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THE RELATIONSHIP BETWEEN DIGITAL ACCESS AND USE AND HEALTH OUTCOMES: EVIDENCE FROM DEMOGRAPHIC AND HEALTH SURVEYS

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The Relationship between Digital Access and Use and Health Outcomes: Evidence from Demographic and Health Surveys

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PREFACE

The Demographic and Health Surveys (DHS) Program is one of the principal sources of international data on fertility, family planning, maternal and child health, nutrition, mortality, environmental health, HIV/AIDS, malaria, and provision of health services.

One of the objectives of The DHS Program is to analyze DHS data and provide findings that will be useful to policymakers and program managers in low- and middle-income countries. DHS Analytical Studies serve this objective by providing in-depth research on a wide range of topics, typically including several countries and applying multivariate statistical tools and models. These reports are also intended to illustrate research methods and applications of DHS data that may build the capacity of other researchers.

The topics in this series are selected by The DHS Program in consultation with the U.S. Agency for International Development.

It is hoped that the DHS Analytical Studies will be useful to researchers, policymakers, and survey specialists, particularly those engaged in work in low- and middle-income countries.

Sunita Kishor
Director, The DHS Program

ABSTRACT

Information and communication technologies (ICT) have become an integral part of people's lives in most parts of the world, influencing politics, social interactions, economic systems and health for billions of people. The potential of ICT for health systems and programs has led to a tremendous growth in digital health interventions aimed at improving access to care and changing behaviors through the dissemination of information. However, the evidence for the effectiveness of these approaches is mixed and there is growing recognition that digital health faces a number of important challenges, including poor infrastructure, affordability and socio-cultural norms that limit the access of some groups to digital technologies. This is especially true for women, who are systematically disadvantaged in terms of access to digital resources, a phenomenon commonly referred to as the 'gender digital divide'.

The gender digital divide poses challenges for the expansion and potential effectiveness of digital health efforts, both because this limits the potential reach of interventions and because the specific health needs of women and the roles they play in the health of others make them particularly important to a range of health outcomes. However, access to digital resources may have an effect on health outcomes even in the absence of specific digital health interventions. These resources facilitate the flow of information between individuals and groups, including about health care matters. However, while there has been considerable research on the effect of digital health interventions, much less is known about how simply being able to access and use digital resources such as mobile phones or the internet may be related to health outcomes.

This study examines this question, focusing on the relationship between three types of access to or use of digital resources (ownership of a mobile phone, use of a mobile phone for financial transactions and frequent use of the internet) and a range of health outcomes, using data collected from women and men in five countries. The findings from the analysis suggest that the strength of the relationship between digital resource access and use varies depending on the health outcome examined and between men and women. In particular, outcomes focused on knowledge or where lack of knowledge is an important factor are most likely to be strongly associated to digital access or use, while this association is weaker for behavioral outcomes. This is especially true for outcomes that might be considered more private, such as use of contraception or seeking help for domestic violence.

Overall, these findings provide strong support for the argument that access and use of digital resources are strongly associated with health, though this varies by context and specific health outcome. This is interesting, because this appears to be a more general effect and not the result of a specific, focused intervention designed to influence health. In other words, just being able to access and use these digital resources is associated with some better health outcomes, even after accounting for other factors that might influence that outcome. This reinforces the pressing need to narrow the gender digital gap while also working to increase the availability and use of digital technologies for all. Women's access to the health system is often dependent on the ability and willingness of others, barriers that digital technology can help to overcome. As a result, addressing this goal should be a focus of policymakers and programmers worldwide.

Key words: digital resources, contraceptive use; antenatal care; child health; maternal health; domestic violence help seeking

ACRONYMS AND ABBREVIATIONS

ANC	antenatal care
ARI	acute respiratory infection
DHS	Demographic and Health Survey
ICT	information and communication technologies
SRH	sexual and reproductive health

1 BACKGROUND

The past decade has seen a dramatic expansion of access and use of information and communication technologies (ICT) such as the Internet and mobile phones. By the end of 2021, 5.3 billion people had subscriptions to mobile services, with over three-quarters of these users also subscribed to mobile Internet services (GSMA 2022). In many low- and middle-income countries, the expansion of mobile technology has outstripped other infrastructural improvements, and now reaches people in relatively remote communities. As a result, ICT and in particular, mobile communication and Internet access, have become an integral part of life in most parts of the world, and have influenced the political, social, academic, health, and economic domains of life.

The potential of ICT to address some fundamental challenges that health systems face in terms of distance and access to health services has encouraged the rapid development of digital health as a distinct field of practice, potentially transforming the delivery of health services (Haas 2016; Marcolino et al. 2018; WHO 2019). Digital health, and in particular, the use of mobile wireless technologies for health (commonly referred to as mHealth), is increasingly being used to directly communicate with patients, monitor their treatment, educate them on health issues worldwide, and facilitate targeted communications to selected groups or individuals through reminders and health promotion messaging.

Overall, there is widespread acknowledgement of the potential of this approach for broadening access to health information, increasing knowledge about health and health-seeking behaviors, and stimulating demand for services. This is especially the case for behavior change communication and the dissemination of information about available services. Mobile technology provides a means for health care systems to reach a wider range of potential patients. A diverse range of approaches have been used to achieve these goals, including voice communication, text messaging, and short message service, interactive voice response, multimedia message services, use of online support and communication groups, and online games (Marcolino et al. 2018; WHO 2019).

Although the promise of digital health, and mHealth in particular, for improving access to health-related information and overall quality of care is clear, the evidence of its effectiveness is generally mixed (Haas 2016; WHO 2019). Research on the effect of mHealth interventions on family planning and other sexual and reproductive health (SRH) outcomes suggests that while these interventions can increase knowledge, the effects on more ‘downstream’ behaviors such as contraceptive use, the likelihood of discussing family planning with a partner, or visiting a clinic to discuss family planning are typically much more limited (Alhassan et al. 2019; Johnson et al. 2017; Lopez et al. 2014; Pedrana et al. 2020; Rokicki et al. 2017). The effects of mHealth interventions on maternal and child health outcomes are generally more comprehensive, and often lead to improvements in both knowledge and care-seeking behaviors, such as obstetric care visits, antenatal care (ANC) visits, post-delivery baby follow-up, and healthcare utilization among children (Datta, Ranganathan, and Sivakumar 2014; Entsieh, Emmelin, and Pettersson 2015; Huq et al. 2014; Lund et al. 2014; Mushamiri et al. 2015; Simonyan et al. 2013), as well the early initiation of breastfeeding and exclusive breastfeeding (Flax et al. 2014; Jiang et al. 2014; Maslowsky et al. 2016).

Digital health has the potential to address some challenges in improving health outcomes, although it shares many of the underlying challenges faced by health system intervention in general. These include poor

infrastructure, affordability, and accessibility for persons of minority and disability status, lack of education and/or technological literacy, and sociocultural norms (Acilar and Sæbø 2021; Borgonovi et al. 2018; WHO 2019). Women especially are systematically disadvantaged in terms of access to digital resources, a phenomenon that is referred to as the ‘gender digital divide’ (Acilar and Sæbø 2021; Borgonovi et al. 2018; MacQuarrie, Edmeades, and Rosenberg 2022). At the global level, women are still less likely to own a basic mobile phone than men, and are even less likely to own a smartphone or use the Internet (Borgonovi et al. 2018). The women who use the Internet also use it with less frequency and intensity than men (Borgonovi et al. 2018). A recent study that used DHS data in 23 countries found that while overall access to and use of digital resources was strongly influenced by age, wealth, and living in a rural or urban area, women systematically lagged behind men and that residence and wealth gaps were often wider for women (MacQuarrie, Edmeades, and Rosenberg 2022).

Although the gender digital divide poses problems for both the expansion and potential effectiveness of digital health efforts, less is known about how health outcomes are influenced by access to digital resources, even in the absence of a coordinated digital health intervention. There are a number of reasons why access to and use of digital resources, such as a mobile phone or the Internet, might be related to health outcomes. Most importantly, these resources facilitate the flow of information (correct or incorrect) between individuals, groups, and even globally. Women with a mobile phone may be more able to talk to friends and family to obtain health-related advice, or to consult with a medical provider. More sophisticated users of these technologies may be able to consult the Internet or to take advantage of websites or applications that facilitate the use of medical services. In situations where telemedicine is available, these technologies may also facilitate the actual use of services, which reduces travel time and costs and provides remote areas with access to basic advice and services. Finally, because both the access and use of digital resources and health are strongly influenced by wealth and residence (urban vs rural) in many settings, it may be that at least some of the relationship between access to digital resources and use and health actually reflects differences in wealth and residence, among other factors.

In this study, we aim to address this gap in the literature by exploring the relationships between three measures of access to and use of digital technology and a range of health outcomes for both women and men: personal ownership of a mobile phone, use of a mobile phone for financial transactions, and the frequency of Internet use. Using data from five countries with different health and ICT environments, we examine how access to and use of digital resources are related to health knowledge and behavior, with a focus on SRH, maternal and child health, and help-seeking after domestic violence.

2 DATA AND METHODS

2.1 Data

This study uses data from five Demographic Health Surveys (DHS), and builds on the findings of MacQuarrie, Edmeades, and Rosenberg (2022). We selected the countries based on the levels of use of digital technologies and the observed gap between men and women’s use of these technologies. In addition, each DHS met the following criteria:

- Was conducted since 2015 with the data publicly released by March 2022
- Administered both the Woman’s and Man’s Questionnaires
- Contained complete data on key outcome and digital variables of interest
- Included the domestic violence module

The surveys and their sample sizes are listed in Table 1. The DHS surveys are nationally representative, household-based surveys that collect data from the household, all de facto women age 15–49, and frequently all de facto men age 15–59. In these analyses, the men’s sample is restricted to those age 15–49, which allows for direct comparison with the women’s sample. Sample sizes for the men’s surveys are frequently smaller than the women’s surveys because they are often administered in a sub-sample of one-half or one-third of selected households, while the women’s survey is administered in all the selected households. All data are made publicly available in standard recode data files in a variety of formats from <https://www.dhsprogram.com/Data/>.

Table 1 Study surveys and sample sizes

Survey	Number of women age 15–49 (weighted)	Number of men age 15–49 (weighted) ^a
Liberia 2019–20	8,065	3,760
Nepal 2016	12,862	4,063
Nigeria 2018	41,821	11,845
Rwanda 2019–20	14,634	5,833
Senegal 2018	9,414	3,394

^a The Liberia 2019–20, Nigeria 2018 and Rwanda 2019–20 surveys sampled men age 15–59, although the analysis is restricted to those aged 15–49.

2.2 Research Questions

The goal of this study is to increase our understanding of the association between access to and use of digital resources and multiple women and men’s health outcomes.

We are guided by three related research questions:

1. What commonalities and differences are there in the strength and direction of the statistical association between individual measures of digital resource access/use and individual health outcomes across the five countries? For example, is the frequency of Internet use associated with modern contraceptive use in the same way in the five countries?
2. Is the relationship between the health outcomes and each of the measures of digital resource access and use the same, or does it vary depending on the measure?
3. Where it is possible to compare outcomes, does the association between digital resource access/use and health outcomes differ for men and women? What are the similarities and differences?

We then turn to examining the broader patterns that emerge from the analysis, and focusing on the commonalities and differences across health outcomes. This is guided by the following two research questions:

1. What commonalities and differences are there in the strength and direction of the statistical association between individual measures of digital resources and all the health outcomes, and does this vary by country? For example, does owning a mobile phone have a positive and statistically significant association with all the health outcomes, or only some? Is there a general pattern across countries, or are some very different from others?
2. As a group, are there commonalities and differences in the associations between the measures of digital resources and the health outcomes? For example, do they all have the same general association with health outcomes, or do they appear to be related to them in different ways?

This approach allows for the exploration of both the unique relationships that individual types of digital resources may have with specific outcomes, as well as the broader general relationship between access and use of the resources and the range of health outcomes included in the study. Finally, we placed these results in the context of the gender digital divide to highlight the impact this divide may have on women's health and the potential implications for policy and programming.

2.3 Measures

2.3.1 Health outcome measures

A wide range of health outcomes were identified as potentially being influenced by digital resource access and use, either because the outcomes are commonly targeted in mHealth interventions or because they were thought to be influenced by the additional access to information enabled by digital resources. The selected outcomes include reproductive health, maternal and child health/treatment, and access to and use of support networks for women who are experiencing domestic violence. More specifically, the health outcomes include:

Correct knowledge of the fertility cycle. This is based the respondent correctly identifying that a woman is more likely to become pregnant roughly halfway between one menstrual period and the next, as

opposed to other points in time.¹ These questions were asked of all women and men in the sample. The measure is coded as a dichotomous variable in the analyses, with those who had correct knowledge coded as a ‘1’ and those with incorrect knowledge as a ‘0’. Given the findings of prior research on the effects of digital health programs and interventions, we expect that greater access to and use of digital resources will be associated with higher levels of correct knowledge.

Current use of modern contraception. This refers to the type of contraceptive method (if any) women report that they or their partner were currently using that is considered a modern contraceptive method.² In all five countries, a modern contraceptive method is defined as one of the following: male and female sterilization, injectables, intrauterine devices, contraceptive pills, implants, female and male condoms, the standard days method, the lactational amenorrhea method, and emergency contraception. Nepal did not include female condom or standard days method as response options, while Senegal did not include the female condom. To more accurately capture current behavior, we restrict this variable to all women who were sexually active in the 12 months before the survey. The measure is coded as a dichotomous variable with those using a modern method coded as a ‘1’ and those who were not as a ‘0’. Based on the mixed findings in prior research that examined the effect of digital health programs and interventions on contraceptive behavior (as opposed to knowledge) (Johnson et al. 2017; Nulhakim and Samosir 2017; Rokicki et al. 2017), we expect this relationship to be either be positive (higher access/use of digital resources is associated with higher likelihood of using modern contraception) or that there be no statistical relationship, either negative or positive.

Use of condom at last sexual intercourse. In contrast to women, we focus on men’s use of condoms at last sexual intercourse rather than the overall use of a modern contraceptive method.³ This is for three reasons. First, given that the majority of modern contraceptive methods are female-controlled methods, men may not know what contraceptive method their partner may or may not be using. Second, there is some evidence that condom use is not always viewed through the lens of contraception, and is often considered a method of avoiding sexually transmitted diseases. Third, we hypothesize that access to information via digital sources is likely to have the most direct effect on men’s own behavior, rather than through their partner. This is a particularly relevant issue for condom use, which is a method controlled and influenced by men. To more accurately capture men’s current behavior, we restrict this variable to those men who were sexually active in the 12 months before the survey. The measure is coded as a dichotomous variable, with those reporting having used a condom at last sexual intercourse coded as ‘1’ and those who did not as a ‘0’. As with modern contraception for women, we expect that digital resource access/use will be either positively associated with condom use or that there be no statistical association between the two.

¹ The relevant survey questions are: Q240 (women)/Q304 (men). From one menstrual period to the next, are there certain days when a woman is more likely to become pregnant (Yes, No)?; and Q241 (women)/Q305 (men). Is this time just before her period begins, during her period, right after her period has ended, or halfway between two periods?

² The relevant survey questions from the Woman’s Questionnaire are: Q303 Are you or your partner currently doing something or using any method to delay or avoid getting pregnant (Yes, No)?; and Q304 Which method are you using (list of methods)?

³ This variable is based on a single question, which is asked for each of the three most recent sexual partners: Q417 The last time you had sexual intercourse with this person, was a condom used (Yes, No)?

Use of antenatal care (ANC) during pregnancy. All women who had a birth in the 5 years before the survey were asked about their use of ANC services, including the number of visits for each pregnancy.⁴ To capture a more consistent pattern of ANC use, we used a cutoff of four or more ANC visits, which created a dichotomous measure where those who reported four or more ANC visits during the most recent pregnancy are coded as ‘1’ and those who did not as a ‘0’. While the World Health Organization (WHO) currently recommends a minimum of eight ANC visits, the standard until 2016 was four. Many countries continue to informally rely on this as a standard of care, particularly at the time of the older DHS included in this study. Based on prior research, we expect that digital access/use will be positively associated with the likelihood that women had four or more ANC visits during their most recent pregnancy.

Iron supplementation during pregnancy. Similar to the measure of ANC use during pregnancy, all women with a birth in the past 5 years were asked about their use of iron supplements during each pregnancy.⁵ The measure is coded as a dichotomous variable, with those who reported buying or being given iron supplements coded as ‘1’ and those who did not as ‘0’. Based on prior research, we expect that digital access/use will be positively associated with the likelihood that women purchased or were given iron supplements during their most recent pregnancy.

Medical treatment of child illness (cough, fever, or diarrhea). Information was collected about recent experience (within past 2 weeks) with a range of child illnesses for all children born to surveyed women in the 5 years before the survey. More specifically, respondents were asked if each child had symptoms consistent with an acute respiratory infection (ARI), if they had a fever, or if they had diarrhea in the 2 weeks before the survey.⁶ If the child had experienced these illnesses, respondents were asked if they had sought advice or treatment and, if yes, the source of the advice or treatment. We focus here on if advice and/or treatment was sought from medical sources, either government or private. We began by combining the three types of questions, which resulted in a variable that indicates if the child experienced any ARI symptoms, fever, or diarrhea in the 2 weeks before the survey. We then used the information on the sources of advice or treatment to create a final variable that indicates if advice or treatment were sought from a medical source. The resulting measure is coded as a dichotomous variable, with those children who had experienced any of these symptoms and then received medical advice or treatment coded as ‘1’ and those who experienced an illness but did not receive medical advice or treatment as a ‘0’. Based on prior research, we expect that digital access/use will be positively associated with the likelihood that medical care or advice was sought for children who recently had ARI symptoms, fever, or diarrhea symptoms.

Help-seeking for experience with physical or sexual violence. This captures if women who experienced physical or sexual violence in the 12 months before the survey then sought help or told

⁴The relevant survey question from the Woman’s Questionnaire is: Q412 How many times did you receive antenatal care during this pregnancy?

⁵ The relevant survey question from the Woman’s Questionnaire is: Q420 During this pregnancy, were you given or did you buy any iron tablets or iron syrup?

⁶ The relevant questions from the Woman’s Questionnaire are: Q608 Has (NAME) had diarrhea in the last 2 weeks?; Q618 Has (NAME) been ill with a fever at any time in the last 2 weeks?; Q620 Has (NAME) had an illness with a cough at any time in the last 2 weeks?; and Q621 Has (NAME) had fast, short, rapid breaths or difficulty breathing at any time in the last 2 weeks?

someone.⁷ In all five countries, physical violence included the following acts of violence: being pushed, shaken, having something thrown at you, being slapped, having your arm twisted, hair pulled, punched with a fist or with something that could hurt you, kicked, dragged, beaten up, choked, burned on purpose, and threatened or attacked with a knife, gun, or other weapon. Sexual violence includes being physically forced to have sexual intercourse, physically forced to perform other unwanted sexual acts, and being forced through threats or in any other way to perform unwanted sexual acts.

