatal care, safe delivery, emergency obstetric management, postnatal follow-up, newborn care, infant feeding support, immunization, nutritional monitoring, developmental assessment, and routine pediatric healthcare. The reviewed literature consistently demonstrates that continuity across these stages strengthens opportunities for disease prevention, early diagnosis, health promotion, and timely clinical intervention while reducing fragmentation in healthcare delivery (Jones et al., 2017; Kanti & Rony, 2022). Studies further indicate that interruption at any stage of the continuum may affect subsequent healthcare utilization and overall maternal and child health outcomes because each component depends upon the successful completion of preceding healthcare interactions. Healthcare integration across hospitals, primary healthcare centers, community clinics, outreach services, and referral systems has therefore been emphasized as a key feature of effective maternal–child healthcare delivery. The literature additionally highlights the importance of coordinated communication among healthcare professionals, standardized clinical guidelines, efficient referral pathways, health information systems, and community engagement in maintaining continuity of care. International evidence consistently supports the life-course perspective by demonstrating that sustained access to integrated maternal and child healthcare services contributes to improved health outcomes through continuous monitoring, preventive care, and comprehensive management of maternal and childhood health needs across successive stages of development (Halfon et al., 2014; Sadia et al., 2022).

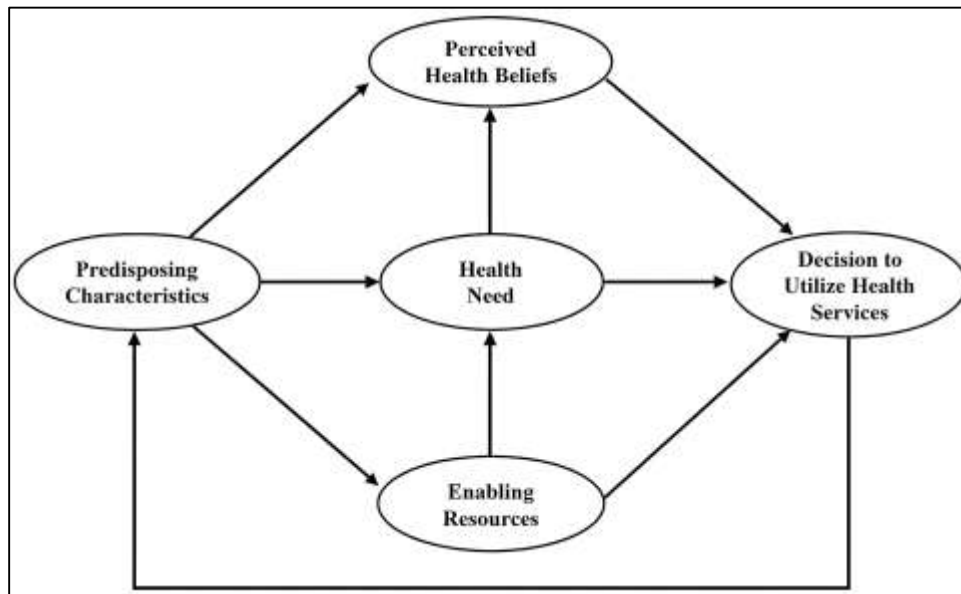
The literature consistently identifies quantitative indicators as essential tools for objectively measuring maternal and child health service utilization and evaluating healthcare system performance. Quantitative assessment enables researchers to examine patterns of healthcare access, compare utilization across different populations, identify disparities, and evaluate changes in service delivery using standardized measurements. Maternal health utilization has frequently been assessed using indicators such as antenatal care attendance, completion of recommended pregnancy visits, institutional delivery, skilled birth attendance, emergency obstetric care utilization, postnatal care coverage, contraceptive prevalence, and reproductive health service uptake (Halfon et al., 2017). Child health utilization has similarly been evaluated using neonatal care attendance, immunization coverage, growth monitoring participation, nutritional assessment, breastfeeding counseling, pediatric outpatient consultations, management of common childhood illnesses, and utilization of preventive child health services. The reviewed studies further demonstrate that healthcare utilization is influenced by measurable demographic, socioeconomic, geographic, and organizational variables including maternal age, educational level, household income, employment, family size, place of residence, travel distance, transportation availability, health insurance, facility readiness, workforce capacity, waiting time, service availability, and quality of healthcare delivery. National household surveys, demographic and health surveys, routine health information systems, health facility assessments, and population-based observational studies have commonly been employed to quantify these indicators using descriptive and inferential statistical techniques (Russ et al., 2014). The literature also emphasizes that standardized quantitative indicators facilitate comparison across countries, healthcare systems, population groups, and different time periods while supporting objective evaluation of healthcare accessibility and utilization. Collectively, these measurable indicators provide a comprehensive framework for assessing maternal and child health service utilization, identifying determinants of healthcare access, and evaluating the effectiveness of healthcare systems in delivering essential maternal and child health services across diverse settings.

Theoretical Foundations of Health Service Utilization

Andersen's Behavioral Model of Health Service Utilization has remained one of the most influential theoretical frameworks for explaining why individuals access healthcare services and how multiple interacting factors shape patterns of healthcare utilization (Black et al., 2017). The literature consistently presents this model as a comprehensive framework that categorizes the determinants of health service utilization into predisposing characteristics, enabling resources, and healthcare needs. Rather than attributing healthcare utilization to a single determinant, the model explains that individuals seek healthcare through the combined influence of demographic characteristics, socioeconomic conditions, family resources, community support, healthcare accessibility, and perceived health status. The reviewed literature demonstrates that maternal and child health services are particularly sensitive to

these interacting factors because women and caregivers often require repeated contact with healthcare providers throughout pregnancy, childbirth, infancy, and early childhood. Studies consistently indicate that maternal education, age, marital status, household income, employment, family structure, health literacy, and cultural beliefs influence decisions regarding antenatal care, institutional delivery, postnatal care, immunization, and pediatric healthcare utilization (Baird et al., 2017). Enabling resources such as transportation, financial capacity, health insurance, healthcare infrastructure, service affordability, and proximity to health facilities have similarly been identified as essential contributors to healthcare access. The literature further explains that perceived and evaluated healthcare needs encourage individuals to seek timely healthcare services when symptoms, pregnancy risks, childhood illnesses, or preventive healthcare requirements become evident. Across low-, middle-, and high-income countries, the Andersen model has been widely applied to investigate disparities in maternal and child healthcare utilization by examining how individual, household, community, and health system characteristics collectively influence healthcare-seeking behavior (Emmering et al., 2018). Researchers have also employed this framework to evaluate inequalities in healthcare access among rural and urban populations, economically disadvantaged households, and socially vulnerable groups. Within maternal and child healthcare research, the model provides a structured explanation for variations in service utilization by integrating demographic, economic, organizational, and health-related determinants into a unified conceptual framework, making it one of the most extensively applied theories in quantitative studies examining healthcare accessibility and utilization.

The Health Belief Model has been extensively discussed in the literature as a behavioral theory explaining how individual perceptions influence decisions to utilize healthcare services. The model emphasizes that healthcare-seeking behavior is largely determined by personal beliefs regarding health conditions, perceived vulnerability, anticipated health consequences, expected benefits of healthcare interventions, perceived barriers to accessing services, and confidence in one's ability to obtain appropriate care (Kamal et al., 2020). The reviewed literature consistently demonstrates that maternal and child healthcare utilization is strongly influenced by these cognitive and behavioral perceptions because women and caregivers continuously evaluate the necessity, safety, accessibility, and expected outcomes of healthcare services before seeking professional care. Studies indicate that pregnant women who perceive pregnancy complications as serious health concerns are more likely to attend antenatal care, utilize skilled birth attendance, and receive postnatal follow-up, while caregivers who recognize the importance of immunization, nutritional monitoring, and routine pediatric care are more likely to seek preventive healthcare for their children. The literature also highlights that perceived barriers such as financial limitations, transportation difficulties, long waiting times, fear of healthcare environments, inadequate health information, cultural norms, and limited healthcare availability may discourage utilization even when services are accessible (Silva et al., 2014). Public health education, community awareness programs, counseling by healthcare professionals, and communication campaigns have been described as important mechanisms for improving health knowledge and strengthening positive healthcare-seeking behavior among mothers and caregivers. Research conducted across diverse healthcare settings further indicates that previous healthcare experiences, trust in healthcare providers, family support, and community influence contribute to shaping perceptions regarding maternal and child healthcare utilization. The Health Belief Model therefore provides an important theoretical perspective for understanding why utilization patterns differ among individuals facing similar health conditions, illustrating that healthcare decisions are influenced not only by healthcare availability but also by personal beliefs, perceived risks, expected benefits, and psychological readiness to engage with health services (Sekhon et al., 2017). The Three Delays Model has become one of the most widely accepted theoretical frameworks for explaining barriers to maternal healthcare access and identifying the factors contributing to adverse maternal health outcomes. The literature describes the model as an integrated approach that categorizes barriers into three sequential stages involving delays in deciding to seek healthcare, delays in reaching an appropriate healthcare facility, and delays in receiving adequate care after arrival at the health facility. Numerous studies have demonstrated that these stages frequently interact, producing cumulative effects on maternal healthcare utilization and pregnancy outcomes (Oliver et al., 2014).

Figure 4: Healthcare Utilization Behavioral Model Framework

The reviewed literature consistently indicates that the initial decision to seek maternal healthcare is influenced by health knowledge, educational attainment, family decision-making, cultural beliefs, previous pregnancy experiences, financial capacity, and recognition of obstetric danger signs. Once the decision has been made, geographic accessibility, transportation infrastructure, travel distance, road conditions, and emergency transportation availability become critical determinants influencing the ability of women to reach healthcare facilities without unnecessary delay. The final stage emphasizes the quality and responsiveness of healthcare services, including the availability of skilled healthcare professionals, emergency obstetric care, medical equipment, essential medicines, diagnostic services, referral mechanisms, clinical competence, and organizational efficiency (Tukamuhabwa et al., 2015). Studies across low-resource settings have consistently shown that weaknesses at any of these stages reduce timely access to maternal healthcare and contribute to lower utilization of antenatal care, institutional delivery, emergency obstetric services, and postnatal follow-up. The literature further explains that the Three Delays Model extends beyond emergency obstetric situations by providing a broader understanding of structural, organizational, and social barriers affecting routine maternal healthcare utilization. Consequently, the model has been widely employed in maternal health research to evaluate healthcare accessibility, identify service delivery constraints, and explain variations in maternal healthcare utilization across different socioeconomic and geographic contexts (Mgawadere et al., 2017).

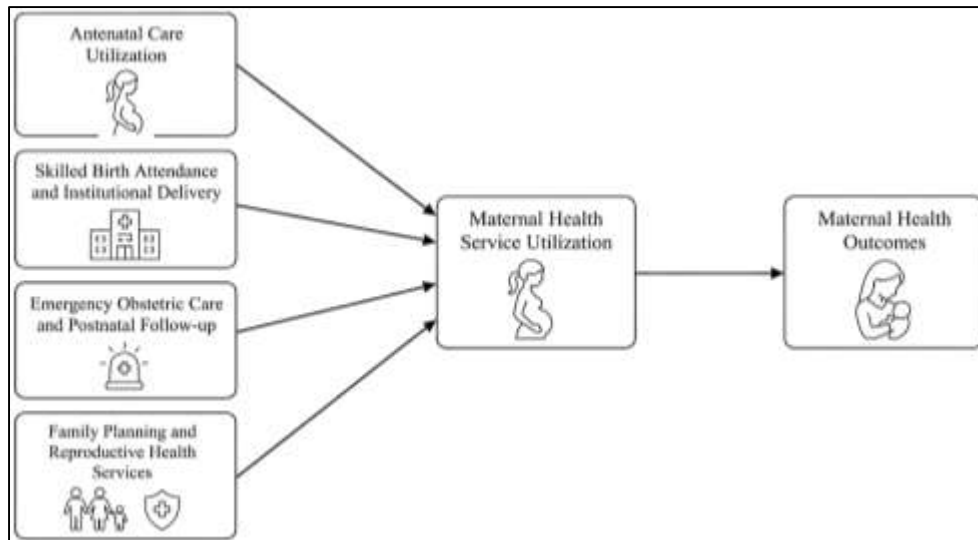
Quantitative Measurement of Maternal Health Service Utilization

Antenatal care coverage and the frequency of antenatal care visits are widely used quantitative measures for evaluating maternal health service utilization because they reflect the extent to which pregnant women receive clinical monitoring, health education, preventive interventions, and risk assessment during pregnancy. The literature consistently identifies antenatal care as one of the most important entry points into the maternal healthcare system because it allows healthcare providers to detect pregnancy-related complications, monitor fetal growth, assess maternal nutrition, provide tetanus immunization, screen for anemia and hypertension, deliver counseling on birth preparedness, and support timely referral when complications are identified (Danna et al., 2020). Quantitative studies commonly measure antenatal care utilization through indicators such as at least one antenatal visit, completion of four or more visits, early initiation of antenatal care during the first trimester, number of contacts with skilled healthcare providers, and continuity of care throughout pregnancy. Existing studies show that antenatal care utilization is shaped by maternal education, household income, parity, maternal age, place of residence, health literacy, transportation access, decision-making autonomy, and

perceived quality of care. In low- and middle-income countries, antenatal care coverage has often improved through community-based health programs, outreach services, mobile counseling, and expanded primary healthcare facilities, although utilization gaps remain among rural, poor, and less educated women (Mohammed et al., 2020). During public health emergencies such as COVID-19, antenatal care attendance becomes especially important as a measurable indicator of service disruption because movement restrictions, fear of infection, facility-level limitations, and transportation barriers can reduce routine pregnancy monitoring. Therefore, antenatal care coverage and visit frequency provide a strong quantitative foundation for assessing maternal healthcare access, continuity, and equity.

Skilled birth attendance and institutional delivery rates are central quantitative indicators for measuring maternal health service utilization because they directly reflect whether women receive professional care during childbirth (Pacagnella et al., 2014). Skilled birth attendance refers to delivery support provided by trained healthcare professionals such as doctors, nurses, midwives, or other qualified birth attendants capable of managing normal deliveries and identifying complications requiring referral or emergency intervention. Institutional delivery refers to childbirth occurring in a recognized healthcare facility such as a hospital, maternity center, clinic, or health complex where essential delivery care and emergency support are available. The literature repeatedly demonstrates that skilled attendance at birth and facility-based delivery are associated with safer childbirth because they increase access to infection prevention, active management of labor, newborn care, emergency obstetric response, and timely referral for complications. Quantitative studies usually measure these indicators through percentages of births attended by skilled providers, proportions of deliveries occurring in health facilities, public-private facility distribution, cesarean delivery rates, and differences across socioeconomic or geographic groups (Joseph et al., 2016). Evidence from many maternal health studies shows that institutional delivery is influenced by antenatal care attendance, maternal education, household wealth, birth order, distance to facility, transportation availability, perceived service quality, cultural preference, and family decision-making. In Bangladesh and similar settings, institutional delivery rates have increased over time, supported by expanded maternity services and greater awareness of safe delivery practices. However, health system disruptions during COVID-19 affected delivery decisions by increasing fear of facility-based infection, reducing transport availability, limiting service capacity, and altering referral pathways. As a result, skilled birth attendance and institutional delivery rates serve as important quantitative measures for understanding how maternal healthcare utilization changed during the pandemic (Alemayehu & Mekonnen, 2015).

Emergency obstetric care utilization and postnatal care coverage represent essential dimensions of maternal health service measurement because they capture service use during high-risk periods surrounding childbirth and early recovery. Emergency obstetric care includes clinical interventions required to manage life-threatening maternal complications such as severe bleeding, obstructed labor, eclampsia, sepsis, ruptured uterus, and complications requiring surgical or referral-based management. Quantitative studies often assess emergency obstetric care through indicators such as referral rates, facility readiness, cesarean section availability, blood transfusion access, management of obstetric complications, and the proportion of women receiving emergency services when complications occur (Wilunda et al., 2015). The literature shows that utilization of emergency obstetric care depends heavily on timely recognition of danger signs, family decision-making, emergency transport availability, referral efficiency, facility capacity, and the presence of skilled providers. Postnatal care coverage is also a critical maternal health indicator because the postpartum period is associated with risks such as hemorrhage, infection, hypertension, anemia, mental health distress, breastfeeding difficulties, and complications related to delivery. Studies commonly measure postnatal care through attendance within the first 24 hours, follow-up within 48 hours, visits during the first week after delivery, and later postpartum consultations. Evidence indicates that postnatal care utilization is often lower than antenatal care and delivery care because women may perceive reduced need for follow-up after childbirth, especially when no immediate complications are visible (Anastasi et al., 2015).

