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# Disparities in mobile phone access and maternal health service utilization in Nigeria: A population-based survey

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## ABSTRACT

**Background:** Mobile communication technologies may reduce maternal health disparities related to cost, distance, and infrastructure. However, the ability of mHealth initiatives to accelerate maternal health goals requires in part that women with the greatest health needs have access to mobile phones.

**Objective:** This study examined if women with limited mobile phone access have differential odds of maternal knowledge and health service utilization as compared to female mobile phone users who are currently eligible to participate in maternal mHealth programs.

**Methods:** Using household survey data from Nigeria, multivariable logistic regressions were used to examine the odds of maternal knowledge and service utilization by mobile phone strata.

**Results:** Findings showed that in settings with unequal access to mobile phones, mHealth interventions may not reach women who have the poorest maternal knowledge and care-seeking as these women often lacked mobile connectivity. As compared to mobile users, women without mobile phone access had significantly lower odds of antenatal care utilization (OR = 0.48, 95%CI: 0.36–0.64), skilled delivery (OR = 0.56, 95%CI: 0.45–0.70), and modern contraceptive use (OR = 0.50, 95%CI: 0.33–0.76) after adjusting for demographic characteristics. They also had significantly lower knowledge of maternal danger signs (OR = 0.69, 95%CI: 0.53–0.90) and knowledge of antenatal (OR = 0.46, 95%CI: 0.36–0.59) and skilled delivery care benefits (OR = 0.62, 95%CI: 0.47–0.82). No differences were observed by mobile phone strata in uptake of emergency obstetric care, postnatal services, or breastfeeding.

**Conclusions:** As maternal mHealth strategies are increasingly utilized, more efforts are needed to improve women's access to mobile phones and minimize potential health inequities brought on by health systems and technological barriers in access to care.

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## 1. Introduction

Mobile communication technologies have the potential to reduce maternal health disparities related to cost, distance, and inadequate health infrastructure, even in technology-poor settings [1–3]. Yet, the ability of mobile health (mHealth) initiatives to accelerate maternal development goals requires in part that women with the greatest health needs have access to mobile communication devices [4,5]. While mobile phone coverage in developing countries has rapidly increased in recent years [3,6], research has shown that significant disparities in access remain by gender, household, and geographic characteristics [4,7,8]. Women account for almost two-thirds of the global mobile phone market that has not yet been reached [7], and those who are the poorest and least educated are most often lacking connectivity [3,4,7]. Poor and uneducated women also have higher rates of prenatal, intranatal, and postnatal morbidity and mortality [9–11]. While substantial gains have been made in addressing maternal morbidity and mortality, some achievements have resulted historically in greater health inequity at the population level with significantly lower uptake among the most vulnerable and marginalized women [12–15]. This has raised concerns whether the expansion of maternal mHealth applications that directly target patients—such as public health communications, personalized behavior change messages, or self-care information—is likely to exacerbate health disparities among women most at-risk for adverse health outcomes [2,4,16].

Implementing equitable maternal mHealth interventions requires information on women's differential health needs by mobile phone strata [3–5,13,17,18]. However, few studies have examined need-related inequalities in maternal service utilization as compared to mobile phone access. This has limited the ability of mobile-based maternal health programs to assess beforehand the potential of serving women and families most at-risk. Given that mHealth applications are increasingly being utilized to improve the delivery of maternal health services, this analysis aimed to preliminarily inform the development of a community-based mHealth initiative targeting women with low maternal knowledge and care-seeking behaviors. We sought to determine whether a mHealth intervention aiming to increase uptake of maternal services through participant interaction was likely to reach women with the highest unmet maternal need (i.e., low antenatal use, unskilled delivery attendance, poor maternal knowledge, etc.), as indicated by access to a mobile phone. Specifically, we examined if women with limited mobile phone access had differential odds of maternal health service utilization or knowledge of pregnancy, birth, and postpartum health as compared to female mobile phone users who are currently eligible to participate in maternal mHealth programs. Implications on equitable implementation of mobile technology to reach the world's most vulnerable women are discussed.

## 2. Methods

### 2.1. Sampling

Data were used from the Partnership for Transforming Health Systems, Phase Two (PATHS2) project's baseline household

survey in Nigeria. Using a population-based, two-stage cluster design, the PATHS2 household survey was conducted in five project states: Enugu, Jigawa, Kaduna, Kano, and Lagos to measure pre-intervention prevalence of a range of maternal, reproductive, and child health outcomes. In the first stage, 625 enumeration areas were selected from the local government areas within the five states. In the second stage, a target sample of 10,000 households was selected from the enumeration areas. Local and trained interviewers then surveyed the head of household and, if applicable, one woman aged 15–49 with a child 23 months or less was randomly selected from the household.

### 2.2. Maternal health setting

Despite declines in recent years, Nigeria accounts for an estimated 14% of maternal deaths worldwide, the second largest contributor to maternal mortality in the world [19]. In 2013, an estimated 40,000 Nigerian women died in pregnancy and birth-related complications representing approximately 560 maternal deaths for every 100,000 live births [20]. Care from a skilled provider during pregnancy and childbirth can reduce the risk of complications and infections that lead to illness or death of mothers and newborns [21–23]. Yet, only 61% of women in Nigeria reported receiving antenatal care from a trained provider during their most recent pregnancy, and only 38% of Nigerian births were delivered by a skilled health provider [22]. As of 2014, there were an estimated 129 million mobile phones in use in Nigeria, representing about 76% of the total population [24]. However, mobile phone coverage varies substantially across the country, and women are significantly less likely than men to own a mobile phone [25–27].

### 2.3. Data collection

Data were collected in July and August 2012. A structured questionnaire was used to elicit information on household demographics and women's maternal and reproductive histories. The questionnaire was developed in English and blind, back-translated into Yoruba, Igbo, and Hausa, the languages spoken predominantly in the study areas. All survey questions were administered orally using personal digital assistants in a language chosen by the participant. Interviewers were trained on the survey's objective and methodology using didactic methods as well as mock interviews and pilot tests.

### 2.4. Outcome measures

The outcome measures for the study comprised maternal knowledge and health service utilization during three periods: pregnancy, labor and delivery, and the early postnatal period. Two care-seeking behaviors were assessed during pregnancy. Women were asked if they received antenatal care during their last pregnancy: yes (code=1) or no (code=0). For women who received antenatal care, we also dichotomized the sample among those who received the minimum recommended four antenatal care visits (code=1) versus those who received three or fewer visits (code=0). To assess maternal knowledge regarding care during pregnancy, women were asked to describe the advantages of attending antenatal care.

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