For these analyses, we created a single measure of experience with either physical or sexual violence in the past 12 months and then combined this with information on help-seeking. This resulted in a dichotomous measure in which those women who had experienced violence in the past 12 months and who did seek help or tell someone are coded as ‘1’ and those who experienced violence in the past 12 months but did *not* seek help or tell someone coded as ‘0’. As a result, the analyses for this outcome are restricted to women who completed the domestic violence module and, among these women, had experienced either physical or sexual violence in the 12 months before the survey. While there is very little research examining the relationship between digital resource access/use and if women seek help or assistance, we anticipate the relationship to be positive, because greater access/use may facilitate women’s access to services and social support networks.

2.3.2 Independent variables

The primary independent variables of interest are those related to digital resources, although a number of additional variables were also controlled in the analyses to account for other factors that may influence the outcomes of interest. Since these outcomes are quite different, the full list of independent variables used in the multivariable regression models is not the same in all models.

Measures of access to and use of digital resources

Mobile phone ownership is asked of all women and men in the survey and simply captures if the respondent personally owns a mobile phone.⁸ Those who own a mobile phone are coded as ‘1’ while those who do not are coded as ‘0’.

Use of mobile phone for financial transactions. Those respondents who own a mobile phone are asked if they use the phone for mobile transactions, which is a potentially important measure of more complex use of mobile technology.⁹ This question is asked without regard to if the respondent has an account at a bank or other type of financial institution. All respondents who report using their mobile for financial

⁷ The relevant questions from the domestic violence module are: DV08A Did your (last) (husband/male partner) ever do any of the following things to you [list of acts of physical or sexual violence]?; DV08B How often did this happen during the last 12 months: often, only sometimes, or not at all?; DV32 Thinking about what you yourself have experienced among the different things we have been talking about, have you ever tried to seek help?; and DV33 From whom have you sought help [list of people or organizations]?

⁸ The relevant question in both the Woman’s and Man’s Questionnaires is: Q116 “Do you own a mobile telephone? (yes/no).”

⁹ The relevant question in both the Woman’s and Man’s Questionnaires is: Q117, “Do you use your mobile phone for any financial transactions? (yes/no).”

transactions are coded as '1' and all cases who either do not own a mobile phone or report they do not use it for financial transactions are coded as '0'.

Frequency of Internet use. This is captured through a series of questions that end with a question about the frequency of Internet use over the month during the survey.¹⁰ We hypothesize that the main influence of Internet use is through increasing access to information and focus on the most frequent users, comparing them to those who use the Internet less frequently. The resulting measure is a dichotomous variable coded as '1' if the respondent used the Internet at least once a week or almost every day in the last month and 0 otherwise.

General control variables

The additional control variables vary according to the specific outcome being examined (see Table 2), and include the following:

Age. Respondents are categorized into groups based on completed age at time of interview: age 15–19, 20–29, 30–39, and 40–49. This variable is included because prior research has demonstrated a strong relationship between age and both digital resource access and use and health outcomes, and is therefore important to consider in our statistical analyses.

Number of living children is coded as '0' if the respondent has no living children at the time of the survey; '1' if they have one or two children; '2' if they have three to five children; and '3' if they have more than five living children. This variable is included to account for shifts in parental knowledge and behavior as they have more experience with child illness, and for the potential competition that children face for household resources when they have siblings.

Desire for additional children captures both a desire for additional children and when the respondent would want those children. The variable is coded as '0' if the respondent reports wanting no more children; '1' wants more children within the next 2 years; '2' wants more but in two or more years; '3' wants more but is unsure about timing; '4' if they are undecided; and '5' if the respondent believes they or their partner are sterile or infecund. This variable is included to account for variation in health preferences and behavior as women and men progress through their reproductive life course.

Highest educational level attained is coded as '0' if the respondent has no formal education; '1' if the highest level attained is primary school; '2' if the highest level is secondary school; and '3' if they have attained post-secondary education. This variable is included because prior research has demonstrated a strong relationship between education, digital resource access and use, and health outcomes.

Employment status is intended to capture if the respondent works and, if so, if they are paid in cash for that work. The variable is coded as '0' if they do not work; '1' if they work but receive no cash payment; and '2' if they work and receive cash payment in return. As with education, employment status is likely to influence both digital resource access and use and health outcomes.

¹⁰ Q119 Have you ever used the Internet? (yes/no); Q120 In the last 12 months, have you used the Internet? (yes/no); Q121 During the last one month, how often did you use the Internet: almost every day, at least once a week, less than once a week, or not at all?

Marital status is coded as ‘1’ if the respondent has never married; ‘2’ if the respondent is currently married or living as if married; and ‘3’ if the respondent is formally married (separated, divorced, or widowed). Since marital status has been demonstrated in prior research to be a strong determinant of health behavior and may influence access to and use of digital resources, it is therefore important to consider in our statistical analyses.

Residence is coded as 1 if the respondent resides in an urban area and 2 in a rural area, as designated by the survey’s sampling frame, which typically is the most recent census.

Household wealth quintile. Relative household wealth is calculated as a numerical index based on a range of assets owned in the household, housing materials, as well as a source of water and toilet facilities (Rutstein and Johnson 2004). The same index value is assigned to every resident of the household. This index is grouped in quintiles and labeled as poorest, poorer, middle, richer, and richest. Prior research has shown that wealth is strongly associated with both digital resource access/use and health outcomes.

Two variables are included only in the analyses focused on women’s use of modern contraception:

Engagement in household decision-making is a continuous variable constructed by summing the number of household decisions (about her health, making large household purchases, visits to family or relatives, and spending money earned by the husband/partner) that women reported either being made mainly by her or jointly with her husband or partner. A large body of research has demonstrated the importance of women’s engagement in household and other decisions to her overall empowerment, which may influence both the access/use of digital resources and health outcomes, particularly as they relate to SRH.

Engagement in contraceptive decision-making is measured for currently married or cohabiting women and is coded as ‘1’ if the women reports making either the decision to use or not to use contraceptive mainly herself; ‘2’ if the decision is made mainly by her husband or partner; ‘3’ if this is mainly a joint decision; and ‘6’ if another person made the decision. As with general household decision-making, this variable is an important indicator of agency and empowerment, which may be of particular importance to SRH outcomes.

Another variable, **Sexual activity in past 12 months**, is included only in the models of women’s use of modern contraception and men’s use of a condom the last time they had sexual intercourse. This variable is coded as ‘1’ if the respondent reports having had sexual intercourse in the past 12 months and ‘0’ if they have not. This is particularly relevant for contraceptive and condom use, because those who are not sexually active may not feel the need to protect themselves from unintended pregnancies or sexually transmitted diseases.

Three variables are included only in the analyses focused on help-seeking after experience with domestic violence:

Parental violence refers to women’s experiences with witnessing domestic violence during childhood, which prior research has shown influences women’s likelihood of experiencing violence in adulthood

and may also influence her help-seeking behavior. This variable is coded '0' if women did not report their father having beat their mother and '1' if they did.

Perpetrator of violence was intimate partner indicates if the perpetrator of the physical or sexual violence experienced by women in the 12 months before the survey was an intimate partner (current or former husband/partner/boyfriend). This is coded as a '0' if the perpetrator was not an intimate partner and as a '1' if he/she was.

Attitudes towards violence are measured by summing the number of hypothetical events that the respondent agreed would justify domestic violence (going out without telling husband/partner, neglecting children, arguing with husband/partner, refusing to have sex with husband/partner, and burning food). This variable was coded as '0' if the respondent did not agree with any statements; '1' if they agreed with one or two; '2' if they agreed with three to five; and '3' if they agreed with all five statements. Prior research has shown that women's responses to domestic violence are shaped by their own experiences as children and may influence help-seeking when they become victims of violence.

Two variables are included only in the analyses focused on the medical treatment of child illness (ARI, fever, or diarrhea), which focuses on the children of respondents rather than the respondents themselves:

Age of the child is a measure constructed only for children born to surveyed women in the past 5 years who are still living at the time of the survey. This is a continuous variable ranging between 0 (less than one year) and 4. This variable is included primarily to account for the differences by age in the likelihood of experiencing childhood illnesses and their potential severity, which may influence the use of health services independently of their mother's digital resource access/use.

Sex of the child is a measure constructed only for children born to surveyed women in the past 5 years who are still living and is coded '1' if the child is male and '2' if the child is female. This variable is included to account for potential differences in the likelihood of parents seeking healthcare in response to childhood illness for boys and girls, a potentially important issue in contexts where preference for sons and discrimination against girls is common.

2.4 Analytical Strategy

We conducted multivariable logistic regression to examine the statistical relationships between each of the outcomes discussed above and the three measures of access to and use of digital resources, adjusted for survey design. The outcome variables draw from different populations within the DHS sample, as shown in Table 2.

Table 2 **Analyses sample restrictions, by outcome of interest**

Outcome	Analysis Sample Restrictions
Correct knowledge of the fertility cycle	All women and men age 15–49
Current use of modern contraception	All currently married or cohabiting, sexually active (in past year) women age 15–49
Use of condom at last sexual intercourse	All sexually active (in past year) men age 15–49
Use of antenatal care during pregnancy	All currently married or cohabiting women age 15–49 who had a birth in past 5 years
Iron supplementation during pregnancy	All currently married or cohabiting women age 15–49 who had a birth in past 5 years
Medical treatment of child illness	All living children born to women age 15–49 in past 5 years
Help-seeking for experience with physical or sexual violence	All women who completed the Domestic Violence module and who had experienced either physical or sexual violence in the last 12 months

To explore the relationship of each measure of access to and use of digital resources with the outcomes of interest, we conducted separate regressions for each outcome, varying only the measure of digital resource included as an independent variable in the model. We also estimated separate models for each survey, rather than pooling data across countries.

To isolate the independent relationship between digital access and use and health outcomes, we controlled for a wide range of other factors that may influence individual health outcomes. The additional control variables included in each regression model vary according to the outcome being examined and is driven primarily by existing research that has demonstrated their importance to each outcome and by the subpopulations for which the data were available. For example, since the data required for measuring engagement in household decision-making is collected only from married women, its inclusion in the models results in the exclusion of unmarried women. The same general control variables are included in all models with a specific outcome, regardless of the measure of digital resource access and use included, as shown in Table 3.

All analysis was conducted with Stata 17 and are adjusted for survey design.

Table 3 Control variables included in regression models, by outcome of interest

Variable	Sexually active in past 12 months	Correct knowledge of fertility cycle	Current use of modern contraception	Use of condom at last sexual intercourse	Use of antenatal care during pregnancy	Iron supplementation during pregnancy	Medical treatment of child illness	Help-seeking for experience with physical or sexual violence
Respondent age	X	X	X	X	X	X	X	X
Age of child							X	
Sex of child							X	
Number of living children	X	X	X	X	X	X	X	X
Desire for additional children	X	X	X	X	X	X	X	X
Education	X	X	X	X	X	X	X	X
Employment status	X	X	X	X	X	X	X	X
Marital status	X	X	X	X	X	X	X	X
Household decision-making			X					
Contraceptive decision-making			X					
Parental violence								X
Attitudes towards violence								X
Residence	X	X	X	X	X	X	X	X
Region	X	X	X	X	X	X	X	X
Household wealth	X	X	X	X	X	X	X	X

3 RESULTS

This section presents the results of the regression analyses conducted to explore the relationship between access to and use of digital resources and the selected health outcomes. We begin by exploring the relationship between each measure of digital resource access/use and the full range of health outcomes. We then turn to examining the broader patterns that emerge from the analysis. While the regression models include a variety of covariates that may be of interest, we focus here on the effect of the measures of digital resource access and use (see Appendix A for the full regression tables).

We present adjusted odds ratios for each outcome, along with the 95% confidence interval for the point estimate. The odds ratios represent the ‘odds’ or likelihood that an individual experienced the outcome if they had access/use of the digital resource being examined, as compared to if they did not. An odds ratio that is greater than one indicates greater odds that they will experience the outcome, while an odds ratio below one indicates lower odds and an odds ratio of one indicates equal chance. For example, an odds ratio of 1.3 associated with mobile phone ownership means that the odds of experiencing that outcome are 1.3 times higher for those that own a mobile phone than for those who do not.

3.1 Distribution of key dependent and independent variables

There is considerable variation across the study countries in the access and use of digital resources, as shown in Table 4. Ownership of mobile phones and frequency of use of the Internet are highest in Nepal for both women and men, although Nepal also has the lowest proportion who use their mobile phones for financial transactions. In contrast, Rwanda has among the lowest proportions of both men and women who own a mobile phone and use the Internet, but relatively high proportions who use their mobile phones for financial transactions. The proportions of men are higher than those of women for every measure in every country, which highlights the pervasive nature of the gender digital divide in these countries.

Table 4 Distribution of digital resources accessed or used, by country and sex

Survey	Women				Men			
	Proportion owning mobile phone	Proportion using mobile phone for financial transactions	Proportion using Internet at least once per week	Number of women age 15–49 (weighted)	Proportion owning mobile phone	Proportion using mobile phone for financial transactions	Proportion using Internet at least once per week	Number of men age 15–49 (weighted)
Liberia	46.7	24.1	17.1	8,065	60.6	30.5	26.7	3,760
Nepal	72.6	6.5	19.7	12,862	89.3	7.0	39.6	4,063
Nigeria	55.3	15.5	12.7	41,821	80.6	28.2	28.5	11,845
Rwanda	47.9	38.1	10.2	14,634	61.6	51.7	19.5	5,833
Senegal	70.8	35.3	29.2	9,414	83.3	38.0	32.8	3,394

The distribution for each key health outcome is shown in Table 5. When interpreting these figures, it is important to keep in mind the relative samples from which they are drawn. For example, the proportion of women attending four or more ANC visits during last pregnancy is taken from all women who had a birth in the 5 years before the survey, not all women.

As with the measures of digital resource access and use, there is considerable variation across the five countries. Correct knowledge of the fertility cycle is highest among women in Nepal (27%) and lowest in

Liberia (12%), although among men, Nepal has the lowest levels of correct knowledge (3%) and Rwanda the highest (27%). In Nepal, Nigeria, and Senegal, the proportion of women with correct knowledge is much higher than that of men, while in Rwanda the reverse is true, with the levels of knowledge being almost equivalent in Liberia. Modern contraceptive use among women is highest in Nepal (33%) and lowest in Nigeria (11%), while condom use at last sex was highest in Nepal and Nigeria (40%) and lowest in Liberia (19%). The highest proportion of women who had four or more ANC visits during their last pregnancy was in Liberia (87%) and lowest in Rwanda (47%). Liberia also had the highest proportion of women receiving iron supplementation during their last pregnancy (94%), while Nigeria had the lowest (69%). The country with the highest proportion of children who had ARI, fever, or diarrhea symptoms for whom medical treatment or advice was sought was Rwanda (76%), while the level was lowest in Nigeria (48%). Finally, the highest proportion of women who reported seeking help or telling other people after domestic violence was in Rwanda (61%) and lowest in Nepal (34%).

Table 5 Distribution of health outcomes, by country

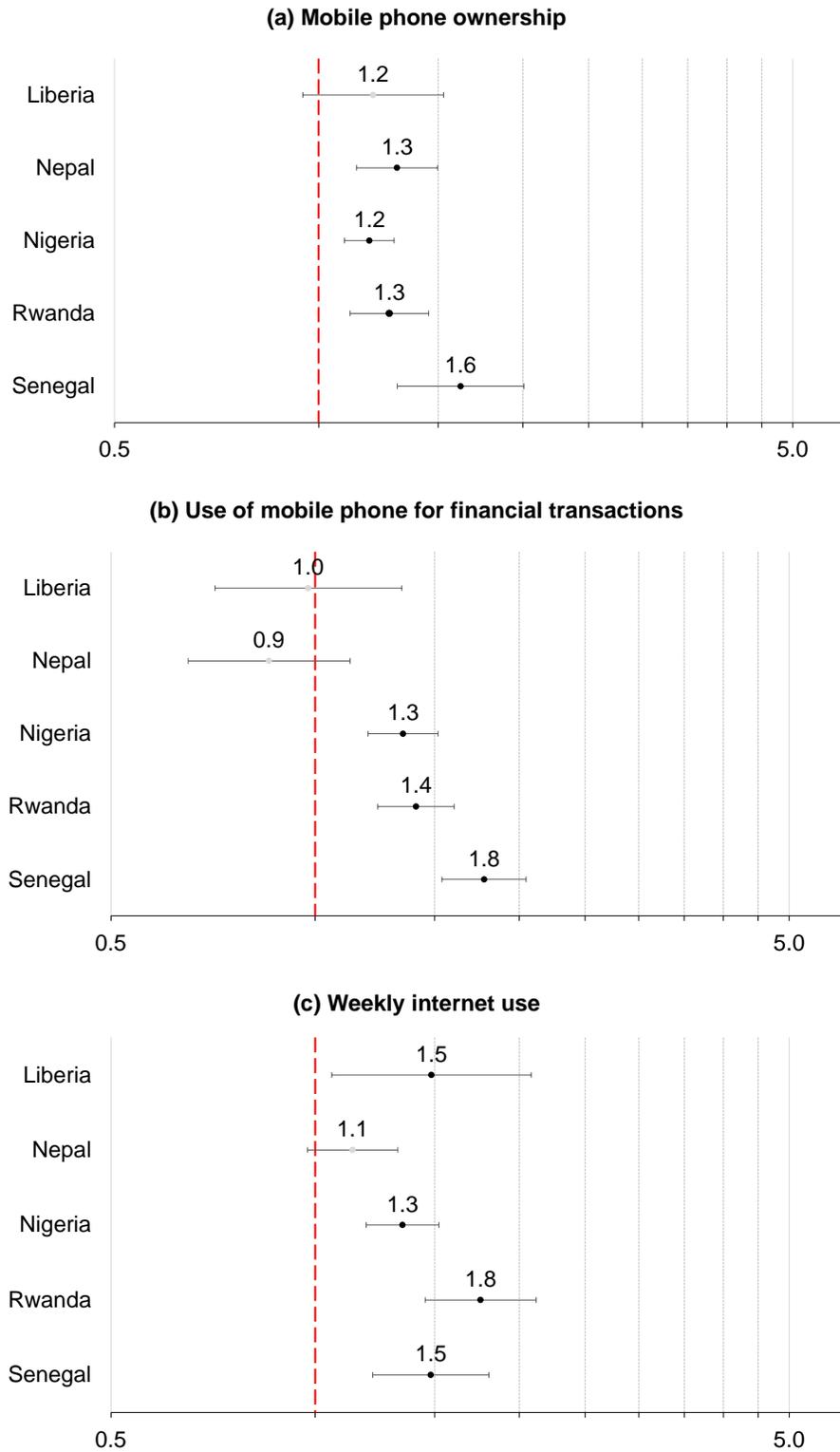
Health outcome	Proportions of men and women experiencing health outcome									
	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	Percent	Weighted N	Percent	Weighted N	Percent	Weighted N	Percent	Weighted N	Percent	Weighted N
Correct knowledge of fertility cycle (women)	11.5	8,065	26.7	12,862	24.2	41,821	16.6	14,634	21.6	9,414
Correct knowledge of fertility cycle (men)	13.9	5,833	3.4	3,760	10.7	3,394	27.0	4,063	9.7	11,845
Use of modern contraception (women)	25.3	8,065	33.2	12,862	10.5	41,821	35.1	14,634	18.2	9,414
Use of condom at last sex (men)	19.2	3,019	40.5	1,167	39.2	515	20.9	2,871	33.7	3,717
4+ ANC visits (women)	87.3	4,267	69.4	4,006	56.8	21,792	47.2	6,167	58.5	4,703
Iron supplementation (women)	93.8	4,267	90.9	4,006	69.3	21,792	80.6	6,167	96.3	4,703
Medical treatment or advice (children)	59.2	2,101	72.4	1,990	48.4	1,967	76.3	1,176	69.0	9,564
Sought help/advice following domestic violence	53.0	1,840	33.9	1,055	45.8	3,802	60.7	1,330	37.8	560

3.2 Correct Knowledge of the Fertility Cycle

3.2.1 Women

Research on the effect of digital health interventions suggests that one of the most direct ways in which access and use of digital resources can influence health outcomes is through facilitating the sharing of knowledge. As shown in Figure 1, the results of the multivariable analyses largely support this conclusion for women, although to varying degrees across the different measures of access to and use of digital resources and across the five countries (see Appendix Tables A1-A3 for the full regression results).