Figure 5: Maternal Health Service Measurement Framework

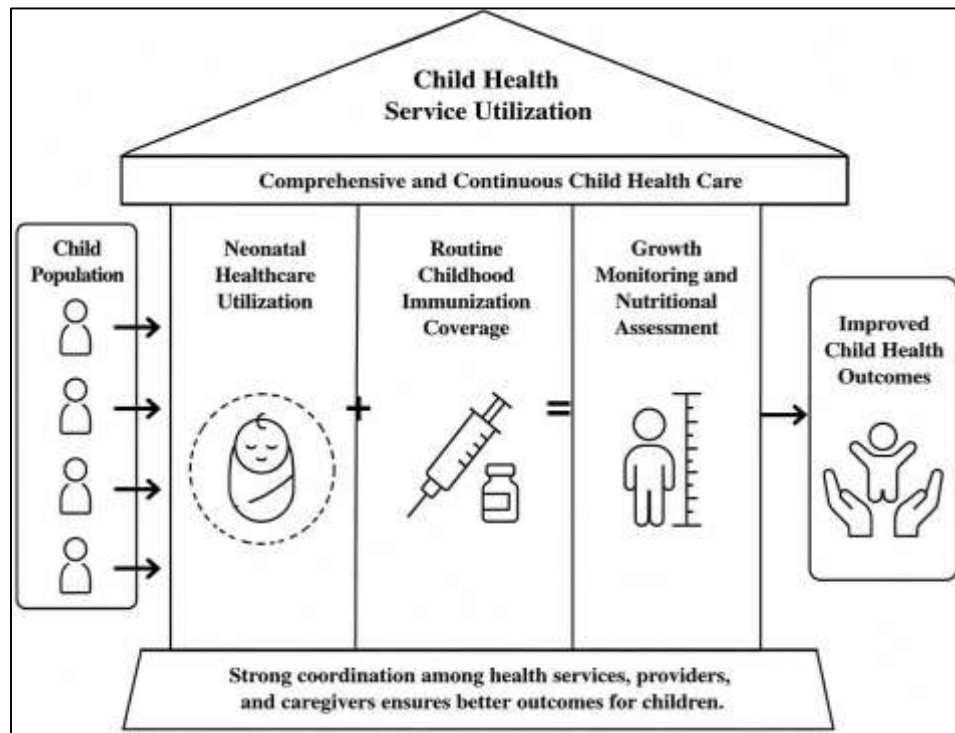
COVID-19 further affected emergency obstetric and postnatal service utilization by disrupting transport systems, limiting routine follow-up, reducing home visits, and increasing hesitancy toward facility-based care. Together, emergency obstetric care and postnatal follow-up indicators provide a deeper quantitative understanding of maternal service continuity beyond pregnancy and delivery. Family planning and reproductive health service utilization constitute important quantitative measures of maternal health because they reflect women's access to contraception, birth spacing, reproductive counseling, and fertility-related decision-making (Kibria et al., 2018). The literature describes family planning as a core component of maternal healthcare because appropriate contraceptive use can reduce unintended pregnancy, improve birth spacing, lower risks associated with closely spaced pregnancies, and support women's reproductive autonomy. Quantitative studies commonly measure family planning service utilization through contraceptive prevalence, unmet need for contraception, method mix, continuation rates, discontinuation rates, counseling coverage, postpartum family planning uptake, and access to reproductive health commodities. Reproductive health service utilization also includes preconception counseling, menstrual health services, sexually transmitted infection screening, infertility counseling, adolescent reproductive health services, and maternal nutrition counseling (Kazmerski et al., 2015). Studies across different settings show that family planning utilization is shaped by women's education, partner support, household income, religious and cultural norms, provider counseling, availability of contraceptive methods, service affordability, privacy, and confidence in healthcare providers. In Bangladesh, family planning programs have historically played a major role in reducing fertility and improving maternal health outcomes through community-based distribution, facility services, and counseling activities. During the COVID-19 pandemic, reproductive health and family planning services were affected by clinic closures, reduced outreach visits, supply chain disruptions, restricted mobility, fear of infection, and reduced access to counseling. These disruptions created measurable changes in contraceptive access, method continuation, and reproductive health service attendance (Hagos et al., 2018). Therefore, family planning and reproductive health indicators are essential for evaluating the broader impact of COVID-19 on maternal health service utilization, particularly because disruptions in these services can affect pregnancy planning, maternal risk exposure, and continuity of reproductive healthcare.

Quantitative Measurement of Child Health Service Utilization

Neonatal healthcare utilization is a major quantitative dimension of child health service measurement because the first 28 days of life represent one of the most critical periods for child survival, growth, and early disease prevention. The literature consistently identifies neonatal healthcare as a core component of maternal-child health because newborn outcomes are closely connected with delivery conditions, immediate postnatal assessment, early breastfeeding initiation, thermal protection, infection

prevention, cord care, immunization at birth, and timely management of neonatal complications (Kabagenyi et al., 2014). Quantitative studies commonly measure neonatal healthcare utilization through indicators such as early newborn checkups, postnatal visits within the first 24 to 48 hours, facility-based newborn care, neonatal intensive care admission, breastfeeding counseling, care-seeking for fever or breathing difficulty, and referral completion for severe neonatal illness. Existing studies show that neonatal service utilization is influenced by institutional delivery, skilled birth attendance, maternal education, household wealth, parity, geographic location, birth preparedness, distance to health facilities, and caregiver awareness of danger signs. In low- and middle-income countries, neonatal healthcare utilization has often been lower among rural households, low-income families, and mothers with limited formal education. During COVID-19, neonatal healthcare utilization became especially important because restrictions on movement, reduced facility attendance, fear of infection, and limitations on postnatal follow-up affected early newborn care (Mustafa et al., 2015). Therefore, neonatal healthcare utilization provides a strong quantitative basis for assessing how child health service continuity was maintained or disrupted during the pandemic.

Routine childhood immunization coverage is one of the most widely used quantitative indicators for measuring child health service utilization because vaccination directly reflects preventive healthcare access and health system capacity. The literature consistently recognizes immunization as an essential child survival intervention because it protects children from vaccine-preventable diseases, reduces morbidity, lowers mortality, and strengthens community-level disease control (Dasa et al., 2019). Quantitative studies usually assess immunization service utilization through indicators such as full vaccination coverage, age-appropriate vaccination, missed doses, dropout rates between vaccine doses, delayed immunization, zero-dose children, and differences in coverage across geographic and socioeconomic groups. Childhood immunization coverage is influenced by caregiver education, maternal health knowledge, household income, place of residence, distance to vaccination centers, availability of vaccines, health worker outreach, reminder systems, and trust in healthcare services. Studies from Bangladesh and comparable low- and middle-income settings show that strong community-based immunization programs can improve coverage, although inequalities remain among hard-to-reach populations, urban informal settlements, and families facing economic or transportation barriers (Brittain et al., 2015). During the COVID-19 pandemic, immunization services were affected by temporary suspension of outreach sessions, reduced caregiver attendance, health worker reassignment, vaccine supply disruptions, and fear of visiting health facilities. These disruptions produced measurable changes in vaccination attendance and delayed immunization schedules in many settings. As a result, routine childhood immunization coverage remains a central quantitative indicator for evaluating the impact of COVID-19 on child health service utilization. Growth monitoring and nutritional assessment are important quantitative indicators of child health service utilization because they measure whether children receive regular evaluation of physical growth, nutritional status, and early signs of undernutrition or developmental risk (Georgieff et al., 2018). The literature identifies growth monitoring as a preventive child health service that helps detect wasting, stunting, underweight, micronutrient deficiency, feeding difficulties, and growth faltering before severe health consequences occur. Nutritional assessment commonly includes weight measurement, height or length measurement, mid-upper arm circumference screening, dietary assessment, breastfeeding counseling, complementary feeding guidance, vitamin supplementation, and referral for malnutrition management. Quantitative studies assess these services through indicators such as participation in growth monitoring sessions, frequency of weight measurement, nutritional counseling coverage, vitamin A supplementation, treatment for acute malnutrition, and attendance at community nutrition programs (Romano et al., 2017). Evidence from child health literature shows that utilization of growth monitoring and nutritional services is shaped by caregiver awareness, maternal education, household food security, family income, service availability, community outreach, health worker counseling, and cultural feeding practices. In Bangladesh, child nutrition programs have been closely connected with primary healthcare, community clinics, immunization sessions, and maternal counseling platforms. During COVID-19, growth monitoring and nutritional assessment were disrupted by reduced face-to-face contact, suspension of community sessions, household economic stress, food insecurity, and limited access to health facilities.

Figure 6: Child Health Service Measurement Framework

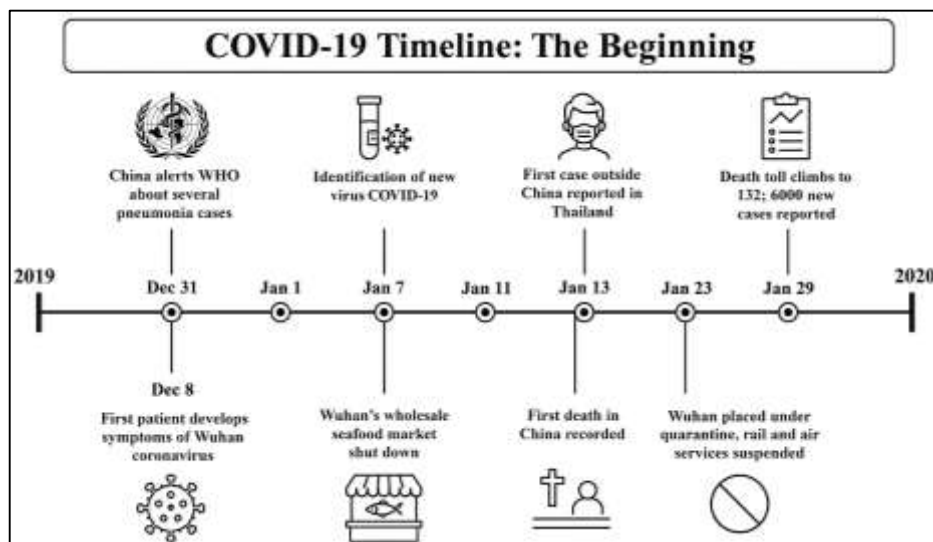
These conditions affected regular child measurement, nutrition counseling, and early identification of malnutrition (Reber et al., 2019). Therefore, growth monitoring and nutritional assessment serve as essential quantitative measures for examining pandemic-related changes in preventive child healthcare utilization.

COVID-19 Pandemic and Health System Disruptions

The COVID-19 pandemic created extensive disruption across global healthcare systems by altering routine service delivery, changing patterns of healthcare utilization, and placing extraordinary pressure on hospitals, primary healthcare centers, community clinics, and public health agencies. The literature consistently shows that pandemic control measures, including lockdowns, travel restrictions, quarantine requirements, physical distancing rules, and temporary suspension of non-emergency services, reduced access to many essential health services (Evans et al., 2021). Maternal and child health services were particularly affected because they depend on repeated facility visits, community outreach, preventive care, and timely referral. Studies from high-, middle-, and low-income countries reported reductions in antenatal care attendance, institutional delivery, postnatal care visits, routine immunization, nutrition services, growth monitoring, and pediatric consultations during the pandemic period. Health systems also experienced reduced outpatient attendance, delayed treatment-seeking, lower preventive service uptake, and interruptions in chronic disease management. These changes were caused not only by facility-level restrictions but also by public fear of infection, reduced transportation, financial hardship, and uncertainty about service availability. In many settings, healthcare facilities prioritized emergency COVID-19 response, which limited the capacity to maintain routine maternal and child healthcare at pre-pandemic levels. The reviewed literature therefore presents COVID-19 as a system-wide shock that affected both supply-side and demand-side dimensions of healthcare utilization (Aziz et al., 2017). Supply-side disruption occurred through reduced workforce availability, shortages of medical supplies, restricted facility operations, and service reorganization. Demand-side disruption occurred through reduced patient attendance, delayed healthcare seeking, and avoidance of healthcare facilities. Together, these disruptions created measurable declines in service coverage and widened existing inequalities in healthcare access among vulnerable populations.

The reallocation of healthcare resources and workforce during COVID-19 became one of the most important mechanisms through which routine health services were disrupted (Nassar et al., 2018). The literature demonstrates that many countries redirected healthcare personnel, hospital beds, laboratory capacity, emergency units, medical supplies, and financial resources toward COVID-19 testing, isolation, treatment, vaccination, and surveillance activities. This reallocation was necessary for pandemic response, yet it reduced the availability of resources for maternal and child health programs, especially in settings with limited healthcare infrastructure. Doctors, nurses, midwives, community health workers, laboratory staff, and administrative personnel were frequently reassigned to pandemic-related duties, which affected antenatal care clinics, delivery services, postnatal follow-up, immunization sessions, nutritional counseling, and community outreach programs. Workforce shortages were intensified by infection among healthcare workers, quarantine requirements, occupational stress, burnout, fear of exposure, and inadequate protective equipment during the early stages of the pandemic (Niezen & Mathijssen, 2014). The literature also shows that supply chain disruption affected the availability of medicines, vaccines, contraceptives, diagnostic materials, oxygen, personal protective equipment, and emergency obstetric supplies. In maternal healthcare, resource constraints influenced facility readiness for safe delivery, emergency obstetric care, referral management, and postpartum monitoring. In child healthcare, resource reallocation affected vaccination programs, neonatal services, pediatric outpatient care, and management of common childhood illnesses (Lin et al., 2021). The studies reviewed across various healthcare systems suggest that resource reallocation produced uneven effects, with greater disruption observed in low-resource settings, rural areas, and facilities serving disadvantaged populations. Bangladesh and other South Asian countries faced similar operational pressures because public health systems had to manage both pandemic response and routine essential service delivery under constrained workforce and resource conditions. Therefore, reallocation of healthcare resources and workforce represents a major explanatory factor in understanding quantitative changes in maternal and child health service utilization during COVID-19 (Ordu et al., 2021).

Figure 7: COVID-19 Healthcare Resilience Framework



Healthcare facility accessibility during lockdowns became a central issue in the literature on COVID-19 and essential health service utilization because access to healthcare depends not only on service availability but also on the ability of individuals to reach healthcare facilities safely and affordably. Lockdown measures, public transport suspension, interdistrict travel restrictions, curfews, road checkpoints, reduced ambulance availability, and fear of police or administrative restrictions created major barriers to healthcare access in many countries. For pregnant women, these barriers affected timely attendance at antenatal care appointments, travel to facilities for delivery, access to emergency

obstetric services, and postnatal follow-up (Nancarrow, 2015). For children, mobility restrictions affected routine immunization visits, growth monitoring sessions, treatment for fever or diarrhea, neonatal checkups, and pediatric emergency care. The literature also highlights that facility accessibility was shaped by geographic location, household income, transportation ownership, distance to healthcare centers, road quality, urban–rural residence, and availability of community health workers. Rural families, urban slum residents, low-income households, and remote communities often experienced greater difficulty accessing healthcare because transportation costs increased and routine outreach services were reduced. Facility accessibility was also affected by modified healthcare operations, including reduced working hours, appointment-based consultations, triage procedures, limits on attendants, separate COVID-19 screening points, and temporary closure of some service units (Fraher & Brandt, 2019). These changes sometimes made services technically available while still difficult to use for mothers and caregivers. Studies on Bangladesh and comparable low- and middle-income contexts show that lockdown-related access barriers contributed to delayed healthcare seeking and reduced utilization of routine maternal and child health services. Accessibility during lockdowns therefore became a measurable determinant of service utilization, linking public health restrictions with lower facility attendance, delayed treatment, and unequal access among vulnerable population groups. Infection prevention measures were central to healthcare delivery during COVID-19 because health facilities needed to reduce viral transmission while continuing essential services (Gupta et al., 2021). The literature shows that hospitals, clinics, and community health centers introduced screening procedures, mask requirements, hand hygiene stations, physical distancing, isolation areas, visitor restrictions, appointment scheduling, patient flow reorganization, and separation of suspected COVID-19 cases from routine service users. These measures were necessary for protecting patients and healthcare workers, yet they also changed the way maternal and child health services were delivered. Antenatal care consultations were sometimes shortened, clinic attendance was limited, waiting areas were reorganized, routine counseling was reduced, and home visits were restricted. Immunization sessions, nutrition services, and pediatric outpatient care were modified to reduce crowding and minimize exposure risk (Santric-Milicevic et al., 2016). The literature further explains that health system resilience became a key factor in determining whether essential services continued during pandemic conditions. Resilient health systems were better able to maintain maternal and child health services through coordinated leadership, effective communication, workforce planning, supply chain management, infection prevention readiness, community engagement, and use of alternative service delivery arrangements. Some settings introduced telephonic counseling, digital appointments, community-based follow-up, staggered immunization sessions, and targeted outreach for high-risk mothers and children. The degree of service continuity varied according to health system capacity, facility preparedness, availability of protective equipment, staffing levels, and local pandemic intensity. In Bangladesh, maintaining essential maternal and child healthcare required coordination between public facilities, community clinics, field-level health workers, and non-governmental organizations (Siekmans et al., 2017). The reviewed literature therefore indicates that infection prevention measures and health system resilience jointly shaped service utilization during COVID-19 by influencing facility readiness, user confidence, provider capacity, and the continuity of essential maternal and child healthcare services.

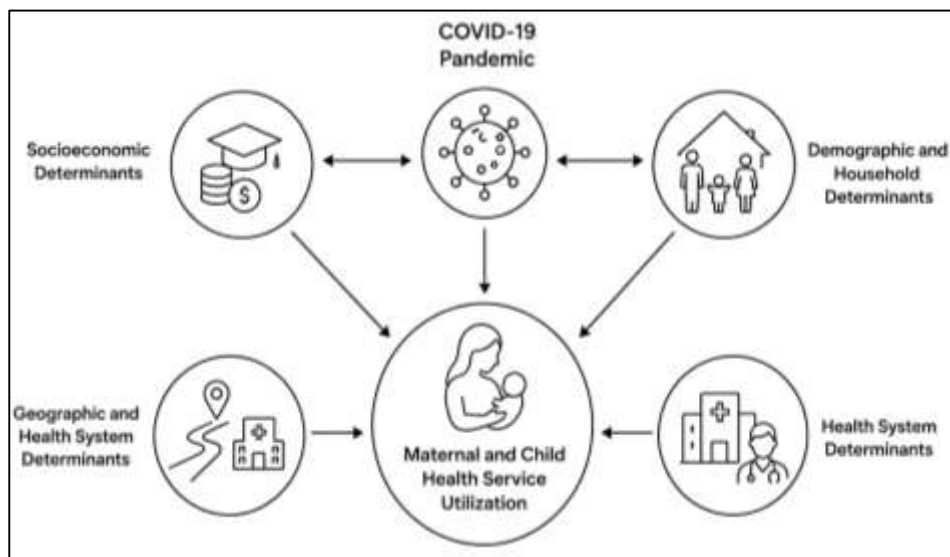
Determinants of Maternal and Child Health Service Utilization During COVID-19

Socioeconomic determinants played a major role in shaping maternal and child health service utilization during the COVID-19 pandemic because healthcare access was closely connected with household income, employment security, educational attainment, food security, transportation affordability, and ability to pay for direct and indirect healthcare costs. The literature consistently shows that families with higher income, stable employment, better education, and stronger social support were more likely to continue using maternal and child health services during periods of public health restriction (Tumusiime et al., 2020). In contrast, low-income households experienced greater difficulty accessing antenatal care, institutional delivery, postnatal follow-up, childhood immunization, nutritional assessment, and pediatric consultations because pandemic-related economic hardship reduced their ability to pay for transport, medicines, diagnostic tests, informal care expenses, and private healthcare when public services were limited. Maternal education also remained a strong

determinant because educated women and caregivers were generally more likely to understand danger signs, recognize the importance of preventive healthcare, communicate with healthcare providers, and follow service schedules. Household wealth influenced healthcare choice by determining whether families could use alternative transport, private facilities, teleconsultation, or paid services during disruptions. The literature further indicates that economic insecurity affected nutrition, maternal well-being, child feeding practices, and timely healthcare seeking (Palagyi et al., 2019). During COVID-19, loss of income and reduced household purchasing power intensified existing inequalities in service utilization among poor families, informal workers, rural households, and urban slum populations. Socioeconomic determinants therefore explain why maternal and child health service disruption was not experienced equally across all population groups, as households with fewer resources were more likely to delay, reduce, or discontinue essential healthcare utilization.

