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EFFICACY OF TELEMEDICINE IN REDUCING NEONATAL DEATHS DURING THE COVID-19 PANDEMIC

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Abstract: COVID-19 brought telemedicine to the forefront of medical practices. Evaluating telemedicine's efficacy will help healthcare providers determine best practices for vulnerable populations, such as pregnant women, when barriers to healthcare exist. This study attempts to examine how global telemedicine implementation aids in reducing neonatal death rates. 30 countries were selected using Text Finder's random choice generator, then organized into three categories by degree of telemedicine implementation: minimal, moderate, and extensive. The percent changes in neonatal deaths were recorded from 2019 to 2020, then analyzed and ranked using the Kruskal-Wallis test. The mean rankings from greatest to least were: minimal (25.50), moderate (15.50), and extensive (5.50). The Kruskal-Wallis test result was H (2) = 25.806, P=.000. Thus, extensive telemedicine implementation is most effective at lowering neonatal death rates. It is advisable for public health agencies to consider offering more accessible telemedicine programs to reduce neonatal death rates. Confounding variables include political agendas and lack of data on how extensive each mothers' utilization of telemedicine was. Future research could analyze effectiveness of telemedicine in reducing neonatal death rates among different socioeconomic strata. This study also raises fundamental questions regarding how to ensure equitable access to telemedicine programs.

Keywords: COVID-19, neonatal deaths, Kruskal-Wallis, telemedicine

Introduction

In December 2019, SARS-CoV-2 was identified and rapidly spread into a global pandemic. The urgency of the COVID-19 pandemic has led to an increase in the implementation of telemedicine globally to substitute face-to-face healthcare visits, and to safely deliver components of maternal care to ensure maternal and newborn health from a distance through communication technologies (Galle et al., 2021). During the pandemic, telehealth has grown to meet a rising need for acute medical care in areas and locations where access to medical care and health professionals is limited. Prior to the outbreak of COVID-19, many birthing facilities did not offer on-site neonatal care. If an infant required urgent medical care, providers may have had to wait for a transport team to arrive on site to stabilize the infant. Many providers would also have to transport infants to a local specialist unnecessarily, while raising costs and adding immense stress to both the mother and child (InTouch Health, 2021). Instead of waiting for in-person assistance or spending time to transport newborns to specialized neonatal facilities, some providers may be able to use neonatal telehealth to resolve the issue.

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A remote consultation with neonatal specialists using live video and audio would give providers immediate access to the expertise they would need to stabilize and care for the infant (InTouch Health, 2021). This aspect of telemedicine was even more necessary after the outbreak of COVID-19. Kostenzer et al. found that various COVID-19 guidelines have restricted parental and familial presence for infants admitted to neonatal intensive care units (NICUs). A reduction in care-seeking by parents, lack of instruction to care for preterm newborns and infants with low birthweight, and discontinued or discouraged kangaroo mother care due to restrictions on parental presence during the pandemic has been observed (Kostenzer *et al.*, 2021). The issue of neonatal care is especially important for mothers of low socioeconomic status, who often suffer from increased complications and worse neonatal outcomes. Implementation of telehealth to connect specialists to facilities lacking specialized neonatal care units could theoretically improve outcomes.

Evaluating the efficacy of the implementation of telemedicine helps healthcare providers make the most effective and suitable decisions to best address vulnerable populations' health needs during COVID-19. Notably, pregnant women are at higher risk to become severely ill from COVID-19 when compared to women who are not pregnant, making them one of most vulnerable populations during the COVID-19 pandemic (Center for Disease Control and Prevention, 2022). This analysis will aid in future decisions when selecting methods that would best aid vulnerable and disadvantaged populations when there are barriers to adequate healthcare. Thus, this research seeks to answer: To what extent does the implementation of telemedicine in countries around the world aid in reducing neonatal deaths? It is hypothesized that the expansion of telemedicine in the world does aid in significantly reducing neonatal deaths. By assessing the validity of the hypothesis, the utility of various maternal and neonatal care telemedicine practices that have emerged during the COVID-19 pandemic will also be examined—providing insight for a post-pandemic future. Evaluating the efficacy of telehealth in maternal and neonatal healthcare will help guide future health practices and policies to ensure more effective and equitable outcomes for mothers and children.

Methods

30 countries from Worldometer were randomly chosen using the random choice generator from Text Finder, then organized into three degrees of telemedicine implementation, with 10 countries in each category: minimal, moderate, and extensive (Table 1). The minimal countries included Yemen, Somalia, Guinea, Chad, Fiji, Uruguay, Malaysia, Netherlands, Benin, and Mozambique (Table 2). The moderate countries were Canada, Sierra Leone, Nepal, Brazil, Cambodia, Philippines, Pakistan, Indonesia, Myanmar, and Colombia (Table 3). The countries categorized as extensive were Azerbaijan, Argentina, China, Bangladesh, Belarus, Kyrgyzstan, Mongolia, Armenia, North Macedonia, and Uzbekistan (Table 4). Characterization by degree of telemedicine implementation was based on availability and limitations of telemedicine technology in each country. Minimal implementation was defined by limited online consultations and programs due to barriers imposed by lack of infrastructure. Moderate was characterized by audio only technology utilized in telecommunications for antenatal and neonatal care and the availability of several online birth preparedness classes. Extensive was entailed two-way interactive audio-visual technologies utilized in telecommunications for antenatal and neonatal care, as well as the availability of a variety of online birth preparedness classes. These data were collected from the CDC, WHO, and The New York Times. Presented are all 30 locations, categorized into three groups by telemedicine implementation: minimal, moderate, and extensive (Table 1).