Figure 1 Association of digital resources with women’s correct knowledge of menstrual cycle. Odds ratios from separate multivariable logistic regressions.



Note: Models control for sexual activity, age, number of children, desire for additional children, education, employment, marital status, region, residence type, and household wealth.

Women who own a mobile phone in Rwanda, Senegal, Nepal, and Nigeria have significantly greater odds of reporting correct knowledge of the fertility cycle, with Liberia being the only country where this relationship was not statistically significant (Figure 1a). The association was strongest in Senegal, where the odds of correct knowledge of the fertility cycle were 1.6 times higher ($OR = 1.6, p = .000$) for those women who owned a mobile phone than for those who did not.

The association is more inconsistent when examining the use of mobile phones for financial transactions (Figure 1b). In Rwanda ($OR = 1.4, p = .000$), Senegal ($OR = 1.8, p = .000$), and Nigeria ($OR = 1.3, p = .000$), using your mobile phone for financial transactions was associated with higher odds of correct knowledge of the menstrual cycle, but not in Liberia ($OR = 1.0, p = .886$) or Nepal ($OR = 0.9, p = .264$).

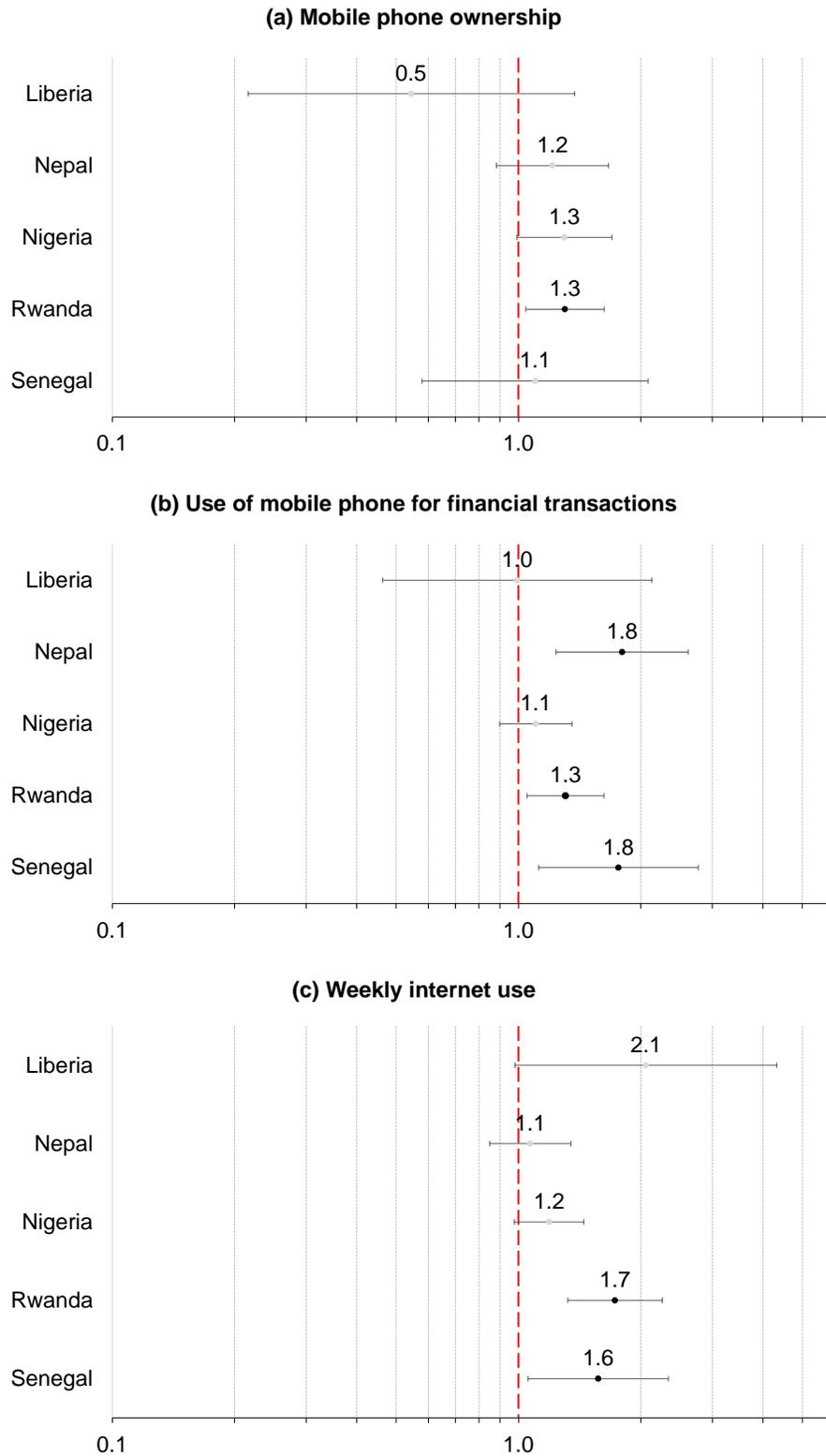
Finally, using the Internet at least once a week had a consistently positive association with correct knowledge of the fertility cycle. Frequent Internet use was positively associated with correct knowledge in Rwanda ($OR = 1.8, p = .000$), Liberia ($OR = 1.5, p = .022$), Senegal ($OR = 1.5, p = .000$), and Nigeria ($OR = 1.3, p = .000$), but not in Nepal ($OR = 1.1, p = .104$).

Overall, all three measures of access to and use of digital resources were significantly and positively associated with correct knowledge of the fertility cycle in Rwanda, Senegal and Nigeria, while only mobile phone ownership was in Nepal and only frequency of Internet use in Liberia.

3.2.2 Men

As shown in Figure 2, the association of digital resource access and use with correct knowledge of the fertility cycle shows a somewhat different pattern for men than for women (see Appendix Tables A4–A6 for the full regression results). Owning a mobile phone (Figure 2a) is significantly and positively associated with correct knowledge only in Rwanda ($OR = 1.3, p = .020$), and not in Liberia ($OR = 0.5, p = .197$), Senegal ($OR = 1.1, p = .772$), Nepal ($OR = 1.2, p = .233$), or Nigeria ($OR = 1.3, p = .058$).

Figure 2 Association of digital resources with men’s correct knowledge of menstrual cycle. Odds ratios from separate multivariable logistic regressions.



Note: Models control for sexual activity, age, number of children, education, employment, marital status, region, residence type, and household wealth.

The association between use of mobile phones for financial transactions (Figure 2b) is stronger overall than for ownership of a mobile phone. This relationship is statistically significant and positive in Rwanda ($OR = 1.3, p = .017$), Senegal ($OR = 1.8, p = .014$), and Nepal ($OR = 1.8, p = .002$), with only Liberia ($OR = 1.0, p = .986$) and Nigeria ($OR = 1.1, p = .344$) showing no association.

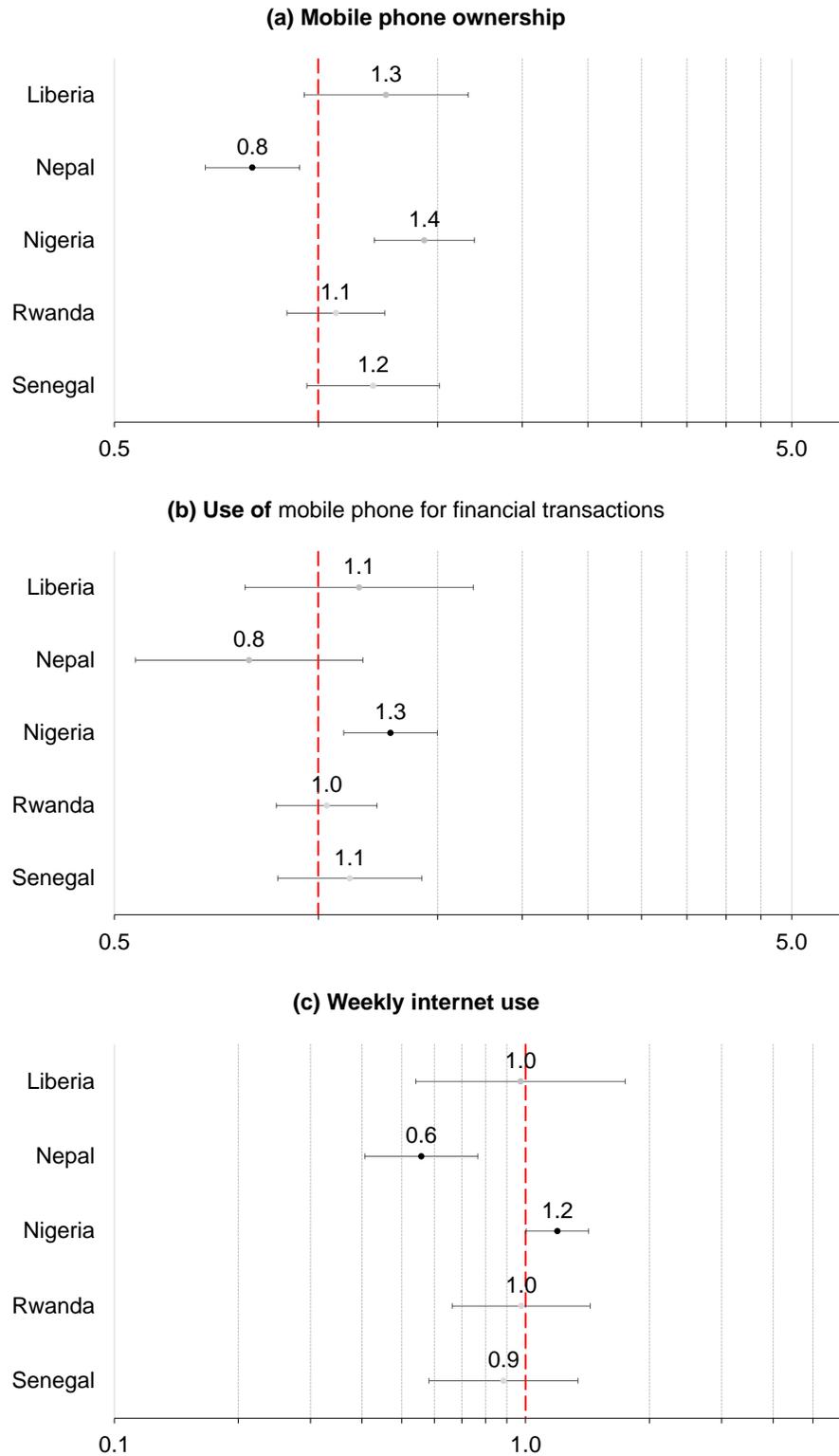
The frequency of Internet use has a more inconsistent association with correct knowledge among men than either mobile phone ownership or use of mobile phones for financial transactions (Figure 2c). Only Rwanda ($OR = 1.7, p = .000$) and Senegal ($OR = 2.1, p = .026$) have a statistically significant and positive association, while no association was found for Liberia ($OR = 2.1, p = .056$), Nepal ($OR = 1.1, p = .569$), or Nigeria ($OR = 1.2, p = .084$).

Overall, only men in Rwanda had statistically significant associations between correct knowledge and all three measures of digital resource access and use. Senegal had positive associations with both use of mobile phones for financial transactions and frequency of Internet use, and Nepal only for use of mobile phones for financial transactions. There were no statistically significant associations found for any of the measures in Liberia or Nigeria for men, despite both countries having a strong pattern of associations for women.

3.3 Current Use of Modern Contraception among Women

The association between resource access and use and current use of modern contraception is clearly weaker for women than for correct knowledge of the fertility cycle, as shown in Figure 3 (see Appendix Tables A7-A9 for the full regression results). This is consistent with prior research that demonstrates more limited effects on behavior. Owning a mobile phone (Figure 3a) was statistically and positively associated with modern contraceptive use in Nigeria ($OR = 1.4, p = .000$), while the association was significant but negative in Nepal ($OR = 0.8, p = .006$). No statistically significant association was found in Rwanda ($OR = 1.1, p = .478$), Liberia ($OR = 1.3, p = .105$), or Senegal ($OR = 1.2, p = .104$).

Figure 3 Association of digital resources with women's use of modern contraception (sexually active ever-married women only). Odds ratios from separate multivariable logistic regressions.



Note: Models control for age, number of children, desire for additional children, education, employment, household decision-making, contraceptive decision-making, region, residence type, and household wealth.

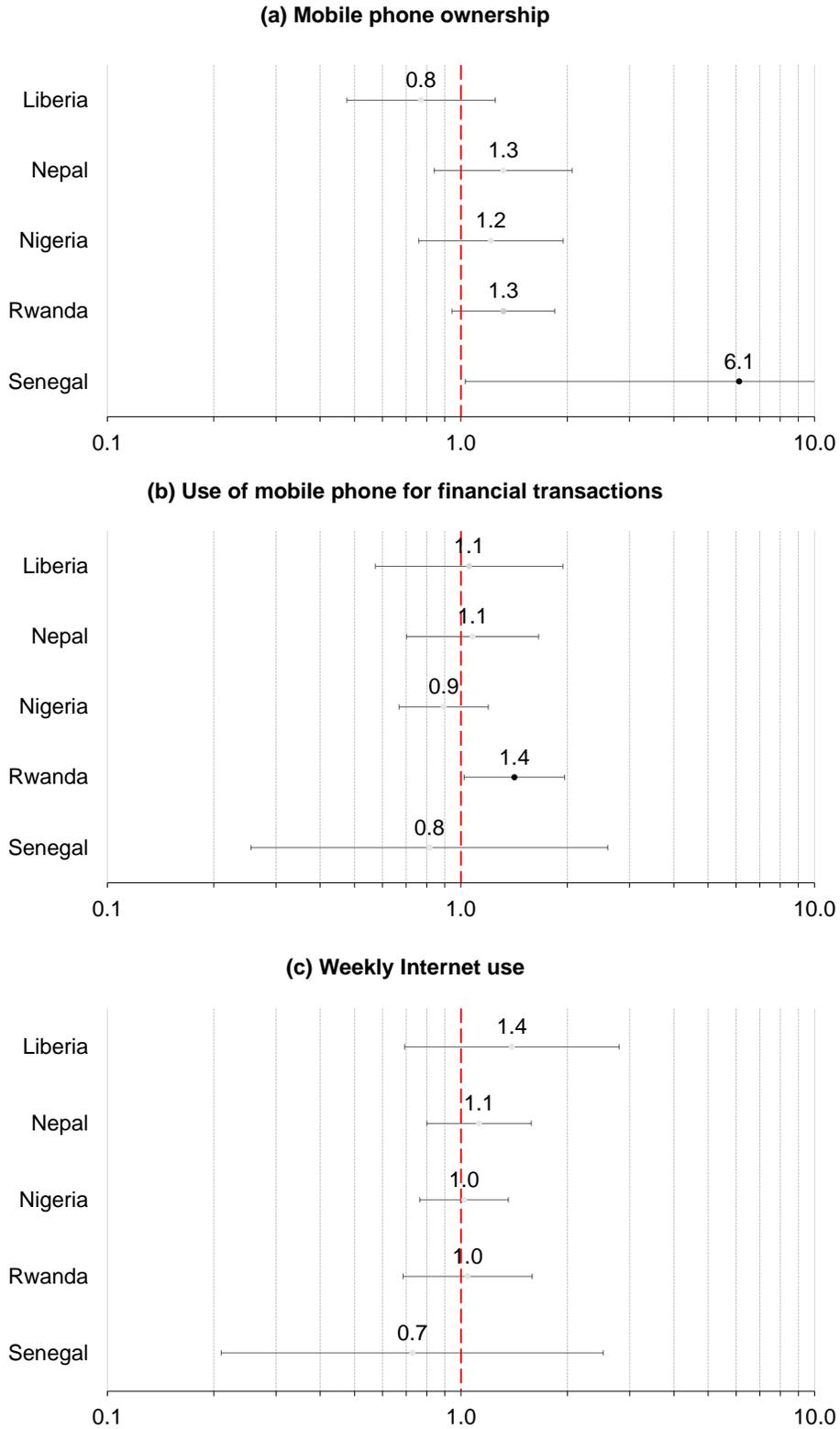
A similar pattern is evident for using mobile phones for financial transactions (Figure 2b). Only Nigeria has a statistically significant and positive association ($OR = 1.3, p = .003$), while no association was found for Rwanda ($OR = 1.0, p = .745$), Liberia ($OR = 1.1, p = .481$), Senegal ($OR = 1.1, p = .390$), or Nepal ($OR = 0.8, p = .232$).

The pattern of the association of modern contraceptive use and frequency of Internet use among women (Figure 2c) is similar to that observed for mobile phone ownership. For women in Nigeria, using the Internet at least once a week is positively associated with modern contraceptive use ($OR = 1.2, p = .045$), while the opposite is true for women in Nepal ($OR = 0.6, p = .000$). No statistically significant association was found in Rwanda ($OR = 1.0, p = .902$), Liberia ($OR = 1.0, p = .926$), or Senegal ($OR = 0.9, p = .559$).

3.4 Men's Use of Condom at Last Sexual Intercourse

In contrast to the patterns for women's use of modern contraception, there is very little association between any measure of digital resource access and use and men's use of condom at the last sexual intercourse, as shown in Figure 4 (see Appendix Tables A10-A12 for the full regression results). Ownership of a mobile phone (Figure 4a) was only significantly associated with condom use in Senegal ($OR = 6.1, p = .046$), but not in Rwanda ($OR = 1.3, p = .105$), Liberia ($OR = 0.8, p = .292$), Nepal ($OR = 1.3, p = .227$), or Nigeria ($OR = 1.2, p = .415$).