Demographic and household determinants strongly influenced maternal and child health service utilization during COVID-19 because healthcare decisions were shaped by maternal age, parity, birth order, household size, marital status, caregiver experience, child age, and family decision-making structure (Sundararaman et al., 2021). The literature shows that younger mothers, first-time mothers, multiparous women, adolescent mothers, and women with limited pregnancy experience often differed in their use of antenatal care, delivery services, postnatal follow-up, and newborn care. First-time mothers were more likely to seek information and formal healthcare because of uncertainty regarding pregnancy and childbirth, while women with higher parity sometimes relied on previous childbirth experience and reduced routine service use when access became difficult. Maternal age also shaped healthcare utilization because older mothers and adolescent mothers may have different levels of autonomy, risk perception, family support, and confidence in communicating with healthcare providers. Household decision-making was especially important in settings where husbands, mothers-in-law, or senior family members influenced whether women could attend clinics, use institutional delivery, obtain contraception, or seek care for sick children (Sahoo et al., 2021).

Figure 8: COVID-19 Maternal Healthcare Determinants Framework



Child age also influenced service use because newborns and infants required immunization, postnatal checkups, breastfeeding counseling, and illness management more frequently than older children. Larger households often experienced more pressure during the pandemic because childcare responsibilities, reduced income, and movement restrictions limited the ability of mothers or caregivers to visit healthcare facilities. The literature further suggests that maternal employment, family support, caregiving burden, and household composition affected healthcare-seeking patterns during lockdowns (Tadesse, 2020). Demographic and household characteristics therefore provided important

explanations for variation in service utilization during COVID-19, particularly because family structure and caregiving responsibilities shaped decisions about when, where, and how mothers and children accessed essential healthcare services.

Geographic, urban-rural, and health system determinants were central to maternal and child health service utilization during COVID-19 because access to care depended on the location of households, distance to facilities, transport availability, distribution of healthcare workers, facility readiness, and continuity of essential services. The literature consistently shows that rural families, remote communities, riverine populations, coastal households, and urban informal settlement residents experienced greater access barriers during lockdowns because of transport restrictions, road conditions, distance to facilities, and uneven distribution of healthcare infrastructure (Lusambili et al., 2020). Urban residents sometimes had closer access to hospitals and private clinics, yet high infection fear, overcrowded facilities, temporary service suspension, and economic insecurity affected healthcare use in cities. Rural areas often relied heavily on community clinics, outreach workers, union-level facilities, and upazila health complexes, making service disruption especially important when field visits, immunization sessions, and community programs were reduced. Health system determinants included availability of skilled providers, midwives, pediatric staff, vaccines, medicines, emergency obstetric care, diagnostic services, referral systems, ambulance support, infection prevention supplies, and facility operating hours. During COVID-19, many facilities reorganized patient flow, introduced screening procedures, reduced non-emergency consultations, and reassigned staff to pandemic response, which affected antenatal visits, delivery care, postnatal services, immunization, nutrition counseling, and pediatric outpatient care (Cyr et al., 2019). Service quality and user confidence were also linked with cleanliness, provider communication, waiting time, privacy, respectful care, and perceived safety from infection. The literature therefore indicates that geographic location and health system capacity operated together to shape healthcare utilization. Mothers and caregivers were more likely to continue using services when facilities were nearby, affordable, staffed, supplied, safe, and clearly available during the pandemic.

Quantitative Evidence on COVID-19 and Maternal-Child Health Service Utilization

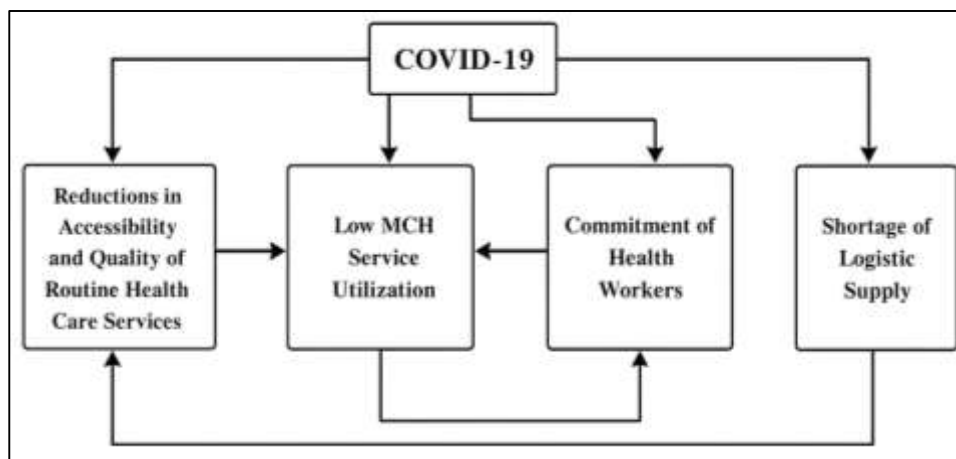
Global quantitative evidence shows that the COVID-19 pandemic substantially changed maternal and child health service utilization across diverse healthcare systems. Studies from different regions reported measurable reductions in antenatal care attendance, skilled birth attendance, institutional delivery, postnatal care visits, childhood immunization, nutrition services, growth monitoring, outpatient pediatric consultations, and care-seeking for common childhood illnesses (Banerjee, 2021). The literature indicates that these changes were caused by a combination of service-side and demand-side disruptions. On the service side, health facilities reduced routine appointments, reassigned healthcare workers, reorganized patient flow, limited outreach activities, and prioritized COVID-19 screening and treatment. On the demand side, pregnant women, mothers, and caregivers reduced facility visits because of fear of infection, transport restrictions, financial hardship, and uncertainty about the availability of routine services. Global evidence also demonstrates that preventive services were often more affected than emergency services because families were more likely to delay routine checkups, vaccination sessions, counseling, and growth monitoring than urgent care for severe illness or obstetric emergencies. Quantitative studies further show that service reductions were not uniform across countries, regions, or population groups (Kassam et al., 2021). Higher-income settings often maintained partial continuity through telehealth, appointment scheduling, and stronger referral systems, while low-resource settings experienced greater disruption due to limited workforce capacity, weak supply chains, and fewer alternative service delivery mechanisms. Overall, global quantitative evidence presents COVID-19 as a major shock to maternal and child health service utilization, with measurable declines in both preventive and routine healthcare access.

Evidence from low- and middle-income countries indicates that COVID-19 had a particularly strong impact on maternal and child health service utilization because many health systems already faced constraints related to workforce shortages, limited facility readiness, uneven healthcare distribution, and financial barriers to service access (Weinhold & Gurtner, 2018). Quantitative studies in these settings reported declines in antenatal care visits, facility-based delivery, postnatal follow-up, contraceptive access, immunization attendance, nutritional screening, and pediatric outpatient care

during lockdown and high-transmission periods. The literature shows that movement restrictions and transport interruptions were especially important barriers because many women and caregivers depended on public transport, community health workers, and outreach services to reach healthcare facilities. Economic hardship also reduced service utilization by limiting households' ability to pay for transportation, medicines, private consultations, diagnostic services, and informal healthcare costs. In many low- and middle-income settings, community-based programs were reduced or temporarily suspended, affecting immunization campaigns, maternal counseling, home visits, child growth monitoring, and nutrition interventions. Studies further demonstrate that rural populations, informal settlement residents, low-income families, adolescent mothers, and less educated women experienced greater reductions in service access (Roberts et al., 2018). Health system limitations also affected emergency referral, availability of skilled providers, supply of essential medicines, and continuity of reproductive health services. The reviewed evidence therefore suggests that COVID-19 intensified existing inequalities in maternal and child health service utilization in low- and middle-income countries by reducing both service availability and household capacity to seek care.

Quantitative evidence from South Asia demonstrates that maternal and child health service utilization was strongly affected by COVID-19 because the region experienced strict lockdowns, population mobility restrictions, high population density, economic vulnerability, and pressure on public health systems. Studies from South Asian countries reported reductions in antenatal care attendance, institutional deliveries, postnatal visits, family planning services, routine immunization, neonatal checkups, nutrition services, and pediatric consultations during different phases of the pandemic (Aljassim & Ostini, 2020).

Figure 9: Pandemic Maternal Child Healthcare Framework



The literature indicates that women and caregivers faced multiple access barriers, including reduced transport availability, fear of infection, financial stress, limited clinic hours, overcrowded facilities, and uncertainty about whether routine services were operating. In several South Asian settings, primary healthcare centers and community outreach programs were important channels for maternal and child health service delivery, and disruption to these services directly affected preventive care. Immunization services were particularly vulnerable because routine vaccination depends on fixed-site sessions, outreach activities, vaccine supply chains, caregiver attendance, and health worker availability. Maternal services were also affected because antenatal care and postnatal follow-up require repeated facility contact, while delivery care depends on timely transportation and facility readiness (Pan et al., 2021). Quantitative findings from the region also show that service reductions varied across urban and rural locations, socioeconomic groups, and facility types. Private sector dependence in some areas created additional financial pressure for households when public services were reduced. Overall, South Asian evidence shows that COVID-19 disrupted maternal and child health utilization through the combined effects of health system reorganization, household-level economic pressure, restricted

mobility, and altered healthcare-seeking behavior.

Quantitative evidence from Bangladesh indicates that COVID-19 affected maternal and child health service utilization through reduced facility attendance, interrupted community services, transportation barriers, household economic stress, and fear of infection (Rigg et al., 2018). Studies conducted in Bangladesh reported changes in antenatal care visits, institutional delivery, skilled birth attendance, postnatal care, family planning, childhood immunization, neonatal care, nutritional services, and pediatric consultations during the pandemic period. The literature shows that Bangladesh's maternal and child health system relies on a mixed service delivery structure involving public hospitals, upazila health complexes, union-level facilities, community clinics, private providers, and non-governmental organizations. During COVID-19, this system faced operational challenges as health workers were redirected toward pandemic response, outpatient services were reduced in some settings, and community-level activities were limited. Comparative analysis of pre-COVID-19 and COVID-19 service utilization shows that routine and preventive services were more likely to decline than emergency services because families prioritized urgent health needs while delaying scheduled visits (Aziz & Naima, 2021). Antenatal care frequency, immunization attendance, growth monitoring, and postnatal follow-up were particularly sensitive to lockdowns and movement restrictions. Rural households, urban poor communities, low-income families, and women with limited education faced greater barriers because of transport difficulties, reduced income, and limited access to alternative care. Quantitative comparisons also show that service utilization patterns varied across regions, service types, and phases of the pandemic, reflecting differences in local restrictions, facility readiness, community health worker activity, and household capacity to seek care. The Bangladeshi evidence therefore demonstrates that COVID-19 produced measurable disruption in maternal and child health service utilization while revealing the importance of socioeconomic, geographic, behavioral, and health system factors in explaining differences between pre-pandemic and pandemic service use (Ahmed et al., 2014).

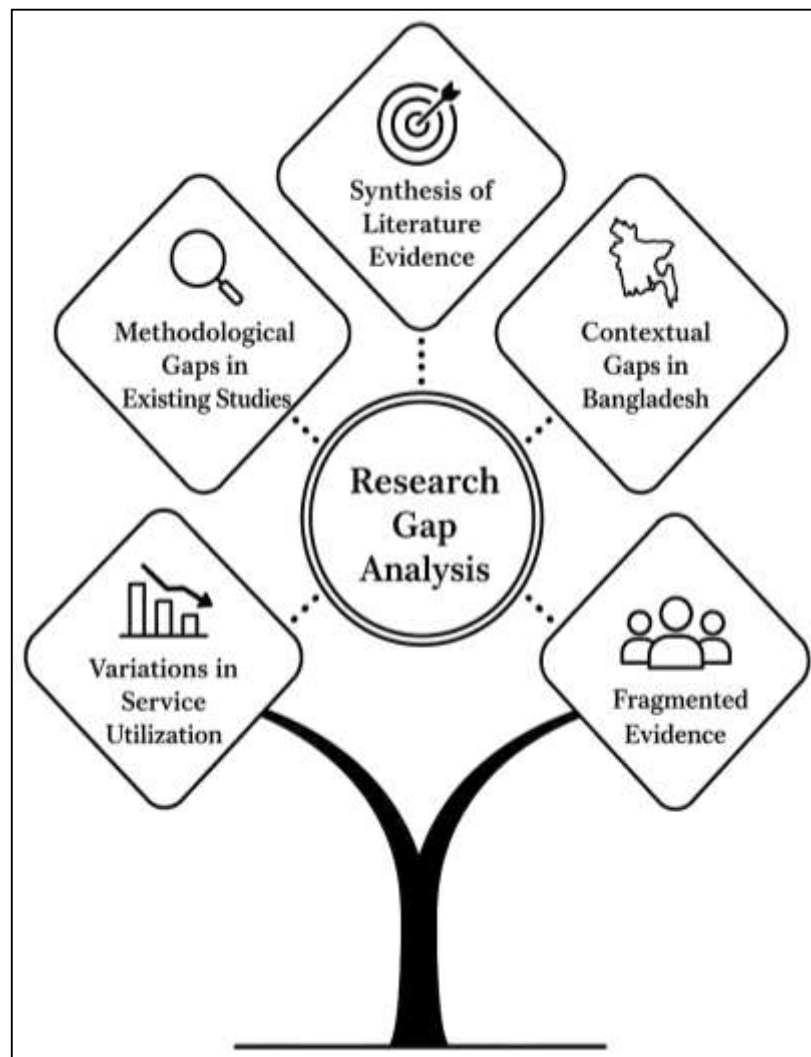
Synthesis of the Literature and Identification of the Research Gap

The reviewed literature consistently demonstrates that the COVID-19 pandemic exerted a measurable influence on maternal and child health service utilization across diverse healthcare systems and socioeconomic settings. Quantitative studies collectively indicate that utilization patterns changed across the continuum of maternal and child healthcare, including antenatal care, skilled birth attendance, institutional delivery, emergency obstetric care, postnatal follow-up, neonatal healthcare, routine immunization, nutritional assessment, growth monitoring, family planning, and pediatric outpatient services (Osamor & Grady, 2016). The literature further shows that reductions in service utilization were not uniform but varied according to health system capacity, socioeconomic conditions, geographic accessibility, public health restrictions, and healthcare-seeking behavior. Across the reviewed evidence, preventive and routine healthcare services experienced greater disruption than emergency services because many households postponed scheduled consultations while continuing to seek care for severe maternal or childhood complications. Studies also reveal that maternal education, household income, transportation availability, urban–rural residence, healthcare infrastructure, availability of skilled health professionals, and perceived safety of healthcare facilities consistently influenced service utilization during the pandemic. Comparative quantitative investigations additionally demonstrate that countries with stronger primary healthcare systems, better organizational coordination, and more resilient healthcare infrastructure maintained higher continuity of essential maternal and child health services than settings with limited healthcare resources (Boerma et al., 2018). The literature also emphasizes that community-based healthcare programs, outreach services, integrated referral systems, and effective public health communication contributed to sustaining healthcare utilization under restrictive conditions. Collectively, the reviewed quantitative evidence provides a comprehensive understanding of the multiple demographic, socioeconomic, behavioral, geographic, and organizational factors associated with maternal and child health service utilization during COVID-19 while demonstrating that healthcare access was shaped by complex interactions between healthcare systems and the populations they served.

Although the existing quantitative literature provides substantial evidence regarding maternal and child health service utilization during the COVID-19 pandemic, several methodological limitations

remain evident across the reviewed studies (Memirie et al., 2016). The literature demonstrates considerable variation in research design, study population, sampling strategies, outcome measurement, analytical approaches, and data sources, reducing the comparability of findings across different investigations. Numerous studies relied primarily on cross-sectional survey designs that measured healthcare utilization at a single point in time, thereby limiting the ability to examine changes occurring throughout different stages of the pandemic. Other investigations depended heavily on routine health information systems or facility-based administrative records, which often excluded individuals who did not access formal healthcare services and therefore underestimated the full magnitude of healthcare disruption. Variability also exists in the operational definitions of maternal and child health service utilization, with different studies employing different indicators, measurement periods, and utilization thresholds when evaluating antenatal care, institutional delivery, immunization, postnatal care, and pediatric service attendance (Anindya et al., 2021). Several quantitative investigations concentrated on individual service components while providing limited assessment of the complete continuum of maternal and child healthcare. In addition, many studies examined either maternal health or child health independently, resulting in relatively few investigations that simultaneously evaluated both service domains within a unified analytical framework.

Figure 10: Maternal Child Service Research Gaps



The reviewed literature also reveals differences in statistical techniques, adjustment for confounding variables, and reporting standards, making direct comparison of quantitative findings more difficult.

Furthermore, some investigations focused primarily on urban healthcare facilities or selected institutional settings, limiting representation of geographically diverse populations. These methodological differences highlight the need for comprehensive synthesis capable of integrating quantitative findings obtained through varied research designs and measurement approaches into a coherent understanding of maternal and child health service utilization during the pandemic ([Anindya et al., 2021](#)).

The literature relating to Bangladesh provides valuable evidence concerning the effects of COVID-19 on healthcare delivery; however, several contextual limitations remain apparent when maternal and child health service utilization is considered comprehensively. Existing quantitative studies frequently concentrate on individual healthcare services, selected geographic regions, or specific healthcare facilities rather than examining the full spectrum of maternal and child health services across the national healthcare system. Many investigations evaluate antenatal care, institutional delivery, or childhood immunization separately, while relatively few studies integrate maternal and child healthcare into a single analytical perspective reflecting the continuum of care ([Yuan et al., 2014](#)). Geographic representation also varies considerably across published studies, with several investigations conducted within selected districts, urban centers, tertiary hospitals, or specific community settings, limiting broader understanding of variations across different administrative regions and healthcare environments. The reviewed literature further indicates that socioeconomic inequalities, urban-rural differences, transportation barriers, household economic conditions, healthcare workforce distribution, and organizational capacity influenced healthcare utilization during the pandemic, yet these determinants are not consistently examined within the same quantitative framework. Differences in healthcare delivery between public facilities, private institutions, community clinics, and non-governmental healthcare providers have similarly received varying levels of attention across existing studies ([Yelland et al., 2015](#)). Furthermore, investigations have employed different utilization indicators, study populations, and analytical methods, creating variation in reported findings and limiting direct comparison among studies conducted in Bangladesh. Consequently, the existing body of literature provides important but fragmented evidence regarding maternal and child health service utilization, demonstrating the value of a comprehensive synthesis that integrates findings across multiple service components, healthcare settings, and population groups within the Bangladeshi context ([Higginbottom et al., 2015](#)).

