The Need for Biomedical Engineering Research and Innovation in Preterm Birth Prevention and Management

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Received : September 04, 2023
Published : September 15, 2023

ABSTRACT

I have been working as a pediatrician in the different underdeveloped areas of Iran for several years, and besides our experience and observation, we have also conducted a retrospective study on the frequency and outcomes of preterm birth in the south of Iran. As a multidisciplinary physician with an interest in biomedical engineering, I am writing to express my concern about the rising rates of preterm birth and the need for more biomedical engineering research and innovation in this area.

Preterm birth, or the birth of a baby before 37 weeks of gestation [1], is a significant health concern worldwide [2]. It is the second-leading cause of neonatal mortality and the leading cause of infant mortality in middle- and high-income societies [3]. This phenomenon ranks as the second most prevalent factor contributing to newborn mortality and holds the distinction of being the primary cause of infant mortality within middle- and high-income cultures. Preterm infants frequently encounter enduring health complications, including respiratory, neurological, and developmental abnormalities [4]. The annual financial burden of preterm birth in the United States is $26.2 billion, as reported by Behrman and Butler [5]. Moreover, it is worth noting that the consequences of preterm delivery can exert enduring influences on an individual's overall quality of life and state of well-being [6].

The etiologies of preterm birth are complex and multifactorial, involving genetic, environmental, social, and behavioral factors [4]. Nevertheless, certain risk factors can be modified and prevented, including infections, chronic diseases, stress, smoking, alcohol consumption, and inadequate nutrition [7]. We have conducted a retrospective study on the medical records of the main neonatal tertiary hospitals in the south of Iran, comparing the frequency and outcomes of preterm birth before, during, and after COVID-19 outbreaks. The initial findings revealed a significant rise in the incidence of preterm birth in regions affected by COVID-19 outbreaks, particularly in underdeveloped regions. This discovery implies a potential correlation between acute stress experienced by individuals within society and inadequate medical monitoring during pregnancy and the occurrence of premature birth.

DOI: https://doi.org/10.35702/mrj.10009

Hence, I contend that the existing approaches to forecasting preterm birth are constrained and inadequate in addressing this significant concern. It is imperative to engage in the development of novel methodologies that are both portable and user-friendly.

Biomedical engineering is an innovative and pioneering field that has the potential to provide answers for the prevention, diagnosis, and treatment of preterm birth through the development of novel drug delivery systems, nanoparticles, biomarkers, biosensors, artificial organs, tissue engineering, and advanced techniques for the future [8-11]. These technologies could potentially improve maternal and fetal health outcomes and reduce the burden of preterm birth on society. However, there is a significant gap between clinical physicians and biomedical engineers in this field. There is a lack of collaboration and communication between these two groups of professionals, which hinders innovation and translation. If there was a seamless collaboration between clinical physicians and biomedical engineers, it is plausible that these technologies may enhance mother and fetal health outcomes and alleviate the societal impact of premature birth.

This correspondence aims to foster a heightened understanding of the significance of biomedical engineering in tackling the worldwide issue of premature birth. Additionally, it is anticipated that this initiative will catalyze increased collaboration and communication between clinical physicians and biomedical engineers, hence promoting innovation and facilitating the translation of advancements in this domain. To accomplish this objective, it is imperative to provide comprehensive education to physicians with diverse talents and expertise across multiple disciplines, enabling them to effectively bridge the divide between clinical medicine and biomedical engineering. It is imperative to allocate additional resources and bolster assistance toward the advancement of biomedical engineering research and innovation about preterm birth. The issue at hand encompasses not solely the preservation of human lives, but also the enhancement of the well-being of many children and families across the globe.

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Citation: Mohajeri E, et al. (2023). The Need for Biomedical Engineering Research and Innovation in Preterm Birth Prevention and Management. Medical Research. 2(1):09.

DOI: https://doi.org/10.35702/mrj.10009