Figure 4 Association of digital resources with men’s use of condom at last sexual intercourse (sexually active men only). Odds ratios from separate multivariable logistic regressions.



Note: Models control for age, number of children, education, employment, marital status, region, residence type, and household wealth.

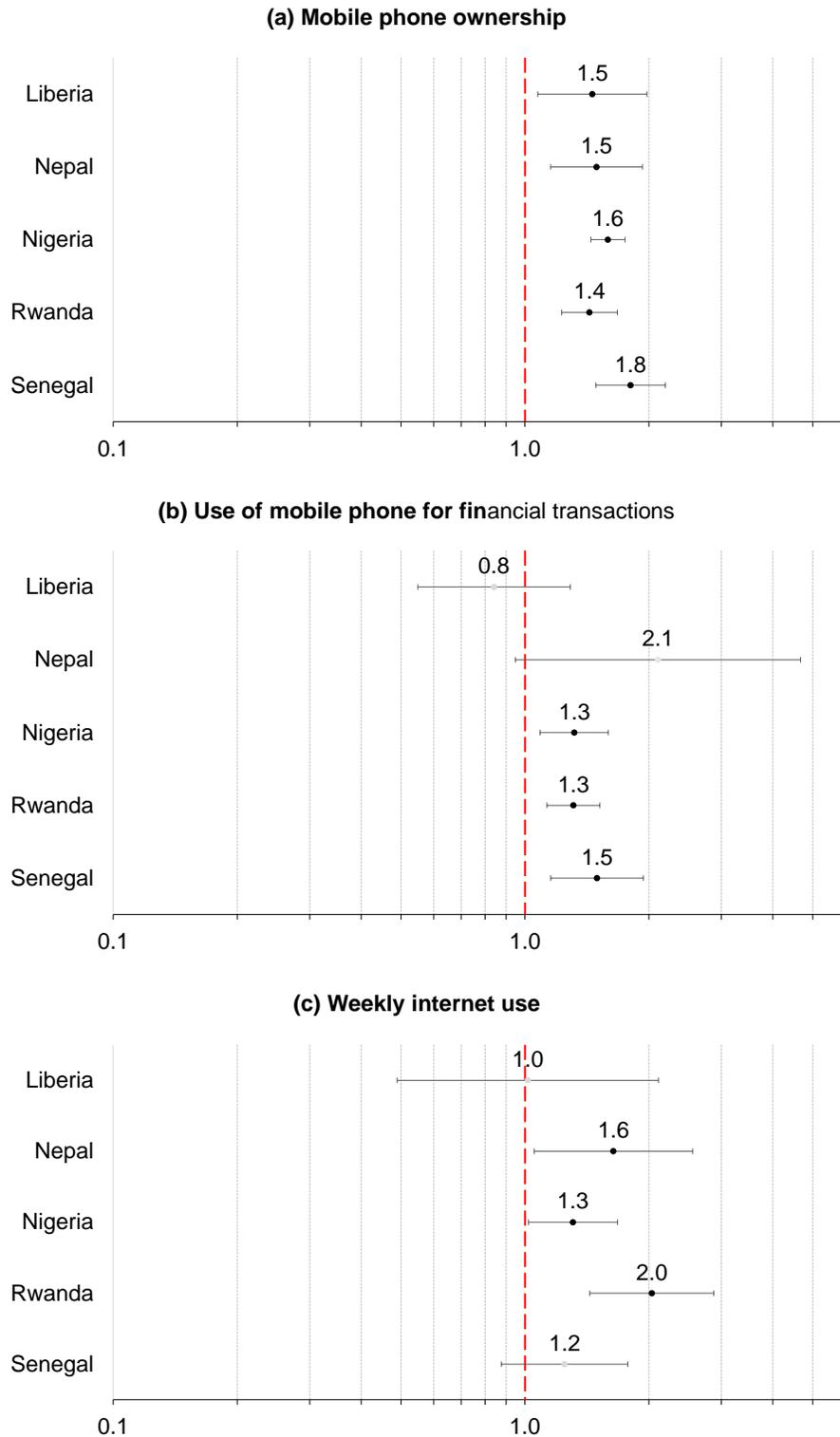
Use of mobile phone for financial transactions (Figure 4b) was only significantly associated with use of condom at last sex in Rwanda ($OR = 1.4, p = .037$). No statistically significant relationship was found in Liberia ($OR = 1.1, p = .863$), Senegal ($OR = 0.8, p = .729$), Nepal ($OR = 1.1, p = 0.728$), or Nigeria ($OR = 0.9, p = .448$).

There is also little evidence of a relationship between men's Internet use and their likelihood of using a condom in their last sexual experience (Figure 4c). No statistically significant relationship was found in Rwanda ($OR = 1.0, p = .839$), Liberia ($OR = 1.4, p = .350$), Senegal ($OR = 0.7, p = .615$), Nepal ($OR = 1.1, p = .497$), or Nigeria ($OR = 1.0, p = .893$).

3.5 Use of Antenatal Care during Pregnancy

The relationship between women's use of ANC during their last pregnancy and digital resource access and use is inconsistent, as shown in Figure 5 (see Appendix Tables A13-A15 for the full regression results). The most consistent associations are found when examining mobile phone ownership (Figure 6a), which had a positive and statistically significant association with women having had four or more ANC visits in their more recent pregnancy in all five countries. This association was strongest in Senegal ($OR = 1.8, p = .000$), with little difference between the size of the odd ratios for Rwanda ($OR = 1.4, p = .000$), Liberia ($OR = 1.5, p = .016$), Nepal ($OR = 1.5, p = .002$), or Nigeria ($OR = 1.6, p = .000$).

Figure 5 Association of mobile phone ownership with women having had four or more antenatal care visits (women with birth in past five years). Odds ratios from separate multivariable logistic regressions.



Note: Models control for sexual activity, age, number of children, desire for additional children, education, employment, marital status, region, residence type, and household wealth.

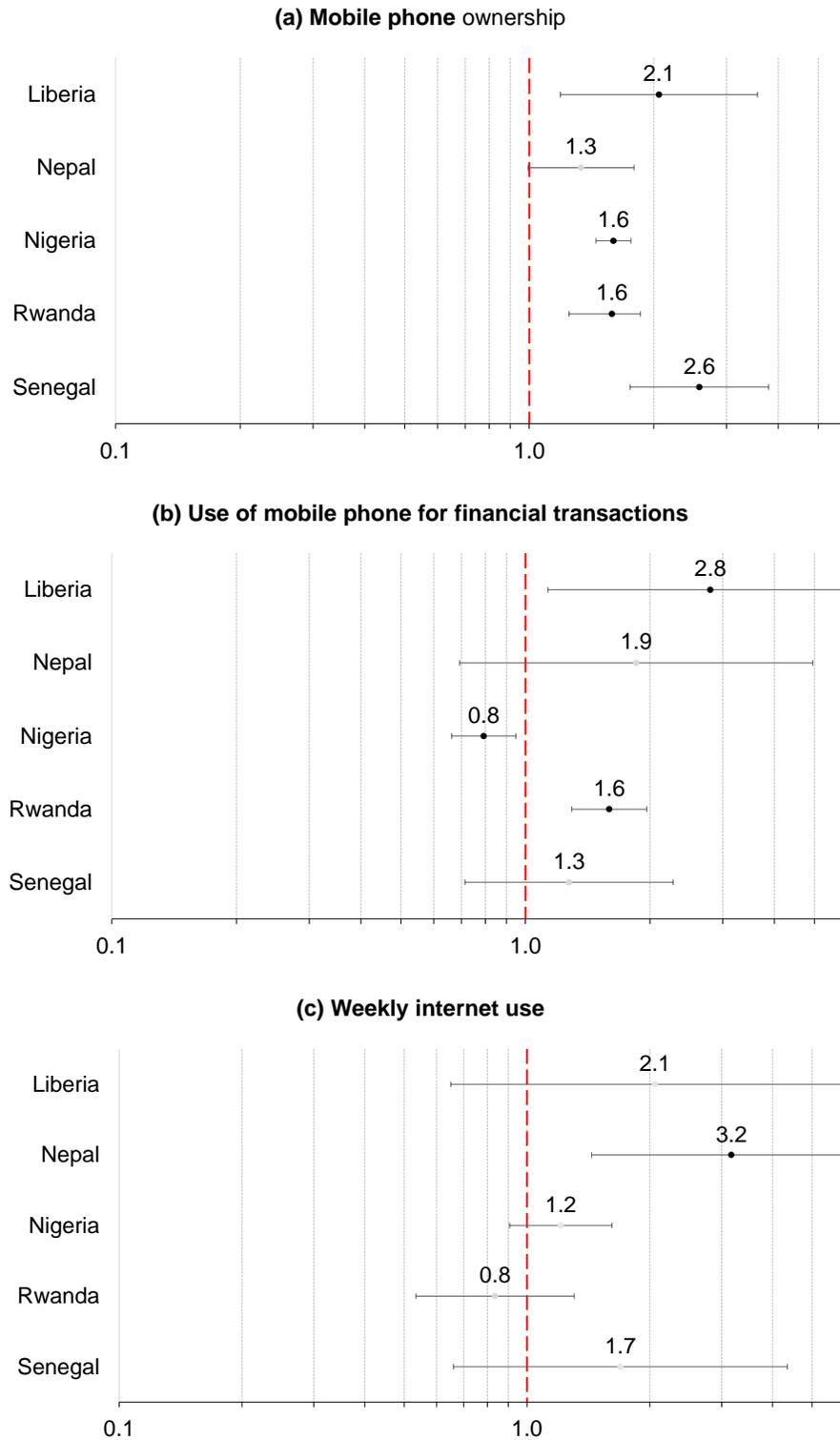
The association of use of mobile phones for financial transactions with ANC visits (Figure 5b) is more inconsistent than for ownership of mobile phones. The association is significant and positive in Rwanda ($OR = 1.3, p = .000$), Senegal ($OR = 1.5, p = .002$), and Nigeria ($OR = 1.6, p = .005$). No statistically significant association was found for Liberia ($OR = 0.8, p = .425$) or Nepal ($OR = 2.1, p = .067$).

A similar pattern was found for the relationship between frequency of Internet use and ANC visits, with three of the five countries having a significant and positive association (Figure 6c). In Rwanda ($OR = 2.0, p = .000$), Nepal ($OR = 1.6, p = .029$), and Nigeria ($OR = 1.3, p = .035$), using the Internet at least once a week over the past month was associated with higher odds of women having had four or more ANC visits, while the relationship was not statistically significant for Liberia ($OR = 1.0, p = .966$) or Senegal ($OR = 1.2, p = .216$).

3.6 Iron Supplementation during Pregnancy

The association between digital resource access and use and iron supplementation during pregnancy is inconsistent, as shown in Figure 6 (see Appendix Tables A16-A18 for the full regression results). Owning a mobile phone increased the odds of women in Rwanda ($OR = 1.6, p = .000$), Liberia ($OR = 2.1, p = .010$) Senegal ($OR = 2.6, p = .000$), and Nigeria ($OR = 1.6, p = .000$) purchasing or being given iron supplementation during their most recent pregnancy, but not in Nepal ($OR = 1.3, p = .056$) (Figure 6a).

Figure 6 Association of digital resources with women having taken iron supplements during most recent pregnancy (women with birth in past 5 years). Odds ratios from separate multivariable logistic regressions.



Note: Models control for sexual activity, age, number of children, desire for additional children, education, employment, marital status, region, residence type, and household wealth.

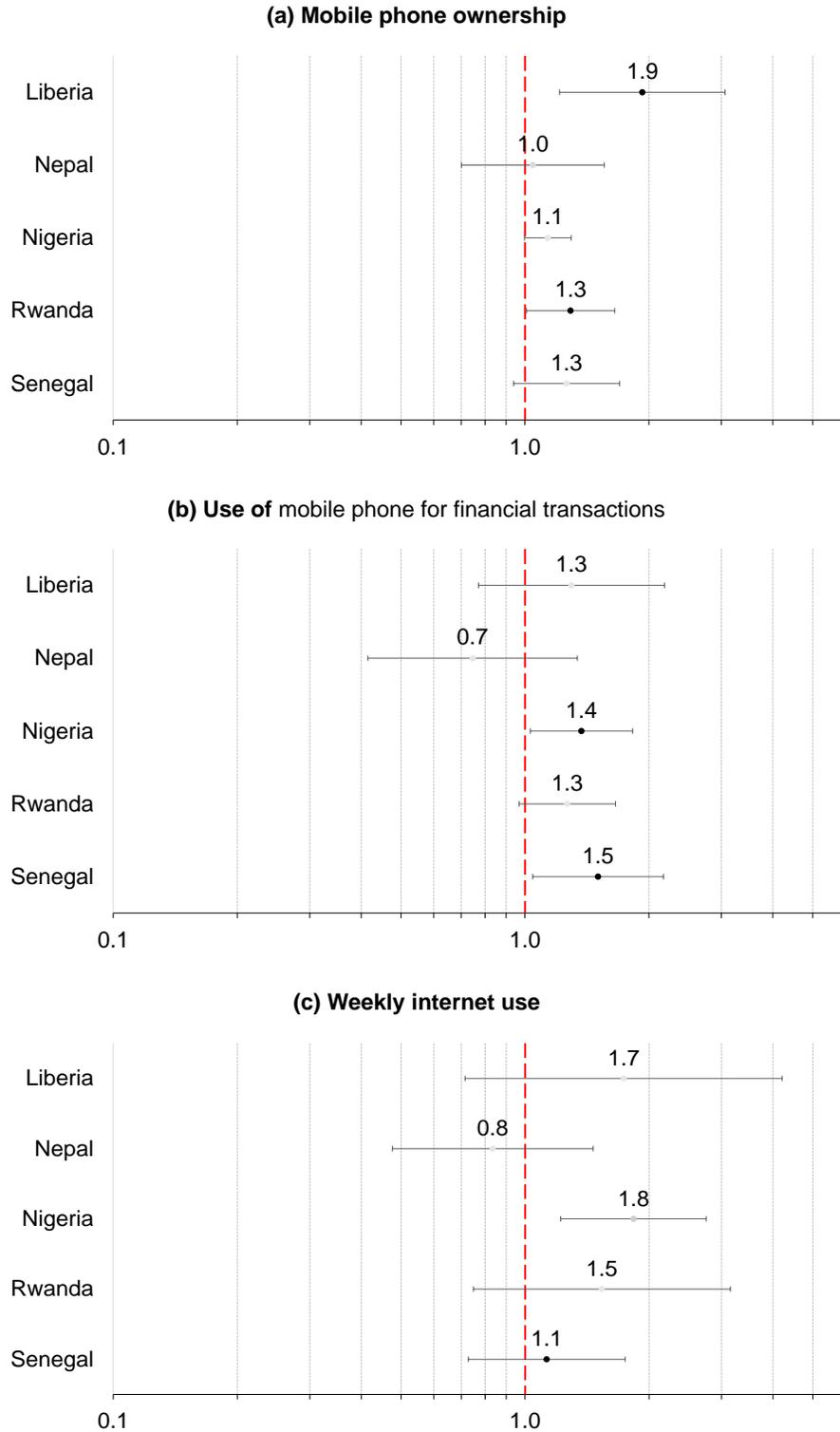
Use of mobile phone for financial transactions was only significantly and positively associated with iron supplementation in Rwanda ($OR=1.6, p = .000$) and Liberia ($OR = 2.8, p = .026$) (Figure 6b). The association was statistically significant in Nigeria, where the use of mobile phone for financial transactions lowered the odds of iron supplementation ($OR = 0.8, p = .011$). No statistically significant association was found in either Senegal ($OR = 1.3, p = .410$) or Nepal ($OR = 1.9, p = .218$).

While the association between using the Internet at least once a week was generally positive (Figure 6c), the relationship was only statistically significant in Nepal ($OR = 3.2, p = .004$). The odds of iron supplementation were not statistically related to frequency of Internet use in Rwanda ($OR = 0.8, p = .429$), Liberia ($OR = 2.1, p = .219$), Senegal ($OR = 1.7, p = .271$), or Nigeria ($OR = 1.2, p = .196$).

3.7 Medical Treatment of Child Illness

The models exploring the relationship between digital resource access and use and whether children who had been sick with ARI symptoms, fever or diarrhea received treatment or advice from a medical provider differ from the other models in that the unit of analysis is the child, rather than women or men. The measures of digital resource access and use therefore refer to the mother, and the results should be interpreted with this in mind. Overall, the regression results present a somewhat inconsistent association between digital resource access and use and if the child received medical treatment or advice, as shown in Figure 7 (see Appendix Tables A19-A21 for the full regression results).

Figure 7 Association of mother's digital resources with children receiving care or advice from a medical source for ARI, fever or diarrhea (children under age 5 who had ARI, fever, or diarrhea symptoms in past 2 weeks). Odds ratios from separate multivariable logistic regressions.



Note: Models control for age and sex of child and the following characteristics of mother: age, number of children, education, employment, marital status, region, residence type, and household wealth.

The odds of seeking medication care or advice for the sick child were higher when the child's mother owned a mobile phone in both Rwanda ($OR = 1.3, p = .043$) and Liberia ($OR = 1.9, p = .006$) (Figure 7a). No association was found in Senegal ($OR = 1.3, p = .122$), Nepal ($OR = 1.0, p = .827$), or Nigeria ($OR = 1.1, p = .056$).