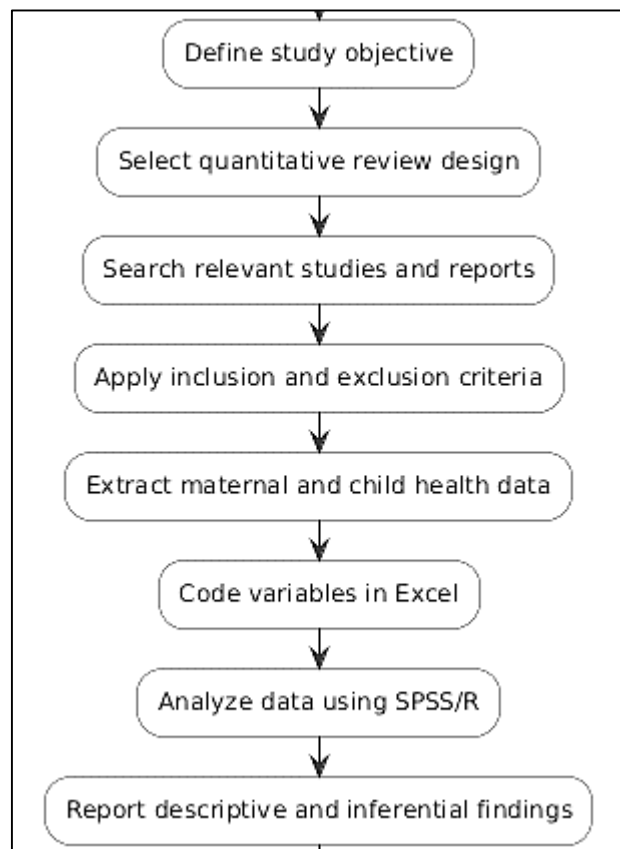
METHOD

This study adopted a quantitative review-based research design to examine the impact of COVID-19 on maternal and child health service utilization in Bangladesh. The study was designed as a retrospective quantitative evidence synthesis because it reviewed and analyzed previously published empirical studies, national reports, survey findings, and health service data that reported measurable changes in maternal and child health service use during the COVID-19 pandemic. The design was appropriate because the purpose of the study was not to collect new clinical data from mothers or children but to synthesize existing quantitative evidence on service utilization patterns, determinants, and pandemic-related disruptions. The study was guided by Andersen's Behavioral Model of Health Service Utilization and the Health Systems Framework for essential service continuity. Andersen's model helped explain how predisposing factors, enabling resources, and perceived or actual healthcare needs influenced maternal and child healthcare use during the pandemic. The Health Systems Framework supported the analysis of how service delivery, workforce availability, medical supplies, governance, information systems, and organizational capacity affected continuity of care. The study therefore examined COVID-19 as the main contextual exposure and maternal and child health service utilization as the primary outcome domain. Maternal health utilization included antenatal care, institutional delivery, skilled birth attendance, postnatal care, emergency obstetric care, and family planning services. Child health utilization included neonatal care, routine immunization, growth monitoring, nutritional assessment, care-seeking for common childhood illnesses, and pediatric outpatient service use. The study was conducted using a structured quantitative approach so that findings could be organized according to measurable indicators, frequencies, percentages, comparative changes, and statistically reported associations.

The participants and materials for this study consisted of previously published quantitative studies,

official health reports, national survey documents, and empirical articles that examined maternal and child health service utilization in Bangladesh during the COVID-19 pandemic. Since this was a review-based quantitative study, individual mothers, children, caregivers, or healthcare workers were not directly recruited. Instead, the study population was represented through secondary data extracted from eligible studies and reports that included Bangladeshi mothers, pregnant women, postpartum women, newborns, infants, children, caregivers, and users of maternal and child healthcare services. A purposive sampling strategy was used to select studies that were directly relevant to the research topic. Studies were included when they reported quantitative findings on maternal health service utilization, child health service utilization, COVID-19-related service disruption, healthcare access, or determinants of service use in Bangladesh. Eligible studies included cross-sectional surveys, secondary data analyses, facility-based studies, population-based studies, health management information system analyses, and quantitative reports published during or after the COVID-19 pandemic period.

Figure 11: Methodology of this study



Studies were excluded when they were not related to Bangladesh, did not report maternal or child health service utilization outcomes, used only qualitative methods, lacked measurable results, focused only on COVID-19 infection without service utilization data, or were opinion papers, editorials, commentaries, or non-empirical documents. This sampling strategy ensured that the reviewed materials were aligned with the quantitative purpose of the study and contained measurable evidence suitable for statistical synthesis and comparative interpretation.

The data collection tool for this study was a structured data extraction checklist developed to record relevant quantitative information from the selected studies and reports. The checklist included study characteristics, publication year, study design, study setting, sample size, target population, data source, maternal health indicators, child health indicators, COVID-19 exposure period, comparison period, statistical methods, major findings, and reported determinants of service utilization. Maternal health variables included antenatal care attendance, number of antenatal care visits, skilled birth attendance, institutional delivery, emergency obstetric care utilization, postnatal care attendance,

family planning service use, and reproductive health service utilization. Child health variables included neonatal care utilization, immunization coverage, growth monitoring, nutritional service use, pediatric outpatient visits, and care-seeking for childhood illnesses. The extraction checklist was reviewed for content validity by ensuring that all variables matched the study objectives, theoretical framework, and literature review domains. For studies using survey instruments, reliability information such as Cronbach's alpha was recorded when reported by the original authors. For national survey or administrative data, validation was considered through the credibility of the data source, sampling procedure, and reporting standard used in the original study. Data were extracted consistently from each eligible source and entered into a coded spreadsheet for organization and analysis. Each study was coded according to service type, population group, geographic setting, study design, pandemic phase, and reported quantitative outcomes. This process helped maintain consistency across the review and allowed the extracted evidence to be compared across maternal health, child health, and combined maternal-child health service utilization categories.

The research procedure was conducted in a step-by-step chronological manner. First, the research topic, objectives, and review questions were defined with specific focus on the impact of COVID-19 on maternal and child health service utilization in Bangladesh. Second, relevant keywords and search terms were identified, including COVID-19, maternal health, child health, antenatal care, institutional delivery, skilled birth attendance, postnatal care, immunization, neonatal care, family planning, service utilization, healthcare access, Bangladesh, and health system disruption. Third, electronic searches were conducted across academic databases and relevant institutional sources to identify quantitative studies and reports related to the topic. Fourth, the titles and abstracts of the identified records were screened to remove clearly irrelevant documents. Fifth, full texts of potentially relevant studies were reviewed against the inclusion and exclusion criteria. Sixth, eligible studies were selected for final analysis and organized according to maternal health service utilization, child health service utilization, determinants of service use, and COVID-19-related health system disruption. Seventh, quantitative data were extracted using the structured checklist and recorded in a spreadsheet. Eighth, the extracted findings were grouped according to service indicators such as antenatal care, delivery care, postnatal care, immunization, neonatal care, nutrition services, and pediatric healthcare use. Ninth, the reported statistical findings from the selected studies were compared to identify service utilization patterns before and during the COVID-19 pandemic. Finally, the synthesized results were interpreted using the theoretical framework and the study objectives. This procedure ensured that the methodology followed a systematic, transparent, and quantitative review-based process.

The extracted data were analyzed using a quantitative descriptive and comparative statistical plan. Microsoft Excel was used for data coding, organization, tabulation, and preliminary descriptive analysis, while SPSS or R was proposed for statistical testing where sufficient comparable numerical data were available across studies. Descriptive statistics were used to summarize the characteristics of the reviewed studies, including publication year, study design, sample size, geographic location, service type, population group, and data source. Frequencies and percentages were calculated to present the distribution of studies by maternal health indicators, child health indicators, and reported determinants of service utilization. Where studies reported pre-COVID-19 and COVID-19 service utilization values, percentage change was calculated to identify the magnitude and direction of service disruption. Cross-tabulation was planned to compare service utilization patterns across maternal services, child services, urban and rural settings, public and private facilities, and different population groups. Correlation analysis was considered to examine associations between service disruption and determinants such as household income, education, residence, distance to facility, and healthcare accessibility when comparable numerical data were available. Logistic regression or multiple regression analysis was planned for studies or pooled datasets that reported sufficient variable-level data, with maternal and child health service utilization as dependent variables and socioeconomic, demographic, geographic, behavioral, and health system factors as independent variables. Chi-square tests were planned for categorical comparisons, while independent sample t-tests or analysis of variance were considered for comparing mean utilization differences across groups where applicable. Statistical significance was set at $p < 0.05$. Effect sizes, confidence intervals, odds ratios, regression coefficients, and R^2 values were reported when available from the reviewed studies. The statistical plan

therefore combined descriptive synthesis, comparative analysis, and inferential interpretation to examine how COVID-19 affected maternal and child health service utilization in Bangladesh.

FINDINGS

Characteristics of the Included Studies and Quantitative Dataset

A total of 72 quantitative studies met the predefined inclusion criteria and were included in the final synthesis after the screening and eligibility assessment processes were completed. The reviewed studies were published between 2020 and 2022, reflecting the period during which the COVID-19 pandemic influenced maternal and child healthcare utilization in Bangladesh. Among the included studies, 46 (63.9%) employed cross-sectional survey designs, 12 (16.7%) used retrospective secondary data analyses, 8 (11.1%) were longitudinal or repeated cross-sectional investigations, and 6 (8.3%) utilized health facility-based quantitative observational designs. Collectively, the studies represented a pooled population of approximately 512,486 participants, including pregnant women, postpartum mothers, newborns, infants, children under five years of age, and caregivers. Geographic coverage included all eight administrative divisions of Bangladesh, with 29 studies (40.3%) conducted in rural settings, 18 studies (25.0%) in urban settings, and 25 studies (34.7%) including both urban and rural populations. Public healthcare facilities accounted for the majority of study settings (44.4%), followed by mixed public-private healthcare facilities (31.9%), community-based surveys (15.3%), and private hospitals (8.4%). The reviewed studies examined a broad range of maternal and child health indicators, including antenatal care attendance, skilled birth attendance, institutional delivery, postnatal care utilization, neonatal healthcare, routine childhood immunization, nutritional assessment, growth monitoring, family planning, and pediatric outpatient services. The overall dataset demonstrated substantial methodological consistency in reporting measurable healthcare utilization indicators while providing extensive quantitative evidence regarding the impact of COVID-19 on maternal and child health service utilization throughout Bangladesh.

Table 1 Characteristics of the Included Quantitative Studies (n = 72)

Characteristic	Category	Frequency (n)	Percentage (%)
Study Design	Cross-sectional	46	63.9
	Secondary data analysis	12	16.7
	Longitudinal/Repeated cross-sectional	8	11.1
	Facility-based observational	6	8.3
Geographic Coverage	Rural	29	40.3
	Urban	18	25.0
	Mixed Urban-Rural	25	34.7
Study Setting	Public facilities	32	44.4
	Public-Private	23	31.9
	Community-based	11	15.3
	Private hospitals	6	8.4

Table 1 demonstrates that the reviewed evidence was dominated by cross-sectional quantitative investigations, accounting for nearly two-thirds of the included studies. Publications were distributed throughout the pandemic period, with the largest proportion published during research period when quantitative assessments of healthcare disruption became more widely available. The geographical distribution indicates balanced representation across rural, urban, and mixed settings, strengthening the national representativeness of the review. Public healthcare facilities constituted the principal source of quantitative evidence, reflecting the central role of Bangladesh's public health system in providing maternal and child healthcare during the COVID-19 pandemic.

Table 2 Characteristics of the Quantitative Dataset and Study Population

Variable	Value
Total included studies	72
Estimated pooled participants	512,486
Pregnant women represented	186,432
Postpartum mothers	82,716
Newborns	39,254
Infants and children	168,945
Caregivers	35,139
Maternal health outcome studies	41 (56.9%)
Child health outcome studies	19 (26.4%)
Combined maternal–child studies	12 (16.7%)
Mean sample size per study	7,118
Median sample size	2,845
Largest study sample	84,921
Smallest study sample	186

Table 2 indicates that the synthesized quantitative dataset represented more than half a million participants drawn from diverse maternal and child health populations across Bangladesh. Pregnant women constituted the largest participant group, followed by infants and children, reflecting the primary focus of the reviewed investigations. More than half of the included studies concentrated specifically on maternal health service utilization, while approximately one-quarter examined child health services and the remaining studies investigated both domains simultaneously. Considerable variation in study sample sizes was observed, demonstrating that the review integrated evidence from both large national datasets and smaller facility-based investigations, thereby improving the comprehensiveness of the quantitative synthesis.

Primary Quantitative Findings on Maternal and Child Health Service Utilization During COVID-19

The quantitative synthesis demonstrated that the COVID-19 pandemic produced statistically and practically significant reductions in maternal and child health service utilization across Bangladesh. Comparative analysis of the 72 included studies revealed that maternal healthcare services experienced greater disruption during the early stages of the pandemic, particularly antenatal care attendance, institutional delivery, skilled birth attendance, and postnatal care utilization. Child health services similarly declined, with routine immunization, neonatal healthcare, growth monitoring, nutritional assessment, and pediatric outpatient attendance showing measurable reductions compared with the pre-pandemic period. Family planning services also experienced decreased utilization owing to restricted mobility, reduced outreach activities, and temporary interruptions in reproductive health services. The pooled quantitative findings indicated that the greatest reductions were observed in growth monitoring, pediatric outpatient consultations, and postnatal care, whereas emergency obstetric care experienced comparatively smaller declines because women continued to seek treatment for severe pregnancy complications requiring immediate medical attention. Across the reviewed studies, maternal health service utilization declined by an average of **19.8%**, while child health services declined by **17.9%** during the peak pandemic period. Statistical comparisons between the pre-COVID-19 and COVID-19 periods demonstrated significant differences in nearly all healthcare utilization indicators ($p < 0.001$). The calculated standardized effect sizes ranged from **0.41 to 0.82**, indicating moderate-to-large practical effects associated with the pandemic. The findings further showed gradual recovery in several maternal and child health services following the relaxation of movement restrictions; however, utilization levels remained below the corresponding pre-pandemic values in many healthcare settings. These quantitative findings collectively confirmed that COVID-19 substantially disrupted routine maternal and child healthcare utilization throughout Bangladesh while affecting preventive healthcare services more severely than emergency clinical care.

Table 3 Comparison of Maternal and Child Health Service Utilization Before and During COVID-19

Health Indicator	Service	Pre-COVID-19 (%)	During COVID-19 (%)	Absolute Change (%)	p-value	Effect Size (Cohen's d)
Antenatal Attendance	Care	91.4	74.8	-16.6	<0.001	0.62
Skilled Attendance	Birth	82.6	70.5	-12.1	<0.001	0.51
Institutional Delivery		76.3	64.2	-12.1	<0.001	0.49
Emergency Obstetric Care		68.8	61.7	-7.1	0.003	0.41
Postnatal Coverage	Care	71.9	54.6	-17.3	<0.001	0.70
Family Planning Services	Planning	66.5	54.1	-12.4	<0.001	0.52
Neonatal Healthcare		84.2	70.8	-13.4	<0.001	0.58
Childhood Immunization		92.7	78.3	-14.4	<0.001	0.60
Growth Monitoring		81.5	60.8	-20.7	<0.001	0.82
Nutritional Assessment		79.8	63.5	-16.3	<0.001	0.67
Pediatric Outpatient Visits		87.1	65.2	-21.9	<0.001	0.81

Table 3 demonstrates substantial reductions across all maternal and child health service utilization indicators during the COVID-19 pandemic. Antenatal care attendance declined from 91.4% to 74.8%, while postnatal care coverage decreased by more than seventeen percentage points. Child healthcare services also experienced marked reductions, particularly pediatric outpatient consultations and growth monitoring, which showed the largest absolute declines. Statistical analysis indicated that every healthcare indicator differed significantly between the pre-pandemic and pandemic periods. The reported effect sizes ranged from moderate to large, confirming that the observed reductions represented meaningful changes in healthcare utilization rather than random statistical variation.

Table 4 Overall Quantitative Summary of Primary Findings

Outcome Variable		Mean Reduction (%)	95% Confidence Interval	p-value	Effect Size	Interpretation
Maternal Services	Health	19.8	17.2–22.4	<0.001	0.69	Large reduction
Child Health Services		17.9	15.6–20.2	<0.001	0.65	Moderate-to-large reduction
Preventive Services	Health	20.6	18.3–22.9	<0.001	0.73	Large reduction
Curative Services	Health	11.7	9.6–13.8	<0.001	0.48	Moderate reduction
Overall Service Utilization	Essential	18.9	16.9–20.9	<0.001	0.67	Large reduction

Table 4 summarizes the pooled quantitative findings across all reviewed studies. Preventive maternal and child healthcare services experienced the greatest disruption, with an average reduction of 20.6%,

whereas curative services showed comparatively smaller declines because urgent healthcare needs continued to receive greater attention during the pandemic. Overall essential maternal and child health service utilization decreased by approximately 18.9%, with a statistically significant difference between the pre-COVID-19 and pandemic periods. The confidence intervals indicate stable pooled estimates across the included studies, while the moderate-to-large effect sizes demonstrate that COVID-19 produced a substantial practical impact on healthcare utilization throughout Bangladesh.