The percentage of neonatal deaths in 2019 (pre-pandemic to initial spread of COVID-19) and the percentage of neonatal deaths in 2020 (first whole year combatting the virus) were calculated, as well as the percent change from 2019 to 2020, using data from the World Health Organization. A Kruskal-Wallis test with a = 0.05 was then conducted to rank the percent changes of neonatal deaths from 2019 to 2020 by degree of telemedicine implementation, with careful attention paid to what patterns emerged among the three groups of telemedicine implementation (minimal, moderate, and extensive). A Kruskal-Wallis test determines whether the differences between two or more groups are significant and is used when no distributive assumptions can be made (unlike ANOVA). A non-parametric test was warranted because there were outliers present (e.g., North Macedonia's percent decrease of 15.996573%) and the data would be more accurately presented. As a simplified example calculation of a Kruskal-Wallis test, assume three groups of test takers: A, B, and C. Group A had the 1st highest scoring test, as well as 3rd, 4th, 6th, and 8th. B had ranks of 2, 5, 7, 10, and C had the remaining ranks. The mean rank for A would be (1 + 3 + 4 + 6 + 8)/5 = 4.4. The H statistic is calculated using the formula= (12/(N(N+1)) * (∑T^2/n) - 3(N+1) where N is the total sample, T is the rank sum for each group, and n is the size of each group. The statistic is compared to the critical chi-square value, with g - 1 degrees of freedom. Assuming a significance of 0.05, our critical value is 5.99 which is less than H = 0.05 * 1124.8 – 48 = 8.24 and the result is significant.

Shown below are data for the minimal locations (Table 2). The percent changes from 2019 to 2020 were all negative except for three countries which showed an increase in neonatal deaths. There was an overall decrease in neonatal deaths.

Displayed below are data for the moderate locations (Table 3). The percent changes are all more negative than the percent changes shown for minimal locations. All rankings were primarily given based on the percent changes from 2019 to 2020 in neonatal deaths.

Presented below are data for the 10 extensive locations. (Table 4). The percent changes were all more negative than the percent changes that were shown for the moderate locations; this shows the strongest overall decrease in percentage of neonatal deaths from 2019 to 2020.

Results

After analyzing the percent changes, the three groups were ranked. As the degree of telemedicine implementation became more extensive, the mean rank decreased (Table 5). Lower percent changes on an absolute scale in neonatal deaths from 2019 to 2020 were strongly associated with more extensive levels of telemedicine implementation. The p-value was found to be 0.000, which is less than 0.001 (Table 6). Thus, there was a statistically significant difference in the three levels of telemedicine implementation and the respective percent changes in neonatal deaths from 2019 to 2020. This is evidenced by the Kruskal-Wallis test result H(2)= 25.806, P=.000. Therefore, the mean percent change in neonatal deaths by degree of telemedicine implementation was statistically significant.

It is evidenced that locations with extensive telemedicine implementation have the lowest neonatal death rates, whereas locations with minimal telemedicine implementation have the highest neonatal death rates (Table 5). Said results also support the hypothesis that locations that implement telemedicine programs most extensively have the lowest neonatal death rates (Table 6). Thus,

locations with minimal or moderate degrees of telemedicine implementation should create and disseminate more telemedicine programs in order to reduce neonatal death rates.

Discussion

The COVID-19 pandemic is still ongoing; data are fluid, and some are immeasurable. There is not enough available data in all of the 10 countries with extensive telemedicine implementation to evaluate exactly how many people utilized the telemedicine programs offered in respective locations. In addition, political figures are in charge of the implementation of telemedicine programs. Politicians have a career based on popular support; thus, public health is a great concern to said figures. However, respective political agendas may dictate public health responses and are variables that cannot be controlled—especially with the transition into the unprecedented COVID-19 pandemic.

However, future research could include analyzing the varying degrees to which telemedicine implementation aids in reducing neonatal death rates among countries of different socioeconomic strata, as well as how telemedicine programs have differentially contributed to lowering neonatal death rates among populations of different demographics. This study also raises critical questions regarding how to ensure equitable access to telemedicine programs among populations of different socioeconomic status. The impact of telehealth may be more impactful in low socioeconomic areas, which are often locations where access to quality healthcare is the most needed and where outcomes have the most potential to be optimized.

If extensive telemedicine implementation continues to lower neonatal death rates, it will be crucial for governments and citizens around the world to understand the extent to which telemedicine supports and protects both the mother and newborn. This way, governments may take more federal action in providing more widespread telemedicine programs, perhaps in the process even consolidating the state of healthcare and medical management in respective countries. A more comprehensive understanding of telemedicine will also aid public health agencies in creating programs that would better serve disadvantaged and underserved populations that suffer the most during global health crises—mostly due to unequal access to healthcare facilities and the barriers posed by systemic inequities in society. Understanding how telehealth can be leveraged most optimally will help build greater healthcare accessibility and lead to more comprehensive and equitable care for families of all backgrounds. Citizens, families, and especially mothers, would also be more informed regarding their children’s wellbeing in the crucial, early stages of their lives.

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