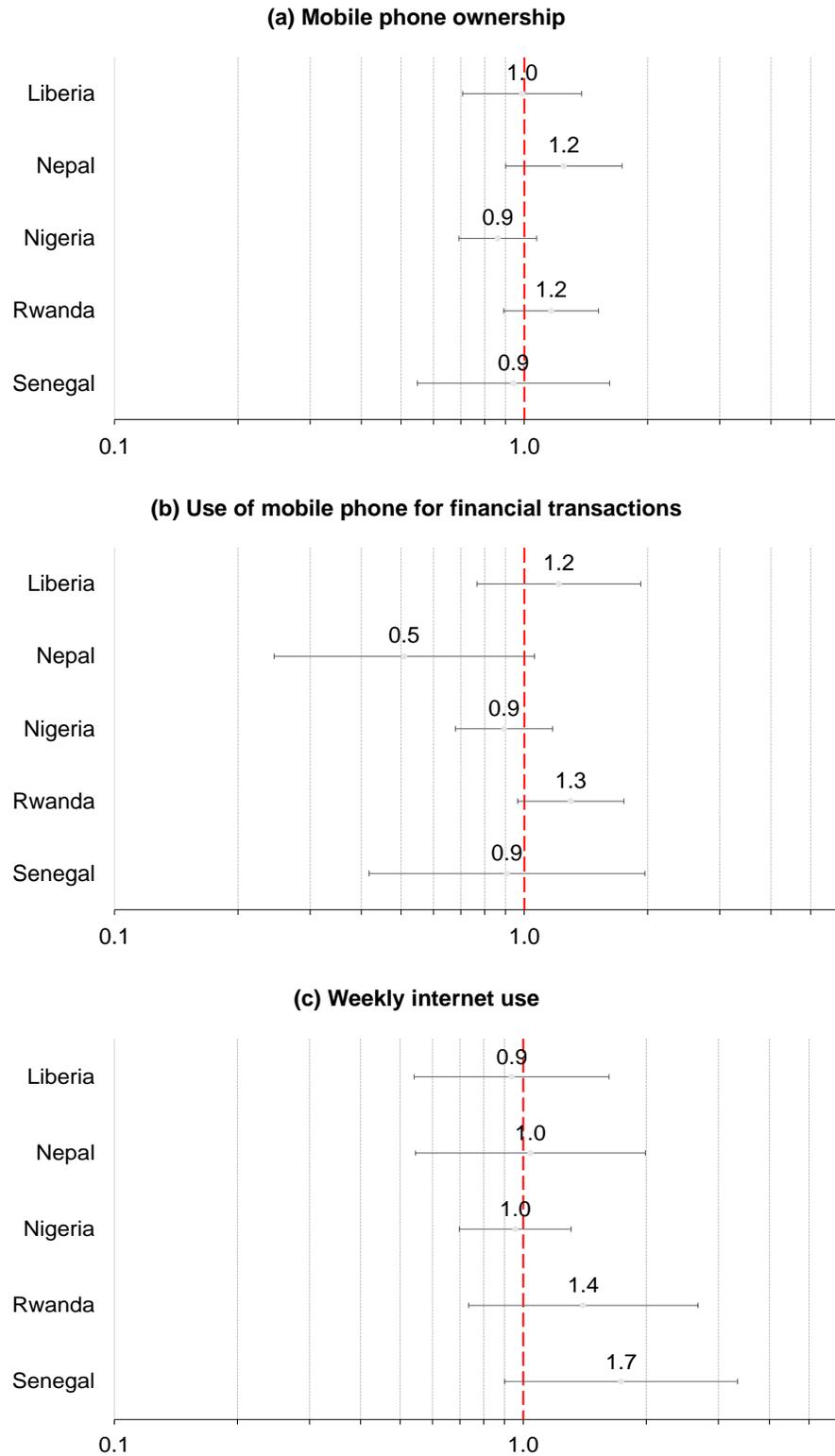
A similarly mixed picture is the case for the association between mother's use of her mobile phone for financial transactions and medical treatment or advice for illness (Figure 7b). The odds of receiving medical treatment or advice were higher and statistically significant in Senegal ($OR = 1.5, p = .028$) and Nigeria ($OR = 1.4, p = .031$), while no statistically significant association was found in Rwanda ($OR = 1.3, p = .086$), Liberia ($OR = 1.3, p = .326$), or Nepal ($OR = 0.7, p = .326$).

While weekly use of the Internet was generally associated with greater odds of seeking medical treatment or advice for sick children, this relationship was only statistically significant in Nigeria ($OR = 1.8, p = .004$) (Figure 7c). No statistically significant relationship was found for Rwanda ($OR = 1.5, p = .241$), Liberia ($OR = 1.7, p = .222$), Senegal ($OR = 1.1, p = .587$), or Nepal ($OR = 0.8, p = .526$).

3.8 Help-seeking for Experience with Physical or Sexual Violence

The regression results do not suggest that digital resource access and use are related to women's likelihood of seeking help or talking to someone after experiencing physical or sexual violence, as shown in Figure 8 (see Appendix Tables A22–A24 for the full regression results). None of the three measures of digital resource access and use have a statistically significant relationship with help-seeking in any country. The calculated odds ratios also all suggest that any effect is small.

Figure 8 Association of digital resources with women’s domestic violence help-seeking (women who had experienced violence in the past 12 months only). Odds ratios from separate multivariable logistic regressions.



Note: Models control for age, number of children, education, employment, marital status, region, residence type, and household wealth.

Ownership of a mobile phone is not associated with help-seeking to a statistically significant extent in Rwanda ($OR = 1.2, p = .266$), Liberia ($OR = 1.0, p = .944$), Senegal ($OR = 0.9, p = .824$), Nepal ($OR = 1.2, p = .182$), or Nigeria ($OR = 0.9, p = .181$) (Figure 8a). The same pattern is true for use of mobile phones for financial transactions, which is not associated with help-seeking in Rwanda ($OR = 1.3, p = .085$), Liberia ($OR = 1.2, p = .408$), Senegal ($OR = 0.9, p = .805$), Nepal ($OR = 0.5, p = .071$), or Nigeria ($OR = 0.9, p = .415$). Finally, weekly Internet use is also not associated with help-seeking in any of Rwanda ($OR = 1.4, p = .305$), Liberia ($OR = 0.9, p = .815$), Senegal ($OR = 1.7, p = .099$), Nepal ($OR = 1.0, p = .902$), or Nigeria ($OR = 1.0, p = .780$).

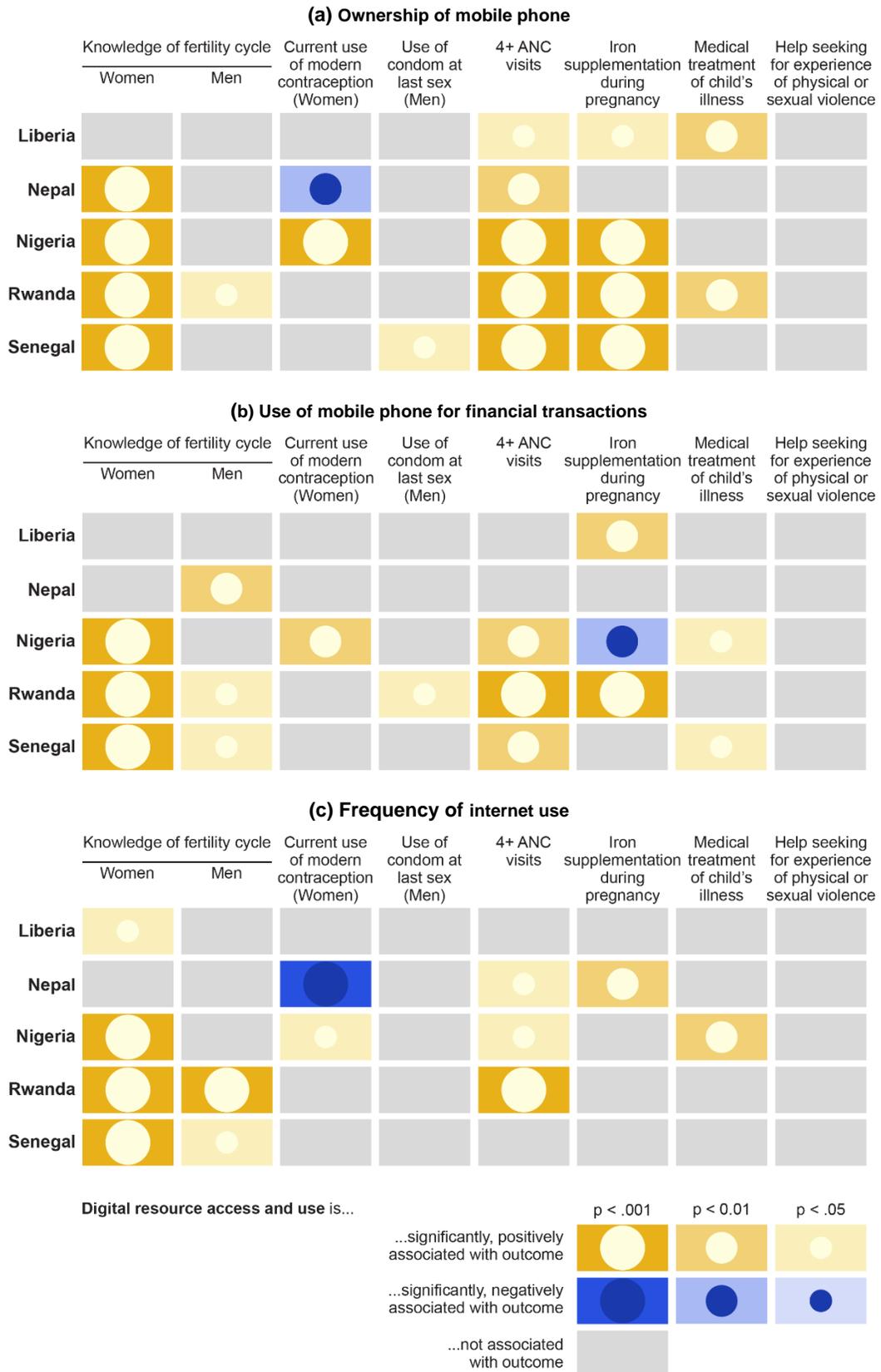
4 SUMMARY OF RESULTS

4.1 Summary of Relationship between Resource Access and Use and Health Outcomes

The findings suggest that there is considerable variation across countries in the association between specific measures of digital resource access and selected health outcomes, although a number of similarities are evident across the different country contexts. In this section, we summarize the findings for each measure of digital resource access and use across all the health outcomes and by country and identifying broader trends.

Figure 9 summarizes the findings by country for each of the three measures of digital resource access and use across all health outcomes. Yellow cells indicate significant results in which owning a mobile phone is positively associated with the outcome, while blue cells indicate a significant negative association. The size of the yellow or blue circle indicates the strength of the association, as indicated by the p value. Grey cells indicate that no association is detected.

Figure 9 Summary of associations between digital resource access and use and health outcomes



We begin by examining ownership of mobile phones, shown in Figure 9a. These results highlight three key outcomes where ownership of mobile phones is particularly strongly associated with favorable health outcomes, especially for women. In four of the five study countries (Nepal, Nigeria, Rwanda, and Senegal), women who own mobile phones had significantly greater odds of correctly knowing when during their menstrual cycle they were more likely to become pregnant. Women who owned mobile phones also had significantly higher odds of having had four or more ANC visits during their last pregnancy in all five countries. In four of the five countries (Nepal being the sole exception), women were also more likely to have purchased or been given iron supplements during their most recent pregnancy. Overall, owning a mobile phone was more commonly associated with positive health outcomes for women than for men, although this difference was primarily evident when examining the relationship with knowledge of the fertility cycle. Mobile phone ownership did not have a strong association overall with either use of modern contraception for women or use of a condom for men, seeking medical treatment or advice for a sick child, or help-seeking after experiences of violence.

When examining patterns across countries, mobile phone ownership was positively associated with the lowest number of health outcomes in Nepal (knowledge of the fertility cycle among women and ANC visits), which also had the only negative association (use of modern contraception among women). Rwanda, Nigeria, and Senegal all had significant positive associations with knowledge of the fertility cycle, ANC visits, and iron supplementation.

A broadly similar pattern is evident for the association between use of mobile phones for financial transactions and health outcomes (Figure 9b), with some important differences. While women's knowledge of the fertility cycle, ANC visits, and iron supplementation remain areas that are strongly associated with use of mobile phones for financial transactions, this is also much more strongly associated with men's knowledge of the fertility cycle than for mobile phone ownership. Rwanda, Senegal, and Nigeria continue to be the countries where the association is strongest across health outcomes, although in the case of Nigeria, this association is negative.

The analysis of the relationship between weekly Internet use and the various health outcomes is largely consistent with those for mobile phone ownership and use of mobile phones for financial transactions. The most consistent associations are found for women's knowledge of the fertility cycle and ANC visits, although there is much less evidence of a relationship with iron supplementation.

When viewed together, these findings suggest two broad patterns in terms of the association between digital resource access and use and the selected health outcomes. First, while the three measures of digital resources capture different aspects of access and use, their relationship with the group of health outcomes examined in this study is very similar. In particular, knowledge of the fertility cycle, ANC visits, and iron supplementation during pregnancy were consistently and positively associated with each measure. Second, in countries where one measure of digital resource access and use was associated with a wider range of health outcome, specifically Rwanda, Senegal and Nigeria, the other measures were also likely to be associated with a range of outcomes. In other words, some countries have a more consistent relationship between digital resource access and use and health outcomes, regardless of the specific measure of digital resource access and use that is used.

5 DISCUSSION AND CONCLUSIONS

This study aimed to develop a better understanding of how access and use of digital resources is associated with a range of health outcomes. The promise of digital technologies for expanding the reach of health systems and improving the delivery of health care and quality of service is tremendous, although the potential implications for health extend well beyond the health system itself. While mHealth programs have shown that they can influence health outcomes, particularly when appropriately targeted, the vast majority of people in most countries are unlikely to be reached through these programs. However, most will use mobile technology to talk to their families, friends and others, often about matters related to their health or that of their children. Others will turn to the Internet for advice or information (accurate or not), to more easily schedule appointments, to check the availability of medicines or services, or for telemedicine appointments. This may expose people to more diverse sources of information beyond their immediate social network, potentially spurring the diffusion of knowledge and behavior.

Despite the potential of ICT to improve health, relatively little research has been done that explores how basic access to digital resources influences health outcomes, particularly in lower- and middle-income countries. Even less research has attempted to explore how the relationship between digital resource access and use and health outcomes differs between men and women, despite the clear differences in their ability in accessing digital resources and using technology. Understanding these relationships is key to beginning to address the gender digital gap and for designing more effective digital health policies and programs.

The results of this study begin to address this gap and suggest that access to digital resources is associated with a range of positive health outcomes, even when other determinants of these outcomes are taken into account. However, this was not the case for all variables. Rather, the majority of the associations between the health outcomes and the measures of digital resource access and use were concentrated in three outcomes: knowledge of the fertility cycle, particularly for women; attending four or more ANC visits during her last pregnancy; and purchasing or being given iron supplements during her last pregnancy.

The strong relationship between digital access and use and knowledge of the fertility cycle is consistent with prior research on digital health, which has found that mHealth and other digital health interventions have more success in changing knowledge than behavior. However, while each of the measures of digital resource access and use had a strong relationship with knowledge in this study for women, the primary associations for men were found with the two measures that reflect a greater engagement or familiarity with digital technology: use of mobile phones for financial transactions and using the Internet at least weekly. This may reflect different ways that men and women engage with and use digital technology. For example, in some settings, women using the Internet to search for information may be seen as potentially dangerous or risky, while for men, it is not. Alternatively, this difference may reflect the higher rates of phone ownership among men than women. For men in some settings, owning a phone may not differentiate them in any meaningful way from other men because so many own phones. That may not be the case for women given the differences in levels of mobile phone ownership by gender.

The strong association with number of ANC visits and iron supplementation during pregnancy are both less consistent with prior research, in that both require shifts in behavior. This is particularly true for ANC visits, which require that women to visit with a trained provider. While some of the association between outcomes

and digital resource access and use may be motivated by the greater access to information that digital resources enable, this is not the case for the other behavioral outcomes. This suggests that there may be other factors also shaping this relationship. It is also likely that ANC visits include the provision of iron supplementation or advice on its importance, which likely explains why both are associated in similar ways with digital resource access and use.

In contrast to ANC visits and iron supplementation, none of the other behavioral health outcomes (women's use of modern contraception, men's use of condom at last sex, and help-seeking after domestic violence) had strong, consistent associations with any measure of digital resource access and use. While this is consistent with much of the prior literature on digital health interventions, it is not as clear why these behaviors were not associated with digital resource access and use while ANC visits and iron supplementation were. One possible explanation is that these three behavioral outcomes are typically considered more private matters, and men and women may be less likely to seek out information through their networks or online. However, this seems unlikely given the role that informal networks serve as important sources of contraceptive information. It is also interesting that access to digital resources had no association with help-seeking after experiences with violence, given the role these may play in facilitating communication with support networks. This may indicate that help-seeking after violence may be different from the other outcomes. In particular, help-seeking may increase the risk of further violence, may be seen in some contexts as unlikely to result in positive outcomes for women and may be seen as both less obviously improving health and more stigmatized than other outcomes. This may mean that factors other than access to or use of digital resources, such as the perceived ability of potential sources of help to respond in a positive manner, are more important in determining whether women seek help or not. Further, increased use of digital technologies may actually result in greater vulnerability to domestic violence, particularly when that technology is used to control or monitor women's behavior or when confidentiality is not guaranteed.

A further finding of interest is how strongly the overall relationship between digital resource access and use and health outcomes appears to be linked to country context. As noted, the relationship is much more consistent across all outcomes in Rwanda, Senegal, and Nigeria than in Liberia and Nepal, regardless of the measure of digital resource access and use. Potential explanations for this range from sociocultural differences that shape people's relationship with digital technologies to basic infrastructure factors that limit, for example, using one's phone for financial transactions and make it impossible without a system for mobile banking that is trustworthy and available.

Overall, these results provide strong support for the argument that access to and use of digital resources are strongly associated with health, although this varies by context and outcome. This is interesting in part because this appears to be a general effect, and not the result of a specific, focused intervention designed to influence a particular health issue. This suggests that users of these resources are obtaining information and/or having their behavior shaped by other factors that are specifically related to their use of the resource. For example, perhaps much of the relationship between ownership of a mobile phone and knowledge of the fertility cycle is due to the greater ease of the sharing of information through social networks. Further research to understand the mechanisms through which use or ownership of digital resources, particularly mobile technology, are influencing health behaviors would allow policymakers and programmers to take advantage of these for more effective, accurate provision of information. In addition, this also suggests that evaluations of mHealth and other digital health interventions must take care in selecting the comparison or

control group, and in ensuring that individuals in these groups have equal access and use of digital resources, because these appear to have an independent influence on behavior beyond the intervention.

These findings also reinforce the pressing need to narrow the gender digital gap, while also increasing the availability and use of digital technologies for all. Being able to access and use digital resources is strongly associated with improved health outcomes, even in the absence of a targeted effort to change behavior or improve knowledge. This is particularly important for women, whose access to the health system is often dependent on the ability and willingness of others and who often have a greater need for formal health care, particularly during their reproductive years. Addressing the digital divide in access to digital resources should therefore be a particularly important goal of policymakers and programmers.

Finally, these analyses have some limitations that should be taken into account when interpreting the results or applying them to different contexts. In particular, we are not able to determine why these digital resources are associated with improved health outcomes, although we do control for many of the factors that might shape this relationship. We also are not able to explore in more depth why this relationship was stronger for some outcomes than for others. Better understanding of what it is about phone ownership, use of one's phone for financial transactions, and regular use of the Internet that improves health in the absence of specific digital health interventions is an important topic for future research. This study also draws on data from a relatively small group of countries and does not explore the macro-level factors that may be driving the observed relationship in each country.