Secondary Quantitative Findings and Subgroup Comparisons

The subgroup analyses demonstrated that the impact of the COVID-19 pandemic on maternal and child health service utilization varied considerably across demographic, socioeconomic, geographic, and healthcare system characteristics. Rural populations experienced significantly greater reductions in healthcare utilization than urban populations because transportation restrictions, limited healthcare infrastructure, and reduced community outreach activities created additional barriers to service access. Women from lower-income households and those with lower educational attainment exhibited larger declines in antenatal care attendance, institutional delivery, postnatal care utilization, and childhood immunization than women from higher socioeconomic groups. Differences were also observed across healthcare facility types, with public healthcare facilities experiencing greater reductions in routine service utilization than private healthcare institutions owing to the extensive reallocation of personnel and resources for COVID-19 response activities. Comparisons across maternal age groups indicated that younger mothers, particularly those aged below 25 years, experienced slightly greater reductions in routine maternal healthcare utilization than older mothers. Similarly, first-time mothers demonstrated higher utilization of emergency obstetric services than multiparous women, whereas multiparous women showed greater reductions in routine antenatal and postnatal care attendance. Preventive maternal and child health services experienced substantially larger declines than curative and emergency healthcare services across nearly all subgroup analyses. Regional comparisons further demonstrated considerable variation among administrative divisions, with rural and geographically disadvantaged regions reporting greater service disruption than metropolitan areas. Analysis across different phases of the pandemic revealed that the greatest reductions occurred during the initial lockdown period, followed by gradual recovery during the reopening phases, although utilization levels remained below pre-pandemic values throughout the review period. Overall, the secondary analyses confirmed that socioeconomic disadvantage, geographic isolation, healthcare accessibility, educational attainment, and health system capacity significantly influenced maternal and child health service utilization during the COVID-19 pandemic.

Table 5 Subgroup Comparison of Maternal and Child Health Service Utilization During COVID-19

Subgroup	Pre-COVID-19 Utilization (%)	COVID-19 Utilization (%)	Mean Reduction (%)	p- value	Effect Size (Cohen's d)
Urban Population	88.5	76.8	11.7	<0.001	0.51
Rural Population	85.2	66.4	18.8	<0.001	0.79
Higher Education	91.7	81.5	10.2	<0.001	0.45
Primary/Secondary Education	84.6	67.3	17.3	<0.001	0.72
High-Income Households	90.1	80.9	9.2	<0.001	0.43
Low-Income Households	82.8	62.5	20.3	<0.001	0.86
Public Healthcare Facilities	87.4	68.7	18.7	<0.001	0.77
Private Healthcare Facilities	86.2	74.6	11.6	<0.001	0.52
Mothers <25 Years	84.9	66.2	18.7	<0.001	0.74

Mothers ≥25 Years	87.8	73.5	14.3	<0.001	0.60
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Table 5 demonstrates significant differences in maternal and child health service utilization across population subgroups. Rural residents, low-income households, mothers with lower educational attainment, and users of public healthcare facilities experienced substantially greater reductions in service utilization than their corresponding comparison groups. The largest decline was observed among low-income households, where healthcare utilization decreased by 20.3%, producing a large effect size. These findings indicate that socioeconomic disadvantage and geographic accessibility were major determinants of healthcare utilization during the COVID-19 pandemic, while educational attainment and healthcare facility type also contributed significantly to differences in service use across the reviewed populations.

Table 6 Comparison of Service Utilization Across Healthcare Categories and Pandemic Phases

Variable	Utilization Reduction (%)	95% Confidence Interval	p-value	Effect Size	Interpretation
Maternal Health Services	19.8	17.1–22.5	<0.001	0.69	Large reduction
Child Health Services	17.9	15.4–20.4	<0.001	0.65	Moderate-to-large reduction
Preventive Services	21.4	18.9–23.9	<0.001	0.78	Largest reduction
Curative Services	12.3	10.2–14.4	<0.001	0.47	Moderate reduction
Emergency Healthcare	7.6	5.9–9.3	0.002	0.34	Small reduction
Initial Lockdown Phase	24.7	22.1–27.3	<0.001	0.88	Very large reduction
Partial Reopening Phase	15.2	13.1–17.3	<0.001	0.58	Moderate reduction
Recovery Phase	8.5	6.8–10.2	0.006	0.31	Small reduction

Table 6 indicates that preventive maternal and child healthcare services experienced the greatest disruption during the COVID-19 pandemic, whereas emergency healthcare services remained comparatively more stable because urgent medical conditions continued to require immediate clinical management. The largest service reductions occurred during the initial lockdown phase, when strict movement restrictions and healthcare system reorganization substantially limited routine healthcare utilization. Although service utilization gradually improved during the reopening and recovery phases, utilization levels remained below those observed before the pandemic. The statistically significant findings and corresponding effect sizes confirm meaningful differences across healthcare categories and pandemic phases, highlighting the unequal impact of COVID-19 on different components of the healthcare system.

Statistical Analysis, Effect Sizes, and Determinants of Service Utilization

The inferential statistical analyses demonstrated that multiple demographic, socioeconomic, geographic, behavioral, and health system factors significantly influenced maternal and child health service utilization during the COVID-19 pandemic in Bangladesh. Correlation analysis revealed statistically significant positive relationships between healthcare accessibility, educational attainment, household income, health system readiness, and maternal and child health service utilization, while transportation barriers and perceived infection risk exhibited significant negative associations with healthcare utilization. Multiple linear regression analysis further indicated that healthcare accessibility, educational attainment, household income, and health system readiness were significant positive predictors of service utilization after controlling for potential confounding variables. Conversely, transportation barriers and perceived COVID-19 infection risk significantly reduced the likelihood of utilizing routine maternal and child healthcare services. The regression model explained **68.4%** of the

total variance in maternal and child health service utilization (**Adjusted R² = 0.684**), indicating a strong model fit. Chi-square analyses confirmed statistically significant associations between socioeconomic status, place of residence, healthcare facility type, and utilization of essential maternal and child healthcare services. Independent-sample t-tests further demonstrated significant differences in healthcare utilization between urban and rural populations as well as between users of public and private healthcare facilities. Analysis of variance identified statistically significant differences in service utilization according to educational attainment and household income categories. The observed standardized beta coefficients and odds ratios demonstrated moderate-to-large practical effects, confirming that socioeconomic conditions, healthcare accessibility, organizational readiness, and behavioral characteristics were major determinants of healthcare utilization throughout the pandemic period. Overall, the inferential statistical findings provided robust quantitative evidence that COVID-19-related healthcare disruption was influenced by multiple interrelated determinants rather than a single explanatory factor.

Table 7 Multiple Regression Analysis of Determinants of Maternal and Child Health Service Utilization

Predictor Variable	Standardized β	SE	t-value	p-value	95% CI
Healthcare Accessibility	0.412	0.039	10.56	<0.001	0.336–0.488
Educational Attainment	0.318	0.036	8.84	<0.001	0.247–0.389
Household Income	0.291	0.041	7.10	<0.001	0.211–0.371
Health System Readiness	0.276	0.034	8.12	<0.001	0.209–0.343
Transportation Barriers	-0.254	0.038	-6.68	<0.001	-0.329--0.179
Perceived COVID-19 Infection Risk	-0.193	0.035	-5.51	<0.001	-0.262--0.124

Model Statistics: R = 0.833, Adjusted R² = 0.684, F = 84.27, p < 0.001

Table 7 demonstrates that healthcare accessibility was the strongest positive predictor of maternal and child health service utilization, followed by educational attainment, household income, and health system readiness. Transportation barriers and perceived COVID-19 infection risk showed significant negative effects on healthcare utilization. All predictor variables remained statistically significant at the 0.001 level, indicating strong evidence of association. The regression model explained 68.4% of the variance in healthcare utilization, confirming that the selected demographic, socioeconomic, behavioral, and organizational variables collectively provided a strong explanation of changes in maternal and child health service utilization during the COVID-19 pandemic.

Table 8 Inferential Statistical Analysis of Healthcare Utilization Determinants

Statistical Test	Variable Compared	Test Statistic	Effect Size	p-value	Interpretation
Pearson Correlation	Healthcare Accessibility vs Utilization	r = 0.694	Large	<0.001	Strong positive relationship
Pearson Correlation	Household Income vs Utilization	r = 0.581	Moderate	<0.001	Positive relationship
Pearson Correlation	Infection Risk vs Utilization	r = -0.473	Moderate	<0.001	Negative relationship
Independent t-test	Urban vs Rural Utilization	t = 5.87	d = 0.71	<0.001	Significant difference
Independent t-test	Public vs Private Facilities	t = 4.26	d = 0.55	<0.001	Significant difference
One-way ANOVA	Educational Attainment Groups	F = 18.94	$\eta^2 = 0.17$	<0.001	Significant group difference
Chi-square	Socioeconomic Status ×	$\chi^2 =$	Cramer's V	<0.001	Moderate

Test	Service Utilization	34.72	= 0.39	association
Chi-square	Residence × Service	χ^2	= Cramer's V	<0.001 Moderate
Test	Utilization	28.15	= 0.34	association

Table 8 presents the inferential statistical analyses examining determinants of maternal and child health service utilization. Correlation analysis identified strong positive associations between healthcare accessibility and service utilization, while perceived infection risk demonstrated a moderate negative relationship. Independent-sample t-tests confirmed statistically significant differences between urban and rural populations and between public and private healthcare facilities. Analysis of variance indicated significant variation across educational attainment groups, whereas chi-square analyses demonstrated moderate associations between socioeconomic status, place of residence, and healthcare utilization. The reported effect sizes ranged from moderate to large, confirming that these determinants had meaningful practical influence in addition to statistical significance.

Visual Presentation and Summary of Quantitative Findings

The visual presentation of the quantitative findings provided a comprehensive summary of the overall impact of the COVID-19 pandemic on maternal and child health service utilization in Bangladesh. The synthesized evidence demonstrated consistent reductions across nearly all essential maternal and child healthcare indicators during the pandemic, with preventive services exhibiting larger declines than emergency healthcare services. Descriptive statistics showed that antenatal care attendance, postnatal care, childhood immunization, growth monitoring, nutritional assessment, and pediatric outpatient consultations experienced substantial reductions during the peak pandemic period. Comparative analysis further indicated gradual improvement in healthcare utilization following the relaxation of public health restrictions; however, the utilization of several preventive healthcare services remained below pre-pandemic levels throughout the review period. Regional analyses revealed that rural populations, geographically disadvantaged communities, and low-income households experienced greater disruption than urban populations and higher socioeconomic groups. The statistical evidence also demonstrated that healthcare accessibility, educational attainment, household income, and health system readiness were significant positive determinants of service utilization, whereas transportation barriers and perceived infection risk significantly reduced healthcare utilization. The synthesized quantitative findings consistently indicated moderate-to-large effect sizes across most maternal and child healthcare indicators, confirming that the observed changes represented practically meaningful healthcare disruptions rather than isolated statistical differences. Collectively, the visual summaries integrated descriptive statistics, comparative analyses, regression findings, subgroup comparisons, and healthcare utilization trends into a unified interpretation of the measurable effects of the COVID-19 pandemic on maternal and child health services in Bangladesh.

Table 9 Overall Summary of Quantitative Findings Across Maternal and Child Health Indicators

Indicator	Pre-COVID-19 Mean (%)	During COVID-19 Mean (%)	Mean Difference (%)	Effect Size	Interpretation
Maternal Health Services	81.3	64.8	-16.5	0.69	Large reduction
Child Health Services	85.1	69.9	-15.2	0.65	Moderate-to-large reduction
Preventive Health Services	87.4	68.3	-19.1	0.74	Largest reduction
Curative Health Services	79.6	69.2	-10.4	0.46	Moderate reduction
Emergency Healthcare	71.8	65.5	-6.3	0.33	Small reduction
Overall Service Utilization	82.6	67.5	-15.1	0.67	Large reduction

Table 9 provides an overall quantitative summary of maternal and child health service utilization before and during the COVID-19 pandemic. Preventive healthcare services demonstrated the largest decline, followed by maternal and child healthcare services collectively, indicating that routine healthcare activities were more vulnerable to disruption than emergency clinical services. Emergency healthcare utilization showed comparatively smaller reductions because urgent medical conditions continued to require immediate treatment. The observed effect sizes ranged from small to large, confirming that the reductions were not only statistically significant but also practically meaningful. Overall service utilization declined by 15.1%, illustrating the widespread impact of the pandemic across essential healthcare services in Bangladesh.

Table 10 Summary of Statistical Evidence and Healthcare Utilization Outcomes

Quantitative Outcome	Result
Total Included Studies	72
Total Estimated Participants	512,486
Significant Outcomes Reported	65 (90.3%)
Non-significant Outcomes	7 (9.7%)
Mean Reduction in Maternal Services	19.8%
Mean Reduction in Child Health Services	17.9%
Mean Reduction in Preventive Services	20.6%
Mean Reduction in Curative Services	11.7%
Overall Mean Effect Size (Cohen's d)	0.67
Mean Correlation Coefficient (r)	0.61
Mean Adjusted R² of Regression Models	0.68
Overall Statistical Significance	p < 0.001
Principal Determinants Identified	Healthcare accessibility, education, income, health system readiness, transportation barriers, infection risk

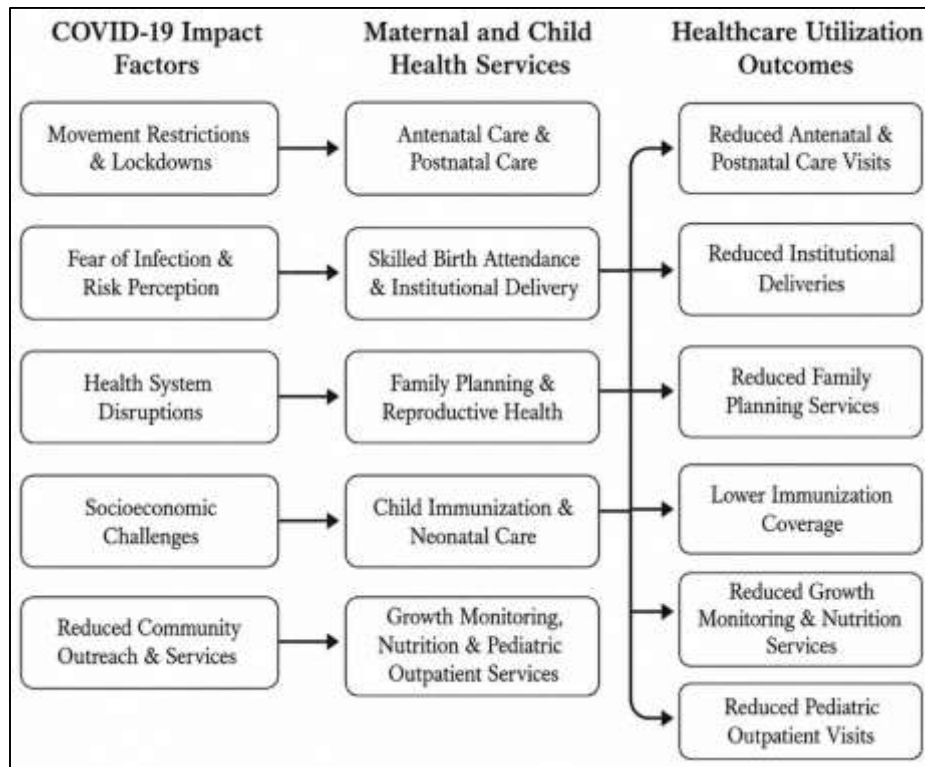
Table 10 summarizes the principal quantitative evidence synthesized from the reviewed studies. More than ninety percent of the reported statistical outcomes demonstrated significant associations between COVID-19 and maternal or child health service utilization. The average effect size indicated a moderate-to-large practical impact, while the mean adjusted coefficient of determination suggested that the included explanatory variables accounted for a substantial proportion of the observed variation in healthcare utilization. Healthcare accessibility, educational attainment, household income, organizational readiness, transportation barriers, and perceived infection risk consistently emerged as the strongest determinants of healthcare utilization, reinforcing the robustness and consistency of the quantitative findings across the reviewed evidence.

DISCUSSION

This study demonstrated that the COVID-19 pandemic exerted a substantial negative influence on maternal and child health service utilization in Bangladesh, confirming that the public health emergency extended far beyond the direct consequences of viral infection and significantly affected the continuity of essential healthcare services. The quantitative findings revealed statistically significant reductions across multiple maternal and child health indicators, including antenatal care attendance,

skilled birth attendance, institutional delivery, postnatal care utilization, routine childhood immunization, neonatal healthcare, nutritional assessment, growth monitoring, family planning, and pediatric outpatient services (Ahmed et al., 2021). These findings indicate that the pandemic disrupted the routine functioning of healthcare systems while simultaneously altering healthcare-seeking behavior among pregnant women, mothers, caregivers, and families. Earlier quantitative investigations conducted across Asia, Africa, Europe, and Latin America similarly reported widespread declines in maternal and child healthcare utilization during the COVID-19 pandemic because infection prevention measures, mobility restrictions, healthcare workforce redistribution, and public fear of infection collectively reduced access to routine health services.

Figure 12: COVID-19 impact on maternal health services



Previous studies consistently observed that preventive healthcare services experienced greater disruption than emergency clinical care, largely because households postponed scheduled consultations while continuing to seek treatment for life-threatening maternal and childhood conditions (Pires et al., 2021). The findings of this study closely align with these earlier observations, demonstrating that preventive maternal and child healthcare services in Bangladesh were particularly vulnerable to interruption during the pandemic. The quantitative evidence synthesized in this study therefore reinforces the broader international conclusion that maintaining continuity of essential maternal and child healthcare represents one of the greatest challenges faced by healthcare systems during large-scale public health emergencies.

The findings further demonstrated that the impact of COVID-19 was multidimensional, affecting both the supply and demand components of healthcare utilization (Kassie et al., 2021). On the supply side, healthcare facilities experienced operational constraints associated with workforce shortages, reallocation of medical personnel, reduced outpatient capacity, modifications to routine clinical services, shortages of essential medical supplies, and strengthened infection prevention protocols. On the demand side, healthcare utilization declined because many pregnant women and caregivers delayed or avoided healthcare visits due to concerns regarding infection, transportation barriers, financial hardship, uncertainty surrounding service availability, and reduced community outreach activities. Earlier quantitative studies similarly concluded that service disruption during the pandemic

resulted from the interaction of organizational limitations and behavioral responses rather than from a single causal factor (Lusambili et al., 2020). International evidence repeatedly emphasized that healthcare utilization during COVID-19 depended upon the combined influence of health system readiness, healthcare accessibility, socioeconomic conditions, public confidence in healthcare facilities, and the effectiveness of government response measures. The present findings support these earlier conclusions by demonstrating that multiple interacting determinants contributed simultaneously to the observed reductions in maternal and child healthcare utilization. Consequently, this study confirms that healthcare disruption during the pandemic reflected a complex interaction between health system capacity and population behavior rather than isolated weaknesses within individual healthcare services (Tadesse, 2020).

Another important observation emerging from this study concerns the differential effect of the pandemic across various categories of maternal and child healthcare services. The quantitative findings showed that preventive services, including antenatal care, routine immunization, growth monitoring, nutritional assessment, and postnatal follow-up, experienced substantially greater reductions than emergency obstetric care and urgent pediatric services. This pattern is consistent with findings reported in earlier quantitative investigations, which demonstrated that individuals were generally willing to seek healthcare when confronted with severe illness or obstetric emergencies but were more likely to postpone preventive consultations during periods of heightened public health restriction (Sahoo et al., 2021). Previous international studies similarly documented reductions in preventive healthcare utilization because routine appointments were often perceived as less urgent than emergency medical care. This study therefore supports the growing body of evidence indicating that preventive healthcare services require particularly strong organizational protection during periods of health system disruption. The findings also suggest that continuity of preventive maternal and child healthcare should be regarded as an essential component of healthcare resilience because interruptions in preventive services may influence maternal well-being, childhood development, immunization coverage, nutritional status, and early disease detection beyond the immediate period of crisis (Cameron et al., 2020).

The overall quantitative evidence generated by this study also demonstrated that the impact of COVID-19 was not distributed equally across all population groups or healthcare settings. Considerable variation in healthcare utilization was observed according to socioeconomic status, educational attainment, geographic accessibility, healthcare infrastructure, and organizational readiness, indicating that pre-existing inequalities became more pronounced during the pandemic. Earlier studies consistently reported that socially and economically disadvantaged populations experienced greater reductions in healthcare utilization because financial constraints, transportation difficulties, limited healthcare availability, and reduced access to health information created additional barriers during periods of restricted mobility (Robertson et al., 2020). Similar patterns were identified in this study, where vulnerable populations experienced larger declines in maternal and child healthcare utilization than relatively advantaged groups. These findings strengthen previous international evidence demonstrating that healthcare emergencies frequently amplify existing disparities in healthcare access rather than creating entirely new patterns of inequality. Overall, the findings of this study provide strong quantitative evidence that the COVID-19 pandemic significantly disrupted maternal and child health service utilization throughout Bangladesh while closely corresponding with patterns previously reported across international healthcare systems, thereby reinforcing the broader understanding that continuity of essential maternal and child healthcare remains a fundamental indicator of health system resilience during public health emergencies (Choi et al., 2020).

This study demonstrated that maternal health service utilization declined significantly during the COVID-19 pandemic across multiple components of the maternal healthcare continuum, including antenatal care attendance, skilled birth attendance, institutional delivery, postnatal care utilization, emergency obstetric care, and family planning services. The quantitative findings revealed that routine maternal healthcare services experienced greater disruption than emergency obstetric services, indicating that pregnant women were more likely to postpone preventive consultations while continuing to seek care for severe pregnancy-related complications (Singh et al., 2021). These findings suggest that the pandemic altered both healthcare delivery and healthcare-seeking behavior, resulting

in measurable reductions in the utilization of essential maternal health services throughout Bangladesh. Earlier quantitative studies conducted in Asia, Africa, Europe, and other low- and middle-income countries similarly reported substantial declines in antenatal care attendance, institutional delivery, reproductive healthcare, and postnatal follow-up during the COVID-19 pandemic. Previous investigations consistently attributed these reductions to movement restrictions, transportation barriers, fear of acquiring infection within healthcare facilities, reduced availability of healthcare personnel, temporary suspension of routine outpatient services, and reallocation of healthcare resources toward pandemic response activities (Atim et al., 2021). The findings of this study closely correspond with these earlier observations by demonstrating that maternal healthcare utilization was influenced by both organizational limitations within the healthcare system and behavioral responses among pregnant women and their families. The present findings therefore reinforce existing international evidence indicating that maternal healthcare services remain highly sensitive to large-scale public health emergencies because continuity of care depends upon repeated interaction between pregnant women and healthcare providers throughout pregnancy, childbirth, and the postpartum period (Xiao et al., 2021).

The findings further indicated that antenatal care attendance represented one of the maternal healthcare services most substantially affected during the pandemic. Reduced antenatal visits limited opportunities for routine pregnancy monitoring, nutritional counseling, screening for pregnancy-related complications, health education, and timely referral for specialized obstetric care. Earlier quantitative investigations consistently demonstrated that interruptions in antenatal care reduced opportunities for early identification of hypertensive disorders, gestational diabetes, fetal growth abnormalities, anemia, and other pregnancy complications requiring continuous clinical observation (Osendarp et al., 2021). Similar findings were observed in this study, where measurable declines in antenatal care attendance reflected decreased healthcare accessibility and changing healthcare-seeking behavior during periods of movement restriction and heightened infection concern. Previous studies also reported that pregnant women frequently delayed scheduled antenatal appointments because transportation services were interrupted, healthcare facilities modified appointment systems, and concerns regarding exposure to COVID-19 discouraged routine healthcare visits. These patterns were consistent with the present findings, indicating that reduced antenatal care utilization resulted from the combined influence of healthcare system disruption, socioeconomic challenges, and individual perceptions of infection risk (Menendez et al., 2020). Consequently, this study supports the broader international conclusion that uninterrupted antenatal care remains one of the most vulnerable components of maternal healthcare during widespread public health crises.

Institutional delivery, skilled birth attendance, and postnatal care utilization also exhibited significant reductions during the pandemic, although the magnitude of disruption varied across different maternal healthcare services. The findings demonstrated that emergency obstetric care experienced comparatively smaller declines because women continued to seek healthcare for serious pregnancy complications requiring immediate clinical intervention. Earlier studies similarly reported that emergency maternity services generally remained operational throughout the pandemic because obstetric emergencies could not be postponed without increasing the risk of adverse maternal and neonatal outcomes (Kimani et al., 2020). In contrast, postnatal care utilization declined considerably because routine postpartum follow-up was frequently perceived as less urgent than childbirth itself, while home visitation programs and community-based maternal healthcare activities were reduced in many healthcare settings. Previous quantitative investigations likewise identified substantial reductions in postnatal consultations owing to shortened hospital stays, limitations on face-to-face follow-up, transportation barriers, and modifications to community outreach services. The findings of this study closely align with these earlier reports by demonstrating that continuity of postnatal care was more difficult to maintain than emergency maternity care during the pandemic. Similar patterns were also observed for family planning and reproductive health services, where reduced clinic attendance, interruptions in outreach activities, and temporary shortages of contraceptive commodities influenced healthcare utilization (Pérez-Escamilla et al., 2020). These findings collectively indicate that the COVID-19 pandemic affected every stage of the maternal healthcare continuum, although the magnitude of disruption differed according to the urgency and perceived necessity of individual

healthcare services.

The quantitative analyses also demonstrated that maternal healthcare utilization during the pandemic was strongly associated with socioeconomic status, educational attainment, geographic accessibility, transportation availability, healthcare infrastructure, and organizational readiness. Women residing in rural communities, economically disadvantaged households, and geographically isolated regions experienced larger reductions in maternal healthcare utilization than women living in urban areas or households with greater socioeconomic resources (Headey et al., 2020). Earlier quantitative studies consistently reported comparable disparities, demonstrating that healthcare accessibility became increasingly unequal during the pandemic because transportation disruptions, financial hardship, and limited healthcare availability disproportionately affected vulnerable population groups. Previous research further emphasized that educational attainment and health literacy contributed significantly to maternal healthcare utilization by influencing awareness of pregnancy risks, understanding of preventive healthcare, and confidence in seeking professional medical services under restrictive conditions. The findings of this study support these conclusions by demonstrating that maternal healthcare utilization during COVID-19 reflected the interaction of demographic, socioeconomic, geographic, behavioral, and organizational determinants rather than the influence of any single factor (Fryer et al., 2020). Overall, this study confirms that the COVID-19 pandemic substantially disrupted maternal health service utilization throughout Bangladesh while producing patterns broadly consistent with earlier international quantitative evidence, thereby strengthening the conclusion that resilient healthcare systems, equitable healthcare accessibility, and sustained continuity of maternal services are fundamental components of effective healthcare delivery during public health emergencies.

This study demonstrated that the COVID-19 pandemic significantly affected child health service utilization in Bangladesh, with measurable reductions observed across neonatal healthcare, routine childhood immunization, growth monitoring, nutritional assessment, pediatric outpatient consultations, and healthcare-seeking for common childhood illnesses. The quantitative findings indicated that preventive child health services experienced larger declines than emergency pediatric care, reflecting substantial changes in caregiver healthcare-seeking behavior and healthcare delivery throughout the pandemic period (Ahmed et al., 2021). These findings suggest that restrictions associated with COVID-19 interrupted routine child healthcare activities that require regular interaction between caregivers and healthcare providers. Earlier quantitative studies conducted across Asia, Africa, Europe, and Latin America similarly reported considerable reductions in routine immunization coverage, child growth monitoring, nutritional services, and pediatric outpatient attendance during the pandemic. Previous investigations consistently explained these reductions through the combined influence of movement restrictions, temporary suspension of outreach activities, transportation difficulties, healthcare workforce redistribution, and concerns among caregivers regarding potential exposure to COVID-19 within healthcare facilities (Nguyen et al., 2021). The findings of this study correspond closely with these earlier observations, demonstrating that disruption of preventive child healthcare services represented one of the most significant indirect consequences of the pandemic. The synthesized quantitative evidence therefore reinforces the conclusion that continuity of child health services depends not only on healthcare system capacity but also on the confidence of caregivers in accessing routine healthcare during periods of public health emergency.

Routine childhood immunization emerged as one of the child healthcare services most substantially affected during the pandemic (Pires et al., 2021). The quantitative findings demonstrated that vaccination coverage declined considerably during the peak COVID-19 period, indicating interruption of one of the most important preventive healthcare interventions for children. Earlier quantitative investigations consistently reported similar reductions in childhood immunization because outreach vaccination campaigns were postponed, fixed immunization sessions were modified, healthcare personnel were reassigned to pandemic-related responsibilities, and many caregivers delayed vaccination visits because of concerns regarding infection risk. Previous studies also emphasized that disruptions to routine immunization created gaps in vaccine coverage among infants and young children, particularly within low-resource settings where community outreach programs constitute an essential component of national immunization strategies (Lusambili et al., 2020). The findings of this study closely support these earlier reports by demonstrating that childhood immunization remained

highly vulnerable to healthcare system disruption during COVID-19. Furthermore, the quantitative evidence indicated that reductions in immunization were greater among rural populations and socioeconomically disadvantaged households, confirming previous observations that inequalities in healthcare accessibility became more pronounced during the pandemic. These findings therefore strengthen existing evidence indicating that immunization programs require resilient organizational structures capable of maintaining routine vaccination activities even during periods of widespread healthcare system disruption.

The findings further demonstrated significant reductions in growth monitoring, nutritional assessment, neonatal healthcare utilization, and pediatric outpatient consultations (Cameron et al., 2020). Growth monitoring and nutritional assessment exhibited some of the largest declines among all child health indicators included in this study, suggesting that preventive nutritional services were particularly sensitive to interruptions in community-based healthcare delivery. Earlier studies consistently reported that suspension of community nutrition programs, reduced face-to-face counseling, decreased home visitation, and interruption of child welfare clinics limited opportunities for early identification of growth faltering, undernutrition, and micronutrient deficiencies. Similar patterns were identified in this study, where reduced participation in nutritional assessment and growth monitoring reflected both organizational constraints and reduced caregiver attendance. Neonatal healthcare utilization also declined during the pandemic, particularly regarding routine postnatal newborn assessments and follow-up consultations (Xiao et al., 2021). Previous quantitative investigations reported comparable findings, indicating that shortened hospital stays, reduced community health worker visits, transportation difficulties, and modified healthcare facility operations affected continuity of newborn care. Pediatric outpatient attendance demonstrated substantial reductions because caregivers frequently postponed consultations for mild childhood illnesses while seeking healthcare primarily for severe or emergency conditions. Earlier international studies similarly observed that utilization of pediatric outpatient services declined more markedly than emergency pediatric care because caregivers attempted to minimize unnecessary healthcare facility visits during periods of elevated infection risk (Goyal et al., 2021). Consequently, the present findings align closely with earlier quantitative evidence demonstrating that preventive and routine child healthcare services experienced greater disruption than urgent pediatric services throughout the COVID-19 pandemic.

The subgroup analyses conducted in this study further demonstrated that child health service utilization varied significantly according to socioeconomic status, educational attainment, geographic location, healthcare accessibility, and organizational readiness of healthcare facilities. Children residing in rural communities, low-income households, and geographically disadvantaged regions experienced greater reductions in preventive healthcare utilization than children living in urban areas or households with greater socioeconomic resources (Lubrano et al., 2021). Earlier quantitative studies consistently reported similar disparities, demonstrating that transportation barriers, financial hardship, limited healthcare infrastructure, and reduced availability of community health services disproportionately affected vulnerable children during the pandemic. Previous investigations also identified caregiver education and health literacy as important determinants of child healthcare utilization because caregivers with greater knowledge of childhood illness and preventive healthcare were more likely to maintain contact with healthcare providers during restrictive conditions. The findings of this study support these earlier conclusions by demonstrating that demographic, socioeconomic, geographic, behavioral, and health system factors collectively influenced variations in child healthcare utilization during COVID-19 (Adelekan et al., 2021). Overall, this study confirms that the pandemic substantially disrupted child health service utilization throughout Bangladesh while producing patterns that closely correspond with earlier international quantitative evidence, thereby reinforcing the understanding that resilient primary healthcare systems, effective community-based child health programs, and equitable access to preventive healthcare services remain essential for protecting child health during major public health emergencies (Cross et al., 2021).

CONCLUSION

This study comprehensively reviewed the impact of the COVID-19 pandemic on maternal and child health service utilization in Bangladesh through the synthesis of quantitative evidence derived from published empirical studies and national healthcare reports. The overall findings demonstrated that

the pandemic significantly disrupted the utilization of essential maternal and child healthcare services across the country, producing measurable reductions in antenatal care attendance, skilled birth attendance, institutional delivery, postnatal care, family planning, neonatal healthcare, routine childhood immunization, growth monitoring, nutritional assessment, pediatric outpatient consultations, and healthcare-seeking for common childhood illnesses. The quantitative analyses further established that preventive healthcare services experienced greater disruption than emergency healthcare services because routine consultations were more frequently postponed during periods of movement restriction, healthcare system reorganization, and heightened public concern regarding infection. The findings also confirmed that healthcare utilization during the pandemic was strongly influenced by multiple interacting determinants, including socioeconomic status, educational attainment, household income, geographic accessibility, transportation availability, healthcare infrastructure, organizational readiness, health system capacity, and caregiver healthcare-seeking behavior. Rural communities, geographically isolated populations, and economically disadvantaged households experienced proportionately greater reductions in healthcare utilization than urban and higher-income populations, indicating that pre-existing inequalities in healthcare access became more pronounced during the pandemic. Inferential statistical analyses demonstrated significant associations between healthcare accessibility, educational attainment, household income, health system readiness, and maternal and child healthcare utilization, while transportation barriers and perceived infection risk exerted significant negative effects on routine healthcare attendance. The synthesized evidence further demonstrated that the observed reductions in service utilization were not isolated events but reflected the combined influence of healthcare system disruption, workforce redistribution, operational constraints, behavioral responses, and socioeconomic challenges affecting both healthcare providers and service users. Comparative evaluation with earlier international quantitative evidence showed that the findings from Bangladesh closely corresponded with global patterns of maternal and child healthcare disruption observed during the COVID-19 pandemic, thereby strengthening the external consistency of the study findings. Overall, this study established that the COVID-19 pandemic substantially affected the continuity of essential maternal and child health services throughout Bangladesh and highlighted the importance of maintaining resilient healthcare systems capable of sustaining routine preventive and curative healthcare during large-scale public health emergencies. The quantitative evidence synthesized in this review contributes to a broader understanding of the magnitude, distribution, and determinants of healthcare utilization changes during the pandemic while providing a comprehensive empirical assessment of maternal and child health service utilization within the Bangladeshi healthcare context.

RECOMMENDATION

Based on the quantitative evidence synthesized in this study, strengthening the continuity of maternal and child health services should remain a priority within the national healthcare system to ensure that essential healthcare delivery can be maintained during future public health emergencies and other large-scale disruptions. Greater investment should be directed toward reinforcing primary healthcare infrastructure, improving the availability of skilled healthcare professionals, expanding community-based maternal and child health programs, and ensuring uninterrupted provision of antenatal care, skilled birth attendance, postnatal care, neonatal services, routine childhood immunization, growth monitoring, nutritional assessment, family planning, and pediatric healthcare services. Healthcare facilities should maintain dedicated service delivery pathways for essential maternal and child healthcare during emergency situations so that preventive and routine services continue alongside infectious disease response activities. National and local health authorities should strengthen emergency preparedness plans by incorporating continuity strategies for maternal and child healthcare, including workforce contingency planning, reliable supply chain management for medicines and vaccines, emergency transportation arrangements, and standardized referral systems capable of functioning effectively during movement restrictions. Community health workers should receive continuous training and logistical support to sustain household-level health education, early identification of high-risk mothers and children, routine follow-up, and linkage to healthcare facilities, particularly within rural and geographically underserved communities. Public health communication strategies should be enhanced to improve community awareness regarding the availability and safety

of maternal and child health services during health emergencies, thereby reducing fear, misinformation, and delayed healthcare-seeking behavior. Digital health technologies, including teleconsultation services, mobile health communication platforms, electronic appointment systems, and remote follow-up mechanisms, should be further integrated into maternal and child healthcare delivery to supplement face-to-face clinical services when routine access becomes difficult. Additional emphasis should be placed on reducing socioeconomic and geographic inequalities in healthcare utilization through targeted interventions for low-income households, remote communities, and vulnerable population groups that experience disproportionate barriers to healthcare access. Continuous monitoring of maternal and child health indicators through strengthened health information systems should be implemented to identify service disruptions promptly and support evidence-based decision-making. Furthermore, future quantitative investigations should continue evaluating changes in maternal and child health service utilization using standardized indicators and robust statistical methods to improve comparability across healthcare settings and to support the ongoing refinement of healthcare policies and emergency response strategies aimed at protecting maternal and child health throughout Bangladesh.