REFERENCES

- Acilar, A., and Ø. Sæbø. 2021. "Towards Understanding the Gender Digital Divide: A Systematic Literature Review." *Global Knowledge, Memory and Communication*. No. ahead of print. <https://doi.org/10.1108/GKMC-09-2021-0147>
- Alhassan, R. K., A. Abdul-Fatawu, B. Adzimah-Yeboah, W. Nyaledzigbor, S. Agana, and P. P. Mwini-Nyaledzigbor. 2019. "Determinants of Use of Mobile Phones for Sexually Transmitted Infections (STIs) Education and Prevention among Adolescents and Young Adult Population in Ghana: Implications of Public Health Policy and Interventions Design." *Reproductive Health* 16 (1): 1–11. <https://doi.org/10.1186/s12978-019-0763-0>
- Borgonovi, F., R. Centurelli, H. Dernis, R. Grundke, P. Horvát, S. Jamet, M. Keese, et al. 2018. *Bridging the Digital Gender Divide: Include, Upskill, Innovate*. Paris, France: OECD. <https://www.oecd.org/digital/bridging-the-digital-gender-divide.pdf>
- Datta, S. S., P. Ranganathan, and K. S. Sivakumar. 2014. "A Study to Assess the Feasibility of Text Messaging Service in Delivering Maternal and Child Healthcare Messages in a Rural Area of Tamil Nadu, India." *Australasian Medical Journal* 7 (4): 175. <https://doi.org/10.4066/AMJ.2014.1916>
- Entsieh, A. A., M. Emmelin, and K. O. Pettersson. 2015. "Learning the ABCs of Pregnancy and Newborn Care through Mobile Technology." *Global Health Action* 8 (1): 29340. <https://doi.org/10.3402/gha.v8.29340>
- Flax, V. L., M. Negerie, A. U. Ibrahim, S. Leatherman, E. J. Daza, and M. E. Bentley. 2014. "Integrating Group Counseling, Cell Phone Messaging, and Participant-Generated Songs and Dramas into a Microcredit Program Increases Nigerian Women's Adherence to International Breastfeeding Recommendations." *The Journal of Nutrition* 144 (7): 1120–1124. <https://doi.org/10.3945/jn.113.190124>
- GSMA. 2022. *The Mobile Economy 2022*. GSM Association. <https://www.gsma.com/mobileeconomy/wp-content/uploads/2022/02/280222-The-Mobile-Economy-2022.pdf>
- Haas, S. 2016. *mHealth Compendium, Special Edition 2016: Reaching Scale*. Arlington, VA, USA: African Strategies for Health, Management Sciences for Health. http://www.africanstrategies4health.org/uploads/1/3/5/3/13538666/2016_mhealth_31may16_final.pdf
- Huq, N. L., A. J. Azmi, M. A. Quaiyum, and S. Hossain. 2014. "Toll Free Mobile Communication: Overcoming Barriers in Maternal and Neonatal Emergencies in Rural Bangladesh." *Reproductive Health* 11 (1): 1–12. <https://doi.org/10.1186/1742-4755-11-52>
- Jiang, H., M. Li, L. M. Wen, Q. Hu, D. Yang, G. He, L. A. Baur, M. J. Dibley, and X. Qian. 2014. "Effect of Short Message Service on Infant Feeding Practice: Findings from a Community-Based Study in Shanghai, China." *JAMA Pediatrics* 168 (5): 471–478. <https://doi.org/10.1001/jamapediatrics.2014.58>

- Johnson, D., R. Juras, P. Riley, M. Chatterji, P. Sloane, S. K. Choi, and B. Johns. 2017. “A Randomized Controlled Trial of the Impact of a Family Planning mHealth Service on Knowledge and Use of Contraception.” *Contraception* 95 (1): 90–97. <https://doi.org/10.1016/j.contraception.2016.07.009>
- Lopez, C., D. C. Ramirez, J. I. Valenzuela, A. Arguello, J. P. Saenz, S. Trujillo, D. E. Correal, R. Fajardo, and C. Dominguez. 2014. “Sexual and Reproductive Health for Young Adults in Colombia: Teleconsultation Using Mobile Devices.” *JMIR mHealth and uHealth* 2 (3): e2904. <https://doi.org/10.2196/mhealth.2904>
- Lund, S., B. B. Nielsen, M. Hemed, I. M. Boas, A. Said, K. Said, M. H. Makungu, and V. Rasch. 2014. “Mobile Phones Improve Antenatal Care Attendance in Zanzibar: A Cluster Randomized Controlled Trial.” *BMC Pregnancy and Childbirth* 14 (1): 1–10. <https://doi.org/10.1186/1471-2393-14-29>
- MacQuarrie, K. L. D., J. Edmeades, and R. Rosenberg. 2022. *The Gender Digital Divide: Evidence from Demographic and Health Surveys*. DHS Analytical Studies. Rockville, Maryland, USA: ICF.
- Marcolino, M. S., J. A. Q. Oliveira, M. D’Agostino, A. L. Ribeiro, M. B. M. Alkmim, and D. Novillo-Ortiz. 2018. “The Impact of mHealth Interventions: Systematic Review of Systematic Reviews.” *JMIR Mhealth Uhealth* 6 (1): e23. <https://mhealth.jmir.org/2018/1/e23/>
- Maslowsky, J., S. Frost, C. E. Hendrick, F. O. T. Cruz, and S. D. Merajver. 2016. “Effects of Postpartum Mobile Phone-Based Education on Maternal and Infant Health in Ecuador.” *International Journal of Gynecology & Obstetrics* 134 (1): 93–98. <https://doi.org/10.1016/j.ijgo.2015.12.008>
- Mushamiri, I., C. Luo, C. Iiams-Hauser, and Y. Ben Amor. 2015. “Evaluation of the Impact of a Mobile Health System on Adherence to Antenatal and Postnatal Care and Prevention of Mother-to-Child Transmission of HIV Programs in Kenya.” *BMC Public Health* 15 (1): 1–16. <https://doi.org/10.1186/s12889-015-1358-5>
- Nulhakim, I., and O. B. Samosir. 2017. “The Effects of Internet Access on Contraceptive Use in Indonesia (Intercensal Population Survey Data Analysis of 2015).” *Proceedings of the 2nd International Conference on Indonesian Economy and Development (ICIED 2017)*: 65–69.
- Pedrana, A. E., J. Pina, R. S. Padmawati, R. Zuhriana, L. Lazuardi, M. S. Lim, M. E. Hellard, and Y. S. Prabandari. 2020. “A Quasi-Experimental Text Messaging Trial to Improve Adolescent Sexual and Reproductive Health and Smoking Knowledge in Indonesia.” *Sexual Health* 17 (2): 167–177. <https://doi.org/10.1071/SH18199>
- Rokicki, S., J. Cohen, J. A. Salomon, and G. Fink. 2017. “Impact of a Text-Messaging Program on Adolescent Reproductive Health: A Cluster–Randomized Trial in Ghana.” *American Journal of Public Health* 107 (2): 298–305. <https://doi.org/10.2105/AJPH.2016.303562>
- Rutstein, S. O., and K. Johnson. 2004. *The DHS Wealth Index, DHS Comparative Reports No. 6*. Calverton, MD, USA: ORC Macro. <https://dhsprogram.com/pubs/pdf/CR6/CR6.pdf>

Simonyan, D., M-P. Gagnon, T. Duchesne, and A. Roos-Weil. 2013. “Effects of a Telehealth Programme Using Mobile Data Transmission on Primary Healthcare Utilisation among Children in Bamako, Mali.” *Journal of Telemedicine and Telecare* 19 (6): 302–306. <https://doi.org/10.1177/1357633X13503429>

WHO. 2019. *WHO Guideline: Recommendations on Digital Interventions for Health System Strengthening*. Geneva, Switzerland: World Health Organization (WHO). <https://www.who.int/publications/i/item/9789241550505>

APPENDIX

Regions are numbered as follows:

Liberia:

1. North Western
2. South Central
3. South Eastern A
4. South Eastern B
5. North Central

Nepal:

1. Province 1
2. Province 2
3. Province 3
4. Province 4
5. Province 5
6. Province 6
7. Province 7

Nigeria:

1. North Central
2. North East
3. North West
4. South East
5. South South
6. South West

Rwanda:

1. Kigali
2. South
3. West
4. North
5. East

Senegal:

1. Dakar
2. Ziguinchor
3. Diourbel
4. Saint-Louis
5. Tambacounda
6. Kaolack
7. Thiès
8. Louga
9. Fatick
10. Kolda
11. Matam
12. Karrfrine
13. Kedougou
14. Sedhiou