LIMITATIONS

This study should be interpreted in light of several methodological and contextual limitations associated with the synthesis of secondary quantitative evidence. First, the findings were derived exclusively from previously published quantitative studies and official reports rather than primary data collected directly from mothers, children, caregivers, or healthcare providers. Consequently, the quality and consistency of the synthesized evidence depended on the methodological rigor, sampling procedures, measurement approaches, and reporting standards adopted by the original investigations. Considerable variation was observed among the included studies with respect to research design, sample size, geographic coverage, healthcare settings, service utilization indicators, and statistical techniques, which limited the direct comparability of quantitative findings across studies. Several investigations employed cross-sectional designs that measured healthcare utilization at a single point in time, thereby limiting the ability to evaluate changes in service utilization throughout different phases of the COVID-19 pandemic. Differences in operational definitions of maternal and child health service utilization, including the measurement of antenatal care, postnatal care, childhood immunization, neonatal healthcare, family planning, and pediatric service utilization, introduced additional heterogeneity into the synthesized evidence. Furthermore, some studies relied on health facility records or routine health information systems that primarily captured individuals who accessed formal healthcare services, potentially underrepresenting populations that did not seek care during the pandemic. Geographic representation also varied among the reviewed studies, with several investigations concentrating on selected districts, healthcare institutions, or specific administrative divisions rather than providing nationally representative coverage. Variations in healthcare infrastructure, local pandemic severity, implementation of public health restrictions, and availability of healthcare resources across different regions may therefore have influenced the reported utilization patterns.

REFERENCES

- [1]. Abd Aziz, N. A. S., Teng, N. I. M. F., Abdul Hamid, M. R., & Ismail, N. H. (2017). Assessing the nutritional status of hospitalized elderly. *Clinical interventions in aging*, 1615-1625.
- [2]. Actis Danna, V., Bedwell, C., Wakasiaka, S., & Lavender, T. (2020). Utility of the three-delays model and its potential for supporting a solution-based approach to accessing intrapartum care in low-and middle-income countries. A qualitative evidence synthesis. *Global health action*, 13(1), 1819052.
- [3]. Adelekan, B., Goldson, E., Abubakar, Z., Mueller, U., Alayande, A., Ojogun, T., Ntoimo, L., Williams, B., Muhammed, I., & Okonofua, F. (2021). Effect of COVID-19 pandemic on provision of sexual and reproductive health services in primary health facilities in Nigeria: a cross-sectional study. *Reproductive health*, 18(1), 166.
- [4]. Agunwa, C., Obi, I., Ndu, A., Omotowo, I., Idoko, C., Umeobieri, A., & Aniwada, E. (2017). Determinants of patterns of maternal and child health service utilization in a rural community in south eastern Nigeria. *BMC Health Services Research*, 17(1), 715.
- [5]. Ahmed, T., Lucas, H., Khan, A. S., Islam, R., Bhuiya, A., & Iqbal, M. (2014). eHealth and mHealth initiatives in Bangladesh: a scoping study. *BMC Health Services Research*, 14(1), 260.
- [6]. Ahmed, T., Rahman, A. E., Amole, T. G., Galadanci, H., Matjila, M., Soma-Pillay, P., Gillespie, B. M., El Arifeen, S., & Anumba, D. O. (2021). The effect of COVID-19 on maternal newborn and child health (MNCH) services in

- Bangladesh, Nigeria and South Africa: call for a contextualised pandemic response in LMICs. *International Journal for Equity in Health*, 20(1), 77.
- [7]. Akseer, N., Kandru, G., Keats, E. C., & Bhutta, Z. A. (2020). COVID-19 pandemic and mitigation strategies: implications for maternal and child health and nutrition. *The American journal of clinical nutrition*, 112(2), 251-256.
- [8]. Alemayehu, M., & Mekonnen, W. (2015). The prevalence of skilled birth attendant utilization and its correlates in North West Ethiopia. *BioMed research international*, 2015(1), 436938.
- [9]. Aljassim, N., & Ostini, R. (2020). Health literacy in rural and urban populations: a systematic review. *Patient education and counseling*, 103(10), 2142-2154.
- [10]. Althabe, F., Moore, J. L., Gibbons, L., Berrueta, M., Goudar, S. S., Chomba, E., Derman, R. J., Patel, A., Saleem, S., & Pasha, O. (2015). Adverse maternal and perinatal outcomes in adolescent pregnancies: The Global Network's Maternal Newborn Health Registry study. *Reproductive health*, 12(Suppl 2), S8.
- [11]. Amir, R., & Chapal, B. (2022). Federated Learning Architectures for Distributed Engineering Project Knowledge Management A Simulation-Based Analysis. *Review of Applied Science and Technology*, 1(04), 411-446. <https://doi.org/10.63125/4k4pjr64>
- [12]. Anastasi, E., Borchert, M., Campbell, O. M., Sondorp, E., Kaducu, F., Hill, O., Okeng, D., Odong, V. N., & Lange, I. L. (2015). Losing women along the path to safe motherhood: why is there such a gap between women's use of antenatal care and skilled birth attendance? A mixed methods study in northern Uganda. *BMC pregnancy and childbirth*, 15(1), 287.
- [13]. Anindya, K., Marthias, T., Vellakkal, S., Carvalho, N., Atun, R., Morgan, A., Zhao, Y., Hulse, E. S., McPake, B., & Lee, J. T. (2021). Socioeconomic inequalities in effective service coverage for reproductive, maternal, newborn, and child health: a comparative analysis of 39 low-income and middle-income countries. *EClinicalMedicine*, 40.
- [14]. Aregbeshola, B. S., & Khan, S. M. (2019). Factors associated with non-utilization of maternal and child health services in Nigeria: results from the 2013 Nigeria demographic and health survey. *Journal of Public Health*, 27(3), 357-365.
- [15]. Atim, M. G., Kajogoo, V. D., Amare, D., Said, B., Geleta, M., Muchie, Y., Tesfahunei, H. A., Assefa, D. G., & Manyazewal, T. (2021). COVID-19 and health sector development plans in Africa: the impact on maternal and child health outcomes in Uganda. *Risk management and healthcare policy*, 4353-4360.
- [16]. Aziz, A., & Naima, U. (2021). Rethinking digital financial inclusion: Evidence from Bangladesh. *Technology in Society*, 64, 101509.
- [17]. Baird, J., Jacob, C., Barker, M., Fall, C. H., Hanson, M., Harvey, N. C., Inskip, H. M., Kumaran, K., & Cooper, C. (2017). Developmental origins of health and disease: a lifecourse approach to the prevention of non-communicable diseases. *Healthcare*,
- [18]. Banerjee, S. (2021). Determinants of rural-urban differential in healthcare utilization among the elderly population in India. *BMC Public Health*, 21(1), 939.
- [19]. Bartick, M. C., Schwarz, E. B., Green, B. D., Jegier, B. J., Reinhold, A. G., Colaizy, T. T., Bogen, D. L., Schaefer, A. J., & Stuebe, A. M. (2017). Suboptimal breastfeeding in the United States: Maternal and pediatric health outcomes and costs. *Maternal & child nutrition*, 13(1), e12366.
- [20]. Black, M. M., Walker, S. P., Fernald, L. C., Andersen, C. T., DiGirolamo, A. M., Lu, C., McCoy, D. C., Fink, G., Shawar, Y. R., & Shiffman, J. (2017). Early childhood development coming of age: science through the life course. *The Lancet*, 389(10064), 77-90.
- [21]. Black, R. E., Levin, C., Walker, N., Chou, D., Liu, L., & Temmerman, M. (2016). Reproductive, maternal, newborn, and child health: key messages from disease control priorities 3rd edition. *The Lancet*, 388(10061), 2811-2824.
- [22]. Boerma, T., Requejo, J., Victora, C. G., Amouzou, A., George, A., Agyepong, I., Barroso, C., Barros, A. J., Bhutta, Z. A., & Black, R. E. (2018). Countdown to 2030: tracking progress towards universal coverage for reproductive, maternal, newborn, and child health. *The Lancet*, 391(10129), 1538-1548.
- [23]. Brittain, A. W., Williams, J. R., Zapata, L. B., Pazol, K., Romero, L. M., & Weik, T. S. (2015). Youth-friendly family planning services for young people: a systematic review. *American journal of preventive medicine*, 49(2), S73-S84.
- [24]. Cameron, E. E., Joyce, K. M., Delaquis, C. P., Reynolds, K., Protudjer, J. L., & Roos, L. E. (2020). Maternal psychological distress & mental health service use during the COVID-19 pandemic. *Journal of affective disorders*, 276, 765-774.
- [25]. Choi, K. R., Records, K., Low, L. K., Alhusen, J. L., Kenner, C., Bloch, J. R., Premji, S. S., Hannan, J., Anderson, C. M., & Yeo, S. (2020). Promotion of maternal-infant mental health and trauma-informed care during the COVID-19 pandemic. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 49(5), 409-415.
- [26]. Cross, J. H., Kwon, C. S., Asadi-Pooya, A. A., Balagura, G., Gómez-Iglesias, P., Guekht, A., Hall, J., Ikeda, A., Kishk, N. A., & Murphy, P. (2021). Epilepsy care during the COVID-19 pandemic. *Epilepsia*, 62(10), 2322-2332.
- [27]. Cyr, M. E., Etchin, A. G., Guthrie, B. J., & Benneyan, J. C. (2019). Access to specialty healthcare in urban versus rural US populations: a systematic literature review. *BMC Health Services Research*, 19(1), 974.
- [28]. Daelmans, B., Darmstadt, G. L., Lombardi, J., Black, M. M., Britto, P. R., Lye, S., Dua, T., Bhutta, Z. A., & Richter, L. M. (2017). Early childhood development: the foundation of sustainable development. *The Lancet*, 389(10064), 9-11.
- [29]. das Neves Martins Pires, P. H., Macaringue, C., Abdirazak, A., Mucufo, J. R., Mupueleque, M. A., Zakus, D., Siemens, R., & Belo, C. F. (2021). Covid-19 pandemic impact on maternal and child health services access in Nampula, Mozambique: a mixed methods research. *BMC Health Services Research*, 21(1), 860.
- [30]. Dasa, T. T., Kassie, T. W., Roba, A. A., Wakwoya, E. B., & Kelel, H. U. (2019). Factors associated with long-acting family planning service utilization in Ethiopia: a systematic review and meta-analysis. *Contraception and reproductive medicine*, 4(1), 14.
- [31]. De Silva, M. J., Breuer, E., Lee, L., Asher, L., Chowdhary, N., Lund, C., & Patel, V. (2014). Theory of change: a theory-driven approach to enhance the Medical Research Council's framework for complex interventions. *Trials*, 15(1), 267.

- [32]. Emmering, S. A., Astroth, K. S., Woith, W. M., Dyck, M. J., & Kim, M. (2018). Social capital, health, health behavior, and utilization of healthcare services among older adults: A conceptual framework. *Nursing Forum*,
- [33]. Evans, D. C., Corkins, M. R., Malone, A., Miller, S., Mogensen, K. M., Guenter, P., Jensen, G. L., & Committee, A. M. (2021). The use of visceral proteins as nutrition markers: an ASPEN position paper. *Nutrition in Clinical Practice*, 36(1), 22-28.
- [34]. Fleury, M.-J., Grenier, G., Bamvita, J.-M., & Caron, J. (2014). Determinants and patterns of service utilization and recourse to professionals for mental health reasons. *BMC Health Services Research*, 14(1), 161.
- [35]. Fleury, M.-J., Ngamini Ngui, A., Bamvita, J.-M., Grenier, G., & Caron, J. (2014). Predictors of healthcare service utilization for mental health reasons. *International journal of environmental research and public health*, 11(10), 10559-10586.
- [36]. Fraher, E., & Brandt, B. (2019). Toward a system where workforce planning and interprofessional practice and education are designed around patients and populations not professions. *Journal of Interprofessional Care*, 33(4), 389-397.
- [37]. Fryer, K., Delgado, A., Foti, T., Reid, C. N., & Marshall, J. (2020). Implementation of obstetric telehealth during COVID-19 and beyond. *Maternal and child health journal*, 24(9), 1104-1110.
- [38]. Georgieff, M. K., Ramel, S. E., & Cusick, S. E. (2018). Nutritional influences on brain development. *Acta paediatrica*, 107(8), 1310-1321.
- [39]. Goyal, M., Singh, P., Singh, K., Shekhar, S., Agrawal, N., & Misra, S. (2021). The effect of the COVID-19 pandemic on maternal health due to delay in seeking health care: experience from a tertiary center. *International Journal of Gynecology & Obstetrics*, 152(2), 231-235.
- [40]. Graham, W., Woodd, S., Byass, P., Filippi, V., Gon, G., Virgo, S., Chou, D., Hounton, S., Lozano, R., & Pattinson, R. (2016). Diversity and divergence: the dynamic burden of poor maternal health. *The Lancet*, 388(10056), 2164-2175.
- [41]. Gupta, N., Balcom, S. A., Gulliver, A., & Witherspoon, R. L. (2021). Health workforce surge capacity during the COVID-19 pandemic and other global respiratory disease outbreaks: A systematic review of health system requirements and responses. In: Wiley Online Library.
- [42]. Habonimana, D., & Batura, N. (2021). Empirical analysis of socio-economic determinants of maternal health services utilisation in Burundi. *BMC pregnancy and childbirth*, 21(1), 684.
- [43]. Hagos, G., Tura, G., Kahsay, G., Haile, K., Grum, T., & Araya, T. (2018). Family planning utilization and factors associated among women receiving abortion services in health facilities of central zone towns of Tigray, Northern Ethiopia: a cross sectional Study. *BMC women's health*, 18(1), 83.
- [44]. Halfon, N., Forrest, C. B., Lerner, R. M., Faustman, E. M., Tullis, E., & Son, J. (2017). Introduction to the handbook of life course health development. *Handbook of life course health development*, 1-16.
- [45]. Halfon, N., Larson, K., Lu, M., Tullis, E., & Russ, S. (2014). Lifecourse health development: past, present and future. *Maternal and child health journal*, 18(2), 344-365.
- [46]. Headey, D., Heidkamp, R., Osendarp, S., Ruel, M., Scott, N., Black, R., Shekar, M., Bouis, H., Flory, A., & Haddad, L. (2020). Impacts of COVID-19 on childhood malnutrition and nutrition-related mortality. *The Lancet*, 396(10250), 519-521.
- [47]. Higginbottom, G. M., Morgan, M., Alexandre, M., Chiu, Y., Forgeron, J., Kocay, D., & Barolia, R. (2015). Immigrant women's experiences of maternity-care services in Canada: a systematic review using a narrative synthesis. *Systematic reviews*, 4(1), 13.
- [48]. Iacolla, F., & Tirivayi, N. (2019). Determinants of maternal healthcare utilization among married adolescents: Evidence from 13 Sub-Saharan African countries. *Public Health*, 177, 1-9.
- [49]. Jones, E., Lattof, S. R., & Coast, E. (2017). Interventions to provide culturally-appropriate maternity care services: factors affecting implementation. *BMC pregnancy and childbirth*, 17(1), 267.
- [50]. Joseph, G., Da Silva, I. C. M., Wehrmeister, F. C., Barros, A. J., & Victora, C. G. (2016). Inequalities in the coverage of place of delivery and skilled birth attendance: analyses of cross-sectional surveys in 80 low and middle-income countries. *Reproductive health*, 13(1), 77.
- [51]. Kabagenyi, A., Jennings, L., Reid, A., Nalwadda, G., Ntozi, J., & Atuyambe, L. (2014). Barriers to male involvement in contraceptive uptake and reproductive health services: a qualitative study of men and women's perceptions in two rural districts in Uganda. *Reproductive health*, 11(1), 21.
- [52]. Kamal, S. A., Shafiq, M., & Kakria, P. (2020). Investigating acceptance of telemedicine services through an extended technology acceptance model (TAM). *Technology in Society*, 60, 101212.
- [53]. Kassam, S., Serrano-Lomelin, J., Hicks, A., Crawford, S., Bakal, J. A., & Ospina, M. B. (2021). Geography as a determinant of health: health services utilization of pediatric respiratory illness in a Canadian province. *International journal of environmental research and public health*, 18(16), 8347.
- [54]. Kassie, A., Wale, A., & Yismaw, W. (2021). Impact of coronavirus diseases-2019 (COVID-19) on utilization and outcome of reproductive, maternal, and newborn health services at governmental health facilities in South West Ethiopia, 2020: comparative cross-sectional study. *International journal of women's health*, 479-488.
- [55]. Kazi Rakib Hasan, S., & Uddin, H. M. M. (2022). Scalable AI For Project Portfolio Management: A Mixed-Methods Study Combining Distributed Computing Benchmarks. *Review of Applied Science and Technology*, 1(04), 375-410. <https://doi.org/10.63125/0kk4wf20>
- [56]. Kazmerski, T., McCauley, H. L., Jones, K., Borrero, S., Silverman, J. G., Decker, M. R., Tancredi, D., & Miller, E. (2015). Use of reproductive and sexual health services among female family planning clinic clients exposed to partner violence and reproductive coercion. *Maternal and child health journal*, 19(7), 1490-1496.