Appendix Table A1 Mobile phone ownership and other factors associated with knowledge of the fertility cycle among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Owns a mobile phone	1.20	.128	1.30***	.000	1.19***	.000	1.27***	.000	1.62***	.000
Sexually active in past year	1.28	.280	0.95	.596	1.19**	.007	1.26*	.024	1.27	.223
Age (ref=15–19)										
20–29	1.59**	.009	1.22*	.035	1.64***	.000	1.48***	.000	1.94***	.000
30–39	1.56	.062	1.41**	.004	1.79***	.000	1.56***	.001	2.37***	.000
40–49	1.92*	.027	1.72***	.000	1.74***	.000	2.04***	.000	3.06***	.000
Number of children (ref=0)										
1–2	0.95	.761	1.12	.334	1.13	.062	1.08	.542	1.08	.655
3–5	0.82	.474	0.97	.807	1.28***	.000	1.42*	.031	1.30	.251
5+	0.81	.512	0.98	.925	1.38***	.000	1.24	.260	1.30	.222
Desire for children (ref=wants no more)										
Wants within 2 years	1.03	.880	1.02	.891	1.13*	.032	1.11	.360	1.01	.935
Wants after 2 years or more	1.12	.598	1.22	.095	.96	.537	0.90	.221	1.13	.542
Wants but unsure of timing	1.11	.625	1.14	.487	0.87	.065	1.35**	.007	1.23	.282
Undecided	1.64*	.018	0.91	.600	0.80**	.007	0.85	.561	0.68	.384
Sterile/infecund	0.87	.650	1.05	.556	1.16	.126	0.73*	.044	1.05	.861
Education (ref=none)										
Primary	0.78	.057	1.00	.961	0.91	.134	1.64***	.000	1.68***	.000
Secondary	1.49*	.022	1.46***	.000	1.11	.103	4.22***	.000	7.32***	.000
Higher	3.64***	.000	2.27***	.000	1.82***	.000	9.54***	.000	22.79***	.000
Employment (ref=does not work)										
Works but not for cash	0.74	.077	1.43***	.000	1.18	.053	1.16	.084	0.76	.077
Works for cash	1.02	.893	1.38***	.000	0.77***	.000	1.37***	.000	0.97	.764
Marital status (ref=not married)										
Married/cohabiting	1.29	.103	1.01	.969	0.81*	.025	1.07	.591	1.24	.373
Formally married	1.55*	.026	1.00	.985	0.93	.464	0.92	.603	1.32	.191
Region (ref=region 1)										
Region 2	0.68*	.026	1.49*	.013	0.89	.164	1.31*	.017	0.84	.458
Region 3	0.65*	.036	0.85	.222	1.26**	.003	1.21	.072	0.89	.470
Region 4	0.91	.618	0.97	.805	2.98***	.000	1.54***	.000	0.55***	.002
Region 5	0.81	.187	0.89	.309	1.69***	.000	2.27***	.000	1.00	.990
Region 6			0.82	.248	1.22*	.020			1.33	.100
Region 7			0.49***	.000					1.07	.712
Region 8									0.52***	.000
Region 9									1.29	.257
Region 10									0.91	.612
Region 11									0.45***	.000
Region 12									1.14	.496
Region 13									0.57	.099
Region 14									1.20	.353
Residence (ref=urban)										
Rural	1.24	.186	0.90	.284	0.93	.187	1.03	.720	1.09	.423
Household wealth quintile (ref=poorest)										
Poorer	1.16	.389	0.95	.570	1.09	.243	1.27*	.017	1.05	.712
Middle	1.29	.160	0.98	.852	1.01	.913	1.39***	.001	1.05	.742
Richer	0.93	.750	0.97	.834	0.99	.894	1.58***	.000	1.45*	.024
Richest	1.10	.716	0.95	.706	1.19	.073	1.84***	.000	1.46*	.044
Observations	6,690		12,099		37,698		13,679		8,470	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A2 Use of mobile phone for financial transactions and other factors associated with knowledge of the fertility cycle among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses phone for financial transactions	0.98	.886	0.86	.264	1.35***	.000	1.41***	.000	1.78***	.000
Sexually active in past year	1.30	.246	0.92	.317	1.19**	.007	1.24*	.034	1.28	.216
Age (ref=15–19)										
20–29	1.67**	.005	1.28**	.008	1.65***	.000	1.43***	.000	1.87***	.000
30–39	1.64*	.043	1.48***	.001	1.78***	.000	1.50**	.002	2.27***	.000
40–49	2.03*	.020	1.76***	.000	1.73***	.000	1.99***	.000	2.90***	.000
Number of children (ref=0)										
1–2	0.95	.770	1.11	.358	1.12	.073	1.07	.583	1.06	.752
3–5	0.82	.468	0.95	.695	1.28***	.000	1.42*	.034	1.29	.256
5+	0.81	.497	0.93	.727	1.39***	.000	1.24	.263	1.31	.217
Desire for children (ref=wants no more)										
Wants within 2 years	1.05	.837	1.02	.881	1.13*	.032	1.11	.367	1.04	.836
Wants after 2 years or more	1.12	.583	1.23	.089	0.96	.559	0.90	.253	1.13	.510
Wants but unsure of timing	1.10	.639	1.13	.513	0.87	.068	1.36**	.007	1.27	.203
Undecided	1.66*	.018	0.91	.574	0.80**	.007	0.86	.580	0.68	.393
Sterile/infecund	0.88	.669	1.04	.599	1.16	.121	0.73*	.045	1.10	.717
Education (ref=none)										
Primary	0.79	.071	1.03	.742	0.94	.333	1.63***	.000	1.64***	.000
Secondary	1.56**	.009	1.56***	.000	1.14*	.045	4.06***	.000	7.06***	.000
Higher	3.92***	.000	2.52***	.000	1.71***	.000	8.93***	.000	20.6***	.000
Employment (ref=does not work)										
Works but not for cash	0.75	.084	1.45***	.000	1.18	.056	1.16	.076	0.76	.071
Works for cash	1.03	.829	1.39***	.000	0.77***	.000	1.36***	.000	0.95	.586
Marital status (ref=not married)										
Married/cohabiting	1.27	.116	1.08	.621	0.82*	.041	1.10	.480	1.27	.335
Formally married	1.56*	.024	1.05	.828	0.95	.618	0.92	.599	1.33	.164
Region (ref=region 1)										
Region 2	0.66*	.021	1.48**	.018	0.89	.157	1.31*	.019	1.01	.969
Region 3	0.65*	.039	0.87	.291	1.24**	.005	1.22	.068	0.96	.797
Region 4	0.91	.628	1.00	.981	2.92***	.000	1.58***	.000	0.58**	.004
Region 5	0.79	.144	0.88	.281	1.68***	.000	2.27***	.000	1.16	.474
Region 6			0.83	.285	1.17	.062			1.54*	.012
Region 7			0.49***	.000					1.04	.814
Region 8									0.56***	.000
Region 9									1.49	.075
Region 10									1.06	.776
Region 11									0.49***	.000
Region 12									1.30	.155
Region 13									0.72	.295
Region 14									1.42	.077
Residence (ref=urban)										
Rural	1.21	.235	0.90	.261	0.93	0.176	1.04	.613	1.13	.245
Household wealth quintile (ref=poorest)										
Poorer	1.18	.320	0.96	.695	1.11	0.147	1.26*	.019	1.11	.461
Middle	1.35	.103	1.00	.975	1.05	0.531	1.39***	.001	1.12	.424
Richer	0.99	.967	1.00	.986	1.03	0.724	1.55***	.000	1.57**	.004
Richest	1.19	.505	0.98	.882	1.20	0.059	1.77***	.000	1.58*	.012
Observations	6,690		12,099		37,698		13,679		8,470	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A3 Weekly internet use and other factors associated with knowledge of the fertility cycle among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Uses internet at least once per week	1.48*	.022	1.14	.104	1.35***	.000	1.75***	.000	1.48***	.000
Sexually active in past year	1.30	.248	0.93	.442	1.19***	.006	1.27*	.023	1.33	.138
Age (ref=15–19)										
20–29	1.55*	.011	1.27*	.011	1.65***	.000	1.56***	.000	2.12***	.000
30–39	1.52	.082	1.48***	.001	1.81***	.000	1.65***	.000	2.63***	.000
40–49	1.89*	.032	1.77***	.000	1.78***	.000	2.18***	.000	3.47***	.000
Number of children (ref=0)										
1–2	0.96	.828	1.13	.306	1.14*	.045	1.10	.461	1.07	.697
3–5	0.85	.570	0.97	.792	1.29***	.000	1.46*	.020	1.30	.256
5+	0.83	.567	0.94	.765	1.39***	.000	1.28	.204	1.26	.293
Desire for children (ref=wants no more)										
Wants within 2 years	1.03	.884	1.02	.882	1.13*	.038	1.12	.332	0.99	.971
Wants after 2 years or more	1.11	.638	1.22	.099	0.95	.462	0.91	.277	1.12	.544
Wants but unsure of timing	1.09	.675	1.13	.511	0.86	.053	1.36**	.006	1.20	.336
Undecided	1.62*	.022	0.91	.610	0.80**	.006	0.84	.531	0.71	.441
Sterile/infecund	0.88	.681	1.04	.600	1.15	.148	0.74	.053	1.08	.774
Education (ref=none)										
Primary	0.78	.068	1.03	.723	0.94	.365	1.72***	.000	1.68***	.000
Secondary	1.45*	.030	1.53***	.000	1.16*	.024	4.16***	.000	7.02***	.000
Higher	3.18***	.000	2.35***	.000	1.73***	.000	7.17***	.000	19.80***	.000
Employment (ref=does not work)										
Works but not for cash	0.74	.076	1.45***	.000	1.18	.051	1.19**	.038	0.76	.071
Works for cash	1.04	.805	1.38***	.000	0.78***	.000	1.40***	.000	0.99	.902
Marital status (ref=not married)										
Married/cohabiting	1.28	.110	1.07	.675	0.84	.065	1.05	.704	1.22	.409
Formally married	1.57*	.021	1.06	.799	0.97	.780	0.93	.626	1.34	.164
Region (ref=region 1)										
Region 2	0.67*	.021	1.49*	.014	0.89	.161	1.33**	.014	0.87	.545
Region 3	0.65*	.036	0.86	.252	1.24***	.006	1.25*	.044	0.92	.625
Region 4	0.91	.618	0.98	.877	2.96***	.000	1.58***	.000	0.57***	.002
Region 5	0.81	.179	0.88	.305	1.66***	.000	2.3***	.000	0.99	.950
Region 6			0.84	.304	1.20*	.034			1.37	.065
Region 7			0.50***	.000					1.10	.582
Region 8									0.53***	.000
Region 9									1.38	.147
Region 10									0.88	.517
Region 11									0.44***	.000
Region 12									1.13	.537
Region 13									0.58	.085
Region 14									1.20	.344
Residence (ref=urban)										
Rural	1.22	.204	0.90	.279	0.93	.182	1.06	.493	1.10	.367
Household wealth quintile (ref=poorest)										
Poorer	1.19	.313	0.96	.680	1.11	.149	1.32**	.005	1.11	.474
Middle	1.35	.104	0.99	.943	1.06	.511	1.49***	.000	1.10	.491
Richer	0.95	.829	0.99	.914	1.04	.660	1.74***	.000	1.50*	.013
Richest	1.06	.828	0.95	.701	1.20	.055	1.92***	.000	1.46*	.050
Observations	6,690		12,099		37,698		13,679		8,470	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A4 Mobile phone ownership and other factors associated with knowledge of the fertility cycle among men age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Owns a mobile phone	0.54	.197	1.21	.233	1.30	.058	1.30*	.020	1.10	.772
Sexually active in past year	1.20	.783	1.12	.531	1.18	.245	0.77	.132	1.90*	.044
Age (ref=15–19)										
20–29	1.49	.676	1.35	.082	1.30	.118	1.26	.131	1.22	.566
30–39	0.99	.995	1.49	.057	1.12	.521	1.24	.245	0.86	.751
40–49	1.08	.940	1.90**	.003	1.08	.681	1.84**	.005	1.37	.483
Number of children (ref=0)										
1–2	1.37	.599	0.90	.614	1.03	.856	2.05**	.003	0.80	.500
3–5	2.43	.154	1.10	.701	1.11	.535	2.02*	.012	0.75	.469
5+	2.23	.282	0.92	.833	1.38	.086	2.27*	.011	1.76	.185
Education (ref=none)										
Primary	0.72	.445	1.26	.176	1.37	.051	1.89**	.002	1.20	.521
Secondary	2.26*	.027	1.94***	.000	1.27	.093	3.86***	.000	5.29***	.000
Higher	7.36***	.000	3.01***	.000	1.75***	.000	9.46***	.000	15.85***	.000
Employment (ref=does not work)										
Works but not for cash	3.55	.053	0.65*	.027	0.66*	.049	1.24	.261	1.17	.697
Works for cash	2.63	.099	0.76	.119	1.64**	.005	0.97	.880	1.31	.516
Marital status (ref=not married)										
Married/cohabiting	1.05	.928	1.32	.269	1.09	.633	0.82	.436	1.70	.078
Formally married	0.80	.720	0.64	.465	1.48	.210	0.82	.552	1.06	.934
Region (ref=region 1)										
Region 2	5.26**	.002	1.25	.320	0.74	.064	0.79	.195	0.21***	.000
Region 3	1.18	.773	1.17	.426	0.54***	.000	0.74	.111	0.47	.067
Region 4	5.02**	.005	1.01	.949	2.05***	.000	0.49***	.001	0.21***	.000
Region 5	0.98	.975	0.78	.262	1.22	.198	0.58**	.008	0.84	.550
Region 6			1.88**	.005	1.31	.091			0.42**	.010
Region 7			1.19	.392					0.80	.329
Region 8									0.54	.079
Region 9									0.46*	.042
Region 10									0.12***	.000
Region 11									0.27*	.045
Region 12									0.43*	.022
Region 13									0.37	.070
Region 14									0.097***	.000
Residence (ref=urban)										
Rural	0.82	.643	0.86	.248	1.276*	.016	1.25	.166	0.72	.086
Household wealth quintile (ref=poorest)										
Poorer	0.75	.510	0.87	.348	1.08	.647	1.18	.333	1.31	.286
Middle	1.35	.434	0.85	.334	1.28	.130	1.22	.279	1.26	.374
Richer	1.11	.837	0.76	.118	1.22	.253	1.27	.189	1.04	.911
Richest	0.62	.357	0.89	.525	1.56*	.014	1.52*	.042	0.86	.709
Observations	3,760		4,063		11,845		5,833		3,394	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A5 Use of mobile phone for financial transactions and other factors associated with knowledge of the fertility cycle among men age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Uses phone for financial transactions	0.99	.986	1.80**	.002	1.10	.344	1.31*	.017	1.76*	.014
Sexually active in past year	1.19	.788	1.14	.440	1.19	.223	0.77	.124	1.83	.072
Age (ref=15–19)										
20–29	1.19	.850	1.36	.077	1.38*	.049	1.26	.137	1.06	.872
30–39	0.79	.819	1.50	.052	1.19	.316	1.24	.250	0.74	.539
40–49	0.85	.868	1.94**	.002	1.14	.488	1.84**	.005	1.18	.737
Number of children (ref=0)										
1–2	1.37	.592	0.90	.615	1.03	.848	2.03**	.004	0.79	.480
3–5	2.54	.126	1.12	.655	1.12	.519	2.02*	.012	0.76	.468
5+	2.23	.270	0.93	.849	1.39	.079	2.27*	.011	1.75	.200
Education (ref=none)										
Primary	0.73	.448	1.29	.139	1.38*	.042	1.87**	.003	1.22	.478
Secondary	2.07*	.044	1.99***	.000	1.28	.086	3.77***	.000	4.93***	.000
Higher	6.28***	.000	2.95***	.000	1.72***	.001	9.19***	.000	12.50***	.000
Employment (ref=does not work)										
Works but not for cash	3.58	.058	0.65*	.025	0.66	.050	1.25	.250	1.18	.675
Works for cash	2.58	.125	0.74	.077	1.66***	.004	0.97	.853	1.23	.615
Marital status (ref=not married)										
Married/cohabiting	1.00	.993	1.28	.328	1.09	.629	0.83	.458	1.64	.105
Formally married	0.83	.750	0.63	.440	1.46	.224	0.83	.565	0.98	.970
Region (ref=region 1)										
Region 2	5.31**	.002	1.28	.257	0.74	.059	0.79	.198	0.21***	.000
Region 3	1.19	.772	1.15	.484	0.54***	.000	0.75	.118	0.44	.052
Region 4	4.93**	.005	1.00	.982	2.04***	.000	0.50***	.001	0.19***	.000
Region 5	0.99	.988	0.78	.267	1.22	.189	0.59**	.009	0.87	.639
Region 6			1.87**	.005	1.30	.100			0.40**	.008
Region 7			1.16	.474					0.83	.437
Region 8									0.47*	.041
Region 9									0.44*	.034
Region 10									0.13***	.000
Region 11									0.25*	.031
Region 12									0.42*	.017
Region 13									0.42	.099
Region 14									0.09***	.000
Residence (ref=urban)										
Rural	0.85	.703	0.87	.275	1.28*	.015	1.25	.159	0.74	.113
Household wealth quintile (ref=poorest)										
Poorer	0.66	.341	0.87	.379	1.11	.523	1.20	.285	1.22	.442
Middle	1.12	.744	0.87	.394	1.33	.075	1.24	.246	1.10	.715
Richer	0.85	.767	0.77	.139	1.26	.178	1.28	.172	0.90	.727
Richest	0.46	.167	0.87	.456	1.59*	.012	1.52*	.041	0.75	.467
Observations	3,760		4,063		11,845		5,833		3,394	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A6 Weekly internet use and other factors associated with knowledge of the fertility cycle among men age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Uses internet at least once per week	2.06	.056	1.07	.569	1.19	.084	1.73***	.000	1.57*	.026
Sexually active in past year	1.07	.916	1.13	.479	1.18	.229	0.77	.119	1.89	.056
Age (ref=15–19)										
20–29	1.11	.915	1.37	.071	1.38*	.048	1.30	.076	1.16	.687
30–39	0.79	.827	1.51*	.047	1.20	.298	1.29	.168	0.84	.736
40–49	0.89	.907	1.93**	.002	1.16	.431	1.90**	.003	1.36	.525
Number of children (ref=0)										
1–2	1.37	.598	0.91	.649	1.03	.838	2.03**	.005	0.80	.511
3–5	2.42	.143	1.11	.678	1.12	.501	2.03*	.014	0.78	.524
5+	2.19	.282	0.92	.824	1.40	.073	2.37**	.009	1.87	.153
Education (ref=none)										
Primary	0.75	.487	1.29	.131	1.38*	.042	1.97***	.001	1.21	.513
Secondary	1.88	.084	1.99***	.000	1.26	.107	3.52***	.000	4.93***	.000
Higher	4.87***	.000	3.08***	.000	1.65**	.002	7.35***	.000	12.92***	.000
Employment (ref=does not work)										
Works but not for cash	3.61	.056	0.65*	.032	0.66	.053	1.28	.200	1.21	.636
Works for cash	2.72	.108	0.77	.136	1.66**	.004	1.01	.964	1.30	.531
Marital status (ref=not married)										
Married/cohabiting	1.02	.966	1.32	.271	1.11	.554	0.88	.610	1.68	.104
Formally married	0.85	.781	0.64	.464	1.50	.195	0.84	.610	1.14	.848
Region (ref=region 1)										
Region 2	5.36**	.002	1.26	.298	0.74	.055	0.83	.288	0.22***	.001
Region 3	1.16	.801	1.16	.445	0.53***	.000	0.76	.137	0.45	.060
Region 4	4.75**	.006	1.01	.962	2.08***	.000	0.50***	.001	0.20***	.000
Region 5	1.05	.931	0.78	.267	1.24	.172	0.60**	.013	0.82	.494
Region 6			1.89**	.004	1.30	.093			0.40**	.007
Region 7			1.19	.396					0.81	.373
Region 8									0.51	.050
Region 9									0.46*	.047
Region 10									0.13***	.000
Region 11									0.25*	.032
Region 12									0.42*	.020
Region 13									0.36	.065
Region 14									0.10***	.000
Residence (ref=urban)										
Rural	0.91	.830	0.87	.260	1.28*	.015	1.29	.118	0.72	.088
Household wealth quintile (ref=poorest)										
Poorer	0.65	.326	0.88	.388	1.10	.545	1.25	.186	1.20	.480
Middle	1.06	.873	0.86	.374	1.32	.081	1.35	.097	1.14	.634
Richer	0.71	.486	0.77	.131	1.25	.198	1.38	.062	0.90	.737
Richest	0.32*	.046	0.89	.528	1.54*	.017	1.48	.070	0.70	.390
Observations	3,760		4,063		11,845		5,833		3,394	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A7 Mobile phone ownership and other factors associated with current use of modern contraception among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value	OR	p value	OR	p value	OR	p value
Owns a mobile phone	1.26	.105	0.80**	.006	1.43***	.000	1.06	.478	1.21	.104
Age (ref=15–19)										
20–29	2.38*	.031	1.00	.995	1.62*	.011	0.57	.241	1.14	.566
30–39	1.77	.189	0.81	.346	1.34	.139	0.38*	.040	1.07	.780
40–49	0.76	.545	0.45***	.001	0.70	.080	0.13***	.000	0.49**	.009
Number of children (ref=0)										
1–2	1.83	.207	3.82***	.000	4.49***	.000	16.84***	.000	15.48***	.000
3–5	2.19	.112	4.77***	.000	6.10***	.000	15.35***	.000	21.74***	.000
5+	2.90*	.036	3.68***	.000	6.12***	.000	10.86***	.000	36.37***	.000
Desire for children (ref=wants no more)										
Wants within 2 years	0.28***	.000	0.17***	.000	0.27***	.000	0.12***	.000	0.17***	.000
Wants after 2 years or more	1.13	.502	0.58***	.000	0.74***	.000	0.75**	.003	0.87	.387
Wants but unsure of timing	1.12	.649	0.38	.094	0.52***	.000	0.38**	.003	0.21***	.000
Undecided	0.68	.072	0.99	.974	0.80	.066	0.42**	.002	0.62	.213
Sterile/infecund	0.28**	.003	15.61***	.000	0.91	.583	1.35	.056	0.42	.054
Education (ref=none)										
Primary	1.31	.054	1.02	.823	2.20***	.000	1.45***	.000	1.61***	.000
Secondary	1.79***	.001	1.00	.996	2.86***	.000	1.51*	.013	1.16	.441
Higher	2.01	.084	0.98	.886	3.15***	.000	1.88**	.003	2.04*	.024
Employment (ref=does not work)										
Works but not for cash	1.03	.871	1.25*	.015	1.50***	.001	1.20	.099	1.10	.621
Works for cash	1.07	.656	1.27**	.009	1.05	.564	1.33**	.006	1.10	.533
Number of household decisions made solely or jointly (ref=0)										
1	2.09	.053	1.44**	.006	1.25**	.008	1.62**	.008	1.21	.259
2	1.63	.098	1.24	.072	1.29**	.003	1.68**	.003	1.00	.987
3	1.71	.071	1.13	.210	1.32*	.011	1.58**	.003	0.93	.820
4	1.51	.126	0.90	.240	1.31**	.005	1.22	.170	1.12	.566
Contraceptive decision-making (ref=mainly herself)										
Mainly husband/partner	1.34	.071	0.58***	.000	0.98	.824	1.68**	.005	1.24	.156
Joint decision	2.12***	.000	0.93	.427	1.80***	.000	3.20***	.000	10.23***	.000
Someone else	0.57	.401	0.02***	.000	0.23***	.001	0.18***	.000	6.24***	.000
Region (ref=region 1)										
Region 2	0.55**	.003	0.49***	.000	0.84	.097	1.03	.845	1.63*	.045
Region 3	1.44	.058	1.27	.056	0.76*	.038	0.83	.285	0.47**	.003
Region 4	2.09***	.000	0.63***	.000	0.45***	.000	1.43*	.046	1.66*	.026
Region 5	0.74	.126	0.76	.062	0.61***	.000	1.14	.464	0.73	.289
Region 6			0.88	.368	0.83*	.043			0.79	.358
Region 7			0.79	.210					1.34	.151
Region 8									1.14	.569
Region 9									0.71	.151
Region 10									2.13**	.005
Region 11									0.70	.229
Region 12									1.44	.153
Region 13									0.73	.329
Region 14									1.51	.109
Residence (ref=urban)										
Rural	1.14	.460	0.83	.059	0.80***	.001	0.94	.677	0.82	.180
Household wealth quintile (ref=poorest)										