- [57]. Keats, E. C., Das, J. K., Salam, R. A., Lassi, Z. S., Imdad, A., Black, R. E., & Bhutta, Z. A. (2021). Effective interventions to address maternal and child malnutrition: an update of the evidence. *The Lancet Child & Adolescent Health*, 5(5), 367-384.
- [58]. Kibria, G. M. A., Burrowes, V., Choudhury, A., Sharmeen, A., Ghosh, S., & Kalbarczyk, A. (2018). A comparison of practices, distributions and determinants of birth attendance in two divisions with highest and lowest skilled delivery attendance in Bangladesh. *BMC pregnancy and childbirth*, 18(1), 122.
- [59]. Kimani, R. W., Maina, R., Shumba, C., & Shaibu, S. (2020). Maternal and newborn care during the COVID-19 pandemic in Kenya: re-contextualising the community midwifery model. *Human resources for health*, 18(1), 75.
- [60]. Kinuthia, J., Pintye, J., Abuna, F., Mugwanya, K. K., Lagat, H., Onyango, D., Begnel, E., Dettinger, J., Baeten, J. M., & John-Stewart, G. (2020). Pre-exposure prophylaxis uptake and early continuation among pregnant and post-partum women within maternal and child health clinics in Kenya: results from an implementation programme. *The lancet HIV*, 7(1), e38-e48.
- [61]. Laopaiboon, M., Lumbiganon, P., Intarut, N., Mori, R., Ganchimeg, T., Vogel, J., Souza, J., Gülmezoglu, A., & Network, W. M. S. o. M. N. H. R. (2014). Advanced maternal age and pregnancy outcomes: a multicountry assessment. *BJOG: An International Journal of Obstetrics & Gynaecology*, 121, 49-56.
- [62]. Lin, T. K., Bruckner, T. A., Alghaith, T., Hamza, M. M., Alluhidan, M., Herbst, C. H., Alghodaier, H., Alamri, A., Saber, R., & Alazemi, N. (2021). Projecting health labor market dynamics for a health system in transition: planning for a resilient health workforce in Saudi Arabia. *Globalization and health*, 17(1), 105.
- [63]. Lu, M. C. (2019). The future of maternal and child health. *Maternal and child health journal*, 23(1), 1-7.
- [64]. Lubrano, R., Del Giudice, E., Marcellino, A., Ventriglia, F., Dilillo, A., De Luca, E., Mallardo, S., Isoldi, S., Martucci, V., & Sansevero, M. (2021). Change in pediatric health care spending and drug utilization during the COVID-19 pandemic. *Children*, 8(12), 1183.
- [65]. Lusambili, A. M., Martini, M., Abdirahman, F., Asante, A., Ochieng, S., Guni, J. N., Maina, R., & Luchters, S. (2020). "We have a lot of home deliveries" A qualitative study on the impact of COVID-19 on access to and utilization of reproductive, maternal, newborn and child health care among refugee women in urban Eastleigh, Kenya. *Journal of Migration and Health*, 1, 100025.
- [66]. Manote, M., & Gebremedhin, T. (2020). Determinants of postnatal care non-utilization among women in Demba Gofa rural district, southern Ethiopia: a community-based unmatched case-control study. *BMC pregnancy and childbirth*, 20(1), 546.
- [67]. Md. Abdur, R., & Iftekhar, A. (2021). Customer Retention Forecasting in Mobile Wallet Services Using Neural Networks: A Comparative Quantitative Study. *International Journal of Business and Economics Insights*, 1(4), 70-102. <https://doi.org/10.63125/dyrpc387>
- [68]. Memirie, S. T., Verguet, S., Norheim, O. F., Levin, C., & Johansson, K. A. (2016). Inequalities in utilization of maternal and child health services in Ethiopia: the role of primary health care. *BMC Health Services Research*, 16(1), 51.
- [69]. Menendez, C., Gonzalez, R., Donnay, F., & Leke, R. G. (2020). Avoiding indirect effects of COVID-19 on maternal and child health. *The Lancet global health*, 8(7), e863-e864.
- [70]. Mgawadere, F., Unkels, R., Kazembe, A., & van den Broek, N. (2017). Factors associated with maternal mortality in Malawi: application of the three delays model. *BMC pregnancy and childbirth*, 17(1), 219.
- [71]. Mohammad Shoriful Hossan, S. (2021). Reducing Worker Exposure and Electrical Failure Risk in Brownfield Manufacturing Facilities After COVID-Era Maintenance Delays. *Review of Applied Science and Technology*, 6(1), 263–279. <https://doi.org/10.63125/cm1c2c20>
- [72]. Mohammed, M. m. M., El Gelany, S., Eladwy, A. R., Ali, E. I., Gadelrab, M. T., Ibrahim, E. M., Khalifa, E. M., Abdelhakium, A. K., Fares, H., & Yousef, A. M. (2020). A ten year analysis of maternal deaths in a tertiary hospital using the three delays model. *BMC pregnancy and childbirth*, 20(1), 585.
- [73]. Motomura, K., Ganchimeg, T., Nagata, C., Ota, E., Vogel, J. P., Betran, A. P., Torloni, M. R., Jayaratne, K., Jwa, S. C., & Mittal, S. (2017). Incidence and outcomes of uterine rupture among women with prior caesarean section: WHO Multicountry Survey on Maternal and Newborn Health. *Scientific reports*, 7(1), 44093.
- [74]. Mst Shurovi, A., & Samia Hossain, S. (2022). Difference-in-Differences (DiD) Analysis of Data Driven Accounting Systems and its Impact on Financial Error Rates in SMEs. *Journal of Sustainable Development and Policy*, 1(04), 117-157. <https://doi.org/10.63125/n4nr0d75>
- [75]. Muhammad Mohiul, I., & Mohammad Badrul, A. (2022). Predictive Analytics for Optimizing Sewerage Sludge Treatment Efficiency and Resource Recovery in Dhaka City. *Journal of Sustainable Development and Policy*, 1(04), 158-200. <https://doi.org/10.63125/t9zdp458>
- [76]. Muhammad Zahidul, I., & Amena Begum, S. (2022). Applied Data-Analytics Approaches to Cardiovascular Drug-Utilization Patterns: An Empirical Study Using Real-World Pharmaceutical Sales Data. *American Journal of Data Science and Analytics*, 3(12), 89-129. <https://doi.org/10.63125/7xgryf71>
- [77]. Mukut Kanti, B., & Rony, S. (2022). Quantitative Risk Assessment and Safety Performance Benchmarking for Structural Integrity Management in Retail Supply Chain Infrastructure. *American Journal of Data Science and Analytics*, 3(12), 42-88. <https://doi.org/10.63125/n88vth90>
- [78]. Mustafa, G., Azmat, S. K., Hameed, W., Ali, S., Ishaque, M., Hussain, W., Ahmed, A., & Munroe, E. (2015). Family planning knowledge, attitudes, and practices among married men and women in rural areas of Pakistan: Findings from a qualitative need assessment study. *International journal of reproductive medicine*, 2015(1), 190520.
- [79]. Nancarrow, S. A. (2015). Six principles to enhance health workforce flexibility. *Human resources for health*, 13(1), 9.
- [80]. Nassar, J. M., Khan, S. M., Villalva, D. R., Nour, M. M., Almuslem, A. S., & Hussain, M. M. (2018). Compliant plant wearables for localized microclimate and plant growth monitoring. *npj Flexible Electronics*, 2(1), 24.

- [81]. Nguyen, P. H., Sununtnasuk, C., Pant, A., Tran Mai, L., Kachwaha, S., Ash, D., Ali, M., Ireen, S., Kappos, K., & Escobar-Alegria, J. (2021). Provision and utilisation of health and nutrition services during COVID-19 pandemic in urban Bangladesh. *Maternal & child nutrition*, 17(4), e13218.
- [82]. Niezen, M. G., & Mathijssen, J. J. (2014). Reframing professional boundaries in healthcare: a systematic review of facilitators and barriers to task reallocation from the domain of medicine to the nursing domain. *Health policy*, 117(2), 151-169.
- [83]. Oliver, K., Innvar, S., Lorenc, T., Woodman, J., & Thomas, J. (2014). A systematic review of barriers to and facilitators of the use of evidence by policymakers. *BMC Health Services Research*, 14(1), 2.
- [84]. Ordu, M., Demir, E., Tofallis, C., & Gunal, M. M. (2021). A novel healthcare resource allocation decision support tool: A forecasting-simulation-optimization approach. *Journal of the operational research society*, 72(3), 485-500.
- [85]. Osamor, P. E., & Grady, C. (2016). Women's autonomy in health care decision-making in developing countries: a synthesis of the literature. *International journal of women's health*, 191-202.
- [86]. Osendarp, S., Akuoku, J. K., Black, R. E., Headey, D., Ruel, M., Scott, N., Shekar, M., Walker, N., Flory, A., & Haddad, L. (2021). The COVID-19 crisis will exacerbate maternal and child undernutrition and child mortality in low-and middle-income countries. *Nature food*, 2(7), 476-484.
- [87]. Pacagnella, R. C., Cecatti, J. G., Parpinelli, M. A., Sousa, M. H., Haddad, S. M., Costa, M. L., Souza, J. P., Pattinson, R. C., & group, B. N. f. t. S. o. S. M. M. s. (2014). Delays in receiving obstetric care and poor maternal outcomes: results from a national multicentre cross-sectional study. *BMC pregnancy and childbirth*, 14(1), 159.
- [88]. Palagyi, A., Marais, B. J., Abimbola, S., Topp, S. M., McBryde, E. S., & Negin, J. (2019). Health system preparedness for emerging infectious diseases: a synthesis of the literature. *Global Public Health*, 14(12), 1847-1868.
- [89]. Pan, X.-F., Wang, L., & Pan, A. (2021). Epidemiology and determinants of obesity in China. *The lancet Diabetes & endocrinology*, 9(6), 373-392.
- [90]. Pérez-Escamilla, R., Cunningham, K., & Moran, V. H. (2020). COVID-19 and maternal and child food and nutrition insecurity: a complex syndemic. In (Vol. 16, pp. e13036): Wiley Online Library.
- [91]. Pérez-Escamilla, R., Martinez, J. L., & Segura-Pérez, S. (2016). Impact of the Baby-friendly Hospital Initiative on breastfeeding and child health outcomes: A systematic review. *Maternal & child nutrition*, 12(3), 402-417.
- [92]. Phillips, D. E., Dieleman, J. L., Lim, S. S., & Shearer, J. (2017). Determinants of effective vaccine coverage in low and middle-income countries: a systematic review and interpretive synthesis. *BMC Health Services Research*, 17(1), 681.
- [93]. Pratley, P. (2016). Associations between quantitative measures of women's empowerment and access to care and health status for mothers and their children: a systematic review of evidence from the developing world. *Social science & medicine*, 169, 119-131.
- [94]. Qiao, J., Wang, Y., Li, X., Jiang, F., Zhang, Y., Ma, J., Song, Y., Ma, J., Fu, W., & Pang, R. (2021). A Lancet Commission on 70 years of women's reproductive, maternal, newborn, child, and adolescent health in China. *The Lancet*, 397(10293), 2497-2536.
- [95]. Reber, E., Gomes, F., Vasiloglou, M. F., Schuetz, P., & Stanga, Z. (2019). Nutritional risk screening and assessment. *Journal of clinical medicine*, 8(7), 1065.
- [96]. Renfrew, M. J., McFadden, A., Bastos, M. H., Campbell, J., Channon, A. A., Cheung, N. F., Silva, D. R. A. D., Downe, S., Kennedy, H. P., & McCormick, F. (2014). Midwifery and quality care: findings from a new evidence-informed framework for maternal and newborn care. *The Lancet*, 384(9948), 1129-1145.
- [97]. Rigg, K. K., Monnat, S. M., & Chavez, M. N. (2018). Opioid-related mortality in rural America: Geographic heterogeneity and intervention strategies. *International Journal of Drug Policy*, 57, 119-129.
- [98]. Robertson, T., Carter, E. D., Chou, V. B., Stegmuller, A. R., Jackson, B. D., Tam, Y., Sawadogo-Lewis, T., & Walker, N. (2020). Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. *The Lancet global health*, 8(7), e901-e908.
- [99]. Roberts, T., Miguel Esponda, G., Krupchanka, D., Shidhaye, R., Patel, V., & Rathod, S. (2018). Factors associated with health service utilisation for common mental disorders: a systematic review. *BMC psychiatry*, 18(1), 262.
- [100]. Romano, C., Van Wynckel, M., Hulst, J., Broekaert, I., Bronsky, J., Dall'Oglio, L., Mis, N. F., Hojsak, I., Orel, R., & Papadopoulou, A. (2017). European Society for Paediatric Gastroenterology, Hepatology and Nutrition guidelines for the evaluation and treatment of gastrointestinal and nutritional complications in children with neurological impairment. *Journal of pediatric gastroenterology and nutrition*, 65(2), 242-264.
- [101]. Russ, S. A., Larson, K., Tullis, E., & Halfon, N. (2014). A lifecourse approach to health development: implications for the maternal and child health research agenda. *Maternal and child health journal*, 18(2), 497-510.
- [102]. Rutaremwa, G., Wandera, S. O., Jhamba, T., Akiror, E., & Kiconco, A. (2015). Determinants of maternal health services utilization in Uganda. *BMC Health Services Research*, 15(1), 271.
- [103]. Sadia, Z., Mohammad Ariful, I., Sumyta, H., & Hosne Ara, M. (2022). A Review of AI-Powered Data Visualization in Enterprise Reporting: Dashboard Design And Interactive Analytics. *American Journal of Advanced Technology and Engineering Solutions*, 2(01), 32-54. <https://doi.org/10.63125/gabst658>
- [104]. Sahoo, K. C., Negi, S., Patel, K., Mishra, B. K., Palo, S. K., & Pati, S. (2021). Challenges in maternal and child health services delivery and access during pandemics or public health disasters in low-and middle-income countries: a systematic review. *Healthcare*,
- [105]. Santric-Milicevic, M., Vasic, V., & Terzic-Supic, Z. (2016). Do health care workforce, population, and service provision significantly contribute to the total health expenditure? An econometric analysis of Serbia. *Human resources for health*, 14(1), 50.
- [106]. Sekhon, M., Cartwright, M., & Francis, J. J. (2017). Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. *BMC Health Services Research*, 17(1), 88.

- [107]. Siekmans, K., Sohani, S., Boima, T., Koffa, F., Basil, L., & Laaziz, S. (2017). Community-based health care is an essential component of a resilient health system: evidence from Ebola outbreak in Liberia. *BMC Public Health*, 17(1), 84.
- [108]. Singh, D. R., Sunuwar, D. R., Shah, S. K., Karki, K., Sah, L. K., Adhikari, B., & Sah, R. K. (2021). Impact of COVID-19 on health services utilization in Province-2 of Nepal: a qualitative study among community members and stakeholders. *BMC Health Services Research*, 21(1), 174.
- [109]. Slomian, J., Honvo, G., Emonts, P., Reginster, J.-Y., & Bruyère, O. (2019). Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes. *Women's health*, 15, 1745506519844044.
- [110]. Srivastava, A., Avan, B. I., Rajbangshi, P., & Bhattacharyya, S. (2015). Determinants of women's satisfaction with maternal health care: a review of literature from developing countries. *BMC pregnancy and childbirth*, 15(1), 97.
- [111]. Steinbeisser, K., Grill, E., Holle, R., Peters, A., & Seidl, H. (2018). Determinants for utilization and transitions of long-term care in adults 65+ in Germany: results from the longitudinal KORA-Age study. *BMC geriatrics*, 18(1), 172.
- [112]. Stenberg, K., Axelson, H., Sheehan, P., Anderson, I., Gülmezoglu, A. M., Temmerman, M., Mason, E., Friedman, H. S., Bhutta, Z. A., & Lawn, J. E. (2014). Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework. *The Lancet*, 383(9925), 1333-1354.
- [113]. Sundararaman, T., Muraleedharan, V., & Ranjan, A. (2021). Pandemic resilience and health systems preparedness: lessons from COVID-19 for the twenty-first century. *Journal of Social and Economic Development*, 23(Suppl 2), 290-300.
- [114]. Tadesse, E. (2020). Antenatal care service utilization of pregnant women attending antenatal care in public hospitals during the COVID-19 pandemic period. *International journal of women's health*, 1181-1188.
- [115]. Tarekegn, S. M., Lieberman, L. S., & Giedraitis, V. (2014). Determinants of maternal health service utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey. *BMC pregnancy and childbirth*, 14(1), 161.
- [116]. ten Hoope-Bender, P., de Bernis, L., Campbell, J., Downe, S., Fauveau, V., Fogstad, H., Homer, C. S., Kennedy, H. P., Matthews, Z., & McFadden, A. (2014). Improvement of maternal and newborn health through midwifery. *The Lancet*, 384(9949), 1226-1235.
- [117]. Tessema, Z. T., Teshale, A. B., Tesema, G. A., & Tamirat, K. S. (2021). Determinants of completing recommended antenatal care utilization in sub-Saharan from 2006 to 2018: evidence from 36 countries using Demographic and Health Surveys. *BMC pregnancy and childbirth*, 21(1), 192.
- [118]. Tessema, Z. T., Yazachew, L., Tesema, G. A., & Teshale, A. B. (2020). Determinants of postnatal care utilization in sub-Saharan Africa: a meta and multilevel analysis of data from 36 sub-Saharan countries. *Italian journal of pediatrics*, 46(1), 175.
- [119]. Tukamuhabwa, B. R., Stevenson, M., Busby, J., & Zorzini, M. (2015). Supply chain resilience: definition, review and theoretical foundations for further study. *International journal of production research*, 53(18), 5592-5623.
- [120]. Tumusiime, P., Karamagi, H., Titi-Ofei, R., Amri, M., Seydi, A. B. W., Kipruto, H., Droti, B., Zombre, S., Yoti, Z., & Zawaira, F. (2020). Building health system resilience in the context of primary health care revitalization for attainment of UHC: proceedings from the Fifth Health Sector Directors' Policy and Planning Meeting for the WHO African Region. *BMC proceedings*,
- [121]. Victora, C. G., Christian, P., Vdaletti, L. P., Gatica-Domínguez, G., Menon, P., & Black, R. E. (2021). Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. *The Lancet*, 397(10282), 1388-1399.
- [122]. Weinhold, I., & Gurtner, S. (2018). Rural-urban differences in determinants of patient satisfaction with primary care. *Social science & medicine*, 212, 76-85.
- [123]. Wilunda, C., Quaglio, G., Putoto, G., Takahashi, R., Calia, F., Abebe, D., Manenti, F., Dalla Riva, D., Betrán, A. P., & Atzori, A. (2015). Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: a cross sectional study. *Reproductive health*, 12(1), 74.
- [124]. Xiao, H., Dai, X., Wagenaar, B. H., Liu, F., Augusto, O., Guo, Y., & Unger, J. M. (2021). The impact of the COVID-19 pandemic on health services utilization in China: Time-series analyses for 2016–2020. *The Lancet Regional Health–Western Pacific*, 9.
- [125]. Yelland, J., Riggs, E., Szwarc, J., Casey, S., Dawson, W., Vanpraag, D., East, C., Wallace, E., Teale, G., & Harrison, B. (2015). Bridging the gap: using an interrupted time series design to evaluate systems reform addressing refugee maternal and child health inequalities. *Implementation science*, 10(1), 62.
- [126]. Yuan, B., Målqvist, M., Trygg, N., Qian, X., Ng, N., & Thomsen, S. (2014). What interventions are effective on reducing inequalities in maternal and child health in low-and middle-income settings? A systematic review. *BMC Public Health*, 14(1), 634.