Poorer	1.01	.956	1.02	.884	1.38*	.016	1.02	.851	1.39*	.032
Middle	0.93	.694	1.01	.964	1.66***	.000	0.89	.291	1.46*	.018
Richer	1.37	.163	0.99	.911	2.00***	.000	0.93	.549	1.80**	.007
Richest	0.65	.162	0.84	.251	1.99***	.000	0.73*	.020	2.07**	.003
Observations	3,301		7,659		21,056		6,230		4,598	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A8 Use of mobile phone for financial transactions and other factors associated with current use of modern contraception among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value	OR	p value	OR	p value	OR	p value
Uses phone for financial transactions (all women)	1.15	.481	0.79	.232	1.28**	.003	1.03	.745	1.11	.390
Age (ref=15–19)										
20–29	2.42*	.029	0.98	.932	1.64**	.009	0.58	.244	1.13	.585
30–39	1.82	.171	0.80	.309	1.34	.130	0.38*	.041	1.07	.783
40–49	0.79	.597	0.45***	.001	0.71	.092	0.13***	.000	0.49**	.009
Number of children (ref=0)										
1–2	1.81	.207	3.79***	.000	4.41***	.000	16.82***	.000	15.44***	.000
3–5	2.18	.110	4.79***	.000	6.04***	.000	15.35***	.000	21.65***	.000
5+	2.87*	.036	3.81***	.000	6.04***	.000	10.86***	.000	36.11***	.000
Desire for children (ref=wants no more)										
Wants within 2 years	0.28***	.000	0.16***	.000	0.27***	.000	0.12***	.000	0.17***	.000
Wants after 2 years or more	1.14	.480	0.58***	.000	0.74***	.000	0.75**	.003	0.87	.383
Wants but unsure of timing	1.14	.586	0.40	.097	0.52***	.000	0.38**	.003	0.21***	.000
Undecided	0.69	.071	0.98	.931	0.81	.084	0.42**	.002	0.62	.219
Sterile/infecund	0.29**	.003	15.65***	.000	0.91	.580	1.35	.057	0.42	.056
Education (ref=none)										
Primary	1.32*	.045	0.99	.951	2.35***	.000	1.46***	.000	1.62***	.000
Secondary	1.82***	.001	0.96	.721	3.09***	.000	1.51*	.013	1.16	.434
Higher	2.01	.089	0.95	.727	3.19***	.000	1.88**	.003	2.03*	.029
Employment (ref=does not work)										
Works but not for cash	1.03	.882	1.24*	.019	1.49***	.001	1.20	.097	1.10	.638
Works for cash	1.07	.616	1.27**	.008	1.06	.470	1.33**	.006	1.10	.525
Number of household decisions made solely or jointly (ref=0)										
1	2.12	.050	1.41**	.009	1.25**	.008	1.62**	.008	1.21	.244
2	1.65	.089	1.22	.093	1.30**	.002	1.68**	.003	0.99	.968
3	1.73	.067	1.11	.287	1.30*	.021	1.59**	.003	0.94	.857
4	1.52	.122	0.88	.149	1.32**	.004	1.22	.163	1.12	.596
Contraceptive decision-making (ref=mainly herself)										
Mainly husband/partner	1.34	.072	0.59***	.000	0.98	.839	1.68**	.005	1.24	.167
Joint decision	2.12***	.000	0.93	.463	1.79***	.000	3.20***	.000	10.25***	.000
Someone else	0.56	.389	0.022***	.000	0.24**	.002	0.18***	.000	6.25***	.000
Region (ref=region 1)										
Region 2	0.55**	.002	0.49***	.000	0.84	.095	1.03	.853	1.70*	.025
Region 3	1.46*	.050	1.25	.067	0.74*	.026	0.83	.284	0.49**	.003
Region 4	2.09***	.000	0.62***	.000	0.45***	.000	1.43*	.045	1.69*	.018
Region 5	0.73	.094	0.76	.062	0.60***	.000	1.14	.469	0.75	.325
Region 6			0.87	.334	0.82*	.023			0.82	.423
Region 7			0.79	.204					1.34	.156
Region 8									1.17	.466
Region 9									0.74	.189
Region 10									2.19**	.003
Region 11									0.72	.268
Region 12									1.48	.120
Region 13									0.76	.395
Region 14									1.57	.072
Residence (ref=urban)										
Rural	1.12	.524	0.83	.065	0.79***	.001	0.94	.678	0.82	.206
Household wealth quintile (ref=poorest)										
Poorer	1.03	.840	1.00	.984	1.44**	.006	1.03	.815	1.42*	.021
Middle	0.97	.882	0.98	.886	1.83***	.000	0.90	.331	1.53**	.008
Richer	1.45	.100	0.96	.738	2.27***	.000	0.95	.652	1.90**	.004
Richest	0.70	.273	0.81	.177	2.18***	.000	0.75*	.027	2.20***	.001
Observations	3,301		7,659		21,056		6,230		4,598	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A9 Weekly internet use and other factors associated with current use of modern contraception among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value	OR	p value	OR	p value	OR	p value
Uses internet at least once per week	0.97	.926	0.56***	.000	1.20*	.045	0.98	.902	0.88	.559
Age (ref=15–19)										
20–29	2.46*	.028	1.00	.992	1.64**	.009	0.58	.246	1.15	.536
30–39	1.86	.160	0.82	.373	1.36	.116	0.38*	.042	1.09	.737
40–49	0.81	.637	0.45***	.001	0.72	.118	0.13***	.000	0.50*	.011
Number of children (ref=0)										
1–2	1.80	.224	3.65***	.000	4.46***	.000	16.82***	.000	15.46***	.000
3–5	2.16	.123	4.53***	.000	6.13***	.000	15.34***	.000	21.56***	.000
5+	2.82*	.042	3.66***	.000	6.08***	.000	10.84***	.000	35.66***	.000
Desire for children (ref=wants no more)										
Wants within 2 years	0.29***	.000	0.16***	.000	0.27***	.000	0.12***	.000	0.17***	.000
Wants after 2 years or more	1.14	.472	0.59***	.000	0.74***	.000	0.75**	.004	0.87	.358
Wants but unsure of timing	1.13	.595	0.40	.103	0.52***	.000	0.38**	.003	0.21***	.000
Undecided	0.68	.070	1.00	.986	0.81	.073	0.42**	.002	0.61	.211
Sterile/infecund	0.29**	.003	15.61***	.000	0.90	.543	1.35	.058	0.42*	.050
Education (ref=none)										
Primary	1.33*	.046	0.98	.815	2.34***	.000	1.46***	.000	1.66***	.000
Secondary	1.88***	.000	1.02	.887	3.12***	.000	1.53**	.009	1.24	.260
Higher	2.16	.084	1.14	.375	3.30***	.000	1.93**	.006	2.26*	.030
Employment (ref=does not work)										
Works but not for cash	1.03	.863	1.25*	.015	1.49***	.001	1.20	.098	1.09	.646
Works for cash	1.08	.607	1.28**	.006	1.07	.408	1.33**	.005	1.11	.504
Number of household decisions made solely or jointly (ref=0)										
1	2.13*	.049	1.44**	.006	1.25**	.009	1.63**	.008	1.20	.264
2	1.67	.083	1.23	.081	1.30**	.003	1.69**	.003	0.99	.965
3	1.74	.066	1.13	.231	1.32*	.013	1.591**	.003	0.94	.838
4	1.54	.113	0.90	.241	1.32**	.004	1.22	.156	1.12	.583
Contraceptive decision-making (ref=mainly herself)										
Mainly husband/partner	1.34	.073	0.58***	.000	0.98	.795	1.68**	.005	1.23	.187
Joint decision	2.13***	.000	0.94	.479	1.79***	.000	3.20***	.000	10.20***	.000
Someone else	0.56	.387	0.022***	.000	0.24***	.001	0.18***	.000	6.27***	.000
Region (ref=region 1)										
Region 2	0.54**	.002	0.48***	.000	0.84	.092	1.03	.855	1.62*	.045
Region 3	1.45	.050	1.28*	.043	0.74*	.024	0.83	.284	0.48**	.003
Region 4	2.09***	.000	0.65***	.001	0.45***	.000	1.43*	.048	1.66*	.026
Region 5	0.72	.089	0.75	.054	0.66***	.000	1.14	.475	0.72	.275
Region 6			0.85	.260	0.83*	.041			0.79	.351
Region 7			0.76	.142					1.35	.138
Region 8									1.16	.501
Region 9									0.72	.162
Region 10									2.09**	.005
Region 11									0.71	.241
Region 12									1.42	.168
Region 13									0.72	.322
Region 14									1.51	.105
Residence (ref=urban)										
Rural	1.11	.550	0.82*	.050	0.79***	.001	0.94	.666	0.82	.176
Household wealth quintile (ref=poorest)										
Poorer	1.03	.835	0.99	.942	1.44**	.006	1.03	.794	1.43*	.019
Middle	0.98	.914	1.00	.986	1.84***	.000	0.91	.360	1.55**	.006
Richer	1.50	.084	0.98	.878	2.29***	.000	0.96	.715	1.95**	.003
Richest	0.74	.353	0.90	.505	2.24***	.000	0.77*	.040	2.31***	.001
Observations	3,301		7,659		21,056		6,230		4,598	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A10 Mobile phone ownership and other factors associated with use of condom at last sex among sexually active men (in last year) age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Owns a mobile phone	0.77	.292	1.32	.227	1.22	.415	1.32	.105	6.13*	.046
Age (ref=15–19)										
20–29	0.90	.819	1.08	.760	0.71	.323	0.80	.579	0.48	.437
30–39	0.77	.627	1.15	.639	0.50*	.043	0.89	.798	0.22	.208
40–49	0.39	.103	1.39	.281	0.37**	.007	0.64	.334	0.18	.144
Number of children (ref=0)										
1–2	0.85	.730	0.99	.960	0.90	.639	0.62*	.038	0.73	.642
3–5	0.98	.976	1.11	.669	1.18	.486	0.74	.273	0.16	.151
5+	0.51	.304	0.83	.645	0.97	.921	0.79	.513	0.45	.418
Education (ref=none)										
Primary	0.64	.109	1.88**	.008	2.82***	.000	0.75	.254	3.65*	.011
Secondary	0.54*	.026	2.49***	.000	2.97***	.000	0.87	.655	11.58***	.000
Higher	0.40*	.016	2.71***	.000	2.32***	.000	0.44*	.040	1.64	.708
Employment (ref=does not work)										
Works but not for cash	0.68	.316	1.06	.826	0.77	.501	0.86	.766	0.68	.792
Works for cash	0.76	.454	1.04	.873	0.60	.158	0.83	.701	2.97	.484
Marital status (ref=not married)										
Married/cohabiting	0.21***	.000	0.06***	.000	0.07***	.000	0.03***	.000	0.014***	.000
Formally married	1.24	.644	0.14*	.027	0.31**	.005	0.36**	.007	1.64	.724
Region (ref=region 1)										
Region 2	0.84	.680	0.74	.210	0.46***	.000	0.71	.226	11.49	.148
Region 3	1.62	.248	2.15***	.001	0.26***	.000	0.93	.790	0.14	.054
Region 4	0.86	.709	2.87***	.000	0.75	.111	0.86	.600	0.32	.286
Region 5	0.99	.976	2.17***	.000	0.98	.916	0.88	.629	3.33	.266
Region 6			3.21***	.000	0.76	.122			0.50	.672
Region 7			3.49***	.000					0.41	.236
Region 8									0.25	.159
Region 9									0.43	.505
Region 10									2.41	.544
Region 11									0.62	.617
Region 12									0.91	.926
Region 13									7.79	.058
Region 14									5.04	.305
Residence (ref=urban)										
Rural	0.91	.711	0.73*	.026	0.92	.553	1.43	.113	0.90	.836
Household wealth quintile (ref=poorest)										
Poorer	1.56	.117	0.88	.536	1.07	.795	0.79	.324	0.62	.488
Middle	1.40	.250	0.74	.169	0.84	.509	0.81	.361	0.58	.467
Richer	2.10*	.022	0.75	.197	0.86	.582	1.00	.992	0.65	.586
Richest	2.26	.064	0.78	.333	0.93	.809	1.31	.368	0.57	.583
Observations	1,167		2,871		3,717		3,019		515	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A11 Use of mobile phone for financial transactions and other factors associated with use of condom at last sex among sexually active men (in last year) age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Uses phone for financial transactions	1.06	.863	1.08	.728	0.89	.448	1.42*	.037	0.82	.729
Age (ref=15–19)										
20–29	0.83	.703	1.09	.735	0.75	.391	0.79	.553	0.62	.675
30–39	0.69	.503	1.16	.620	0.53	.056	0.88	.772	0.31	.402
40–49	0.35	.069	1.39	.281	0.39***	.009	0.64	.329	0.23	.284
Number of children (ref=0)										
1–2	0.85	.723	0.99	.960	0.90	.644	0.62*	.039	0.74	.665
3–5	1.01	.983	1.11	.673	1.18	.480	0.74	.283	0.17	.168
5+	0.52	.299	0.81	.595	0.97	.928	0.80	.525	0.52	.539
Education (ref=none)										
Primary	0.63	.111	1.95**	.006	2.83***	.000	0.73	.215	3.62*	.011
Secondary	0.51*	.018	2.62***	.000	3.06***	.000	0.83	.563	11.16***	.001
Higher	0.37**	.010	2.85***	.000	2.47***	.000	0.42*	.032	1.79	.674
Employment (ref=does not work)										
Works but not for cash	0.69	.327	1.07	.800	0.77	.494	0.86	.767	0.56	.686
Works for cash	0.75	.440	1.04	.860	0.60	.163	0.82	.671	3.22	.441
Marital status (ref=not married)										
Married/cohabiting	0.21***	.000	0.06***	.000	0.07***	.000	0.03***	.000	0.01***	.000
Formally married	1.26	.621	0.13*	.019	0.31**	.005	0.36**	.007	1.71	.700
Region (ref=region 1)										
Region 2	0.83	.656	0.75	.231	0.46***	.000	0.71	.229	12.84	.129
Region 3	1.55	.302	2.15***	.001	0.26***	.000	0.94	.822	0.15	.063
Region 4	0.84	.679	2.88***	.000	0.76	.132	0.88	.645	0.32	.237
Region 5	0.97	.933	2.18***	.000	0.98	.901	0.89	.666	3.54	.203
Region 6			3.21***	.000	0.77	.136			0.53	.684
Region 7			3.45***	.000					0.43	.249
Region 8									0.28	.150
Region 9									0.46	.536
Region 10									2.23	.602
Region 11									0.67	.629
Region 12									0.91	.929
Region 13									7.87	.064
Region 14									5.44	.252
Residence (ref=urban)										
Rural	0.93	.766	0.73*	.028	0.92	.520	1.43	.109	0.96	.940
Household wealth quintile (ref=poorest)										
Poorer	1.46	.188	0.90	.593	1.09	.750	0.79	.337	0.73	.665
Middle	1.29	.362	0.76	.211	0.86	.566	0.80	.339	0.77	.752
Richer	1.87	.053	0.77	.245	0.90	.700	0.97	.908	0.95	.959
Richest	1.94	.126	0.80	.390	1.00	.998	1.25	.458	0.81	.832
Observations	1,167		2,871		3,717		3,019		515	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A12 Weekly internet use and other factors associated with use of condom at last sex among sexually active men (in last year) age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value						
Uses internet at least once per week	1.39	.350	1.13	.497	1.02	.893	1.04	.839	0.73	.615
Age (ref=15–19)										
20–29	0.82	.665	1.08	.764	0.73	.353	0.83	.639	0.61	.663
30–39	0.70	.513	1.16	.621	0.51**	.049	0.94	.884	0.30	.372
40–49	0.36	.079	1.40	.259	0.38***	.008	0.66	.368	0.23	.281
Number of children (ref=0)										
1–2	0.86	.755	1.01	.982	0.90	.643	0.62*	.042	0.74	.651
3–5	1.02	.977	1.13	.620	1.18	.482	0.76	.322	0.17	.163
5+	0.53	.329	0.83	.631	0.98	.938	0.82	.584	0.46	.404
Education (ref=none)										
Primary	0.64	.119	1.95**	.006	2.83***	.000	0.79	.334	3.41*	.018
Secondary	0.50**	.010	2.57***	.000	2.99***	.000	0.92	.797	10.49***	.000
Higher	0.33**	.003	2.75***	.000	2.33***	.000	0.47	.062	1.76	.659
Employment (ref=does not work)										
Works but not for cash	0.69	.339	1.07	.783	0.78	.504	0.88	.806	0.60	.711
Works for cash	0.77	.484	1.05	.832	0.60	.160	0.87	.762	3.40	.409
Marital status (ref=not married)										
Married/cohabiting	0.20***	.000	0.06***	.000	0.07***	.000	0.03***	.000	0.01***	.000
Formally married	1.23	.673	0.13*	.021	0.31**	.005	0.36**	.007	1.92	.672
Region (ref=region 1)										
Region 2	0.83	.658	0.75	.233	0.46***	.000	0.71	.215	11.21	.182
Region 3	1.53	.310	2.13***	.001	0.26***	.000	0.92	.769	0.16	.056
Region 4	0.84	.677	2.85***	.000	0.75	.113	0.85	.586	0.32	.253
Region 5	0.99	.977	2.18***	.000	0.98	.911	0.88	.625	3.54	.233
Region 6			3.23***	.000	0.75	.123			0.55	.721
Region 7			3.48***	.000					0.43	.260
Region 8									0.30	.180
Region 9									0.42	.510
Region 10									2.24	.598
Region 11									0.70	.683
Region 12									0.98	.983
Region 13									8.05	.053
Region 14									5.33	.271
Residence (ref=urban)										
Rural	0.95	.835	0.74*	.030	0.92	.538	1.44	.106	0.95	.924
Household wealth quintile (ref=poorest)										
Poorer	1.48	.167	0.90	.582	1.09	.750	0.86	.516	0.76	.730
Middle	1.27	.414	0.76	.196	0.86	.549	0.91	.660	0.80	.789
Richer	1.78	.088	0.76	.216	0.88	.639	1.16	.494	0.99	.991
Richest	1.67	.279	0.78	.337	0.95	.862	1.52	.164	0.94	.948
Observations	1,167		2,871		3,717		3,019		515	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A13 Mobile phone ownership and other factors associated with 4 or more antenatal care visits among women age 15–49 with a live birth in the past 5 years. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Owns a mobile phone	1.46*	.016	1.49**	.002	1.59***	.000	1.44***	.000	1.81***	.000
Sexually active in past year	1.29	.659	1.42*	.042	0.98	.914	0.75	.146	0.84	.550
Age (ref=15–19)										
20–29	0.85	.634	1.25	.277	1.08	.432	0.86	.560	0.80	.229
30–39	1.09	.841	1.63*	.037	1.27**	.025	0.96	.862	1.04	.866
40–49	0.80	.653	0.96	.887	1.31**	.024	0.88	.654	0.96	.878
Number of children (ref=0)										
1–2	2.02	.200	6.14***	.000	1.05	.814	1.34	.526	2.82*	.049
3–5	1.69	.376	3.87***	.000	0.85	.403	0.96	.935	1.92	.203
5+	1.51	.524	3.05**	.013	0.83	.362	0.69	.418	1.44	.486
Desire for children (ref=wants no more)										
Wants within 2 years	0.67	.067	1.16	.397	0.95	.494	1.04	.803	1.09	.589
Wants after 2 years or more	0.86	.470	1.83***	.000	1.05	.479	0.94	.470	0.89	.411
Wants but unsure of timing	0.74	.234	1.69	.511	0.85	.166	0.90	.666	0.87	.605
Undecided	0.78	.275	0.79	.489	0.77*	.011	0.97	.904	1.22	.490
Sterile/infecund	1.70	.430	0.74	.145	0.80	.290	1.12	.503	0.69	.507
Education (ref=none)										
Primary	0.85	.403	1.49**	.006	1.94***	.000	1.02	.888	1.22	.063
Secondary	1.07	.769	2.05***	.000	2.59***	.000	1.05	.694	1.55**	.006
Higher	7.09**	.006	7.02***	.000	3.69***	.000	2.12***	.002	3.52*	.013
Employment (ref=does not work)										
Works but not for cash	1.22	.410	1.27	.078	1.17	.092	1.01	.899	1.06	.689
Works for cash	1.18	.403	1.13	.349	1.47***	.000	0.94	.466	1.05	.656
Marital status (ref=not married)										
Married/cohabiting	1.28	.355	2.25	.243	1.42	.053	1.68***	.001	0.75	.582
Formally married	0.63	.138			1.60*	.040	1.33	.145	0.55	.276
Region (ref=region 1)										
Region 2	0.52*	.026	0.44***	.000	1.09	.312	1.58***	.001	0.77	.349
Region 3	0.68	.246	0.92	.758	1.08	.379	1.40*	.015	0.84	.463
Region 4	0.65	.168	0.91	.677	2.19***	.000	1.39*	.020	0.94	.805
Region 5	1.30	.430	0.84	.445	1.02	.856	1.30*	.047	0.60	.112
Region 6			0.53**	.003	2.04***	.000			0.69	.130
Region 7			1.57	.059					1.36	.140
Region 8									0.74	.206
Region 9									0.82	.525
Region 10									0.70	.178
Region 11									0.71	.232
Region 12									0.52*	.031
Region 13									0.42***	.001
Region 14									0.89	.680
Residence (ref=urban)										
Rural	1.03	.893	0.82	.133	0.93	.321	1.18	.108	0.86	.196
Household wealth quintile (ref=poorest)										
Poorer	1.27	.140	1.37	.071	1.32***	.000	1.22*	.043	1.22*	.049
Middle	1.15	.468	1.89***	.000	1.87***	.000	1.41***	.001	1.36	.052
Richer	2.30**	.010	2.07***	.000	2.14***	.000	1.56***	.000	1.76**	.004
Richest	2.45*	.012	2.44***	.001	2.84***	.000	1.61***	.001	1.57	.057
Observations	2,938		3,292		17,935		5,371		3,783	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A14 Uses mobile phone for financial transactions and other factors associated with 4 or more antenatal care visits among women age 15–49 with a live birth in the past 5 years. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses phone for financial transactions	0.84	.425	2.11	.067	1.32**	.005	1.31***	.000	1.50**	.002
Sexually active in past year	1.31	.644	1.31	.121	0.96	.834	0.74	.134	0.83	.508
Age (ref=15–19)										
20–29	0.87	.677	1.25	.272	1.09	.394	0.89	.626	0.80	.225
30–39	1.13	.784	1.64*	.036	1.28*	.020	0.99	.959	1.03	.880
40–49	0.83	.705	0.96	.900	1.33*	.019	0.91	.726	0.96	.868
Number of children (ref=0)										
1–2	2.12	.187	6.02***	.000	1.04	.830	1.34	.538	2.64	.057
3–5	1.79	.346	3.76***	.001	0.86	.413	0.97	.947	1.83	.224
5+	1.62	.474	2.75*	.025	0.82	.339	0.69	.438	1.39	.516
Desire for children (ref=wants no more)										
Wants within 2 years	0.68	.081	1.15	.423	0.95	.481	1.04	.764	1.13	.451
Wants after 2 years or more	0.86	.501	1.81***	.000	1.05	.470	0.95	.544	0.89	.412
Wants but unsure of timing	0.74	.233	1.68	.520	0.86	.212	0.91	.681	0.89	.669
Undecided	0.78	.275	0.80	.517	0.77*	.012	0.99	.977	1.25	.449
Sterile/infecund	1.66	.457	0.74	.125	0.78	.248	1.13	.471	0.69	.484
Education (ref=none)										
Primary	0.87	.470	1.54**	.003	2.05***	.000	1.03	.788	1.25*	.042
Secondary	1.20	.424	2.16***	.000	2.86***	.000	1.06	.663	1.59**	.005
Higher	8.38**	.003	7.34***	.000	3.89***	.000	2.12**	.002	3.34*	.016
Employment (ref=does not work)										
Works but not for cash	1.25	.350	1.31	.051	1.15	.126	1.02	.872	1.04	.782
Works for cash	1.23	.298	1.13	.337	1.51***	.000	0.93	.439	1.07	.563
Marital status (ref=not married)										
Married/cohabiting	1.23	.449	2.28	.228	1.36	.095	1.64***	.001	0.76	.602
Formally married	0.64	.157			1.61*	.039	1.32	.161	0.54	.263
Region (ref=region 1)										
Region 2	0.52*	.027	0.46***	.000	1.10	.306	1.57***	.001	0.89	.670
Region 3	0.70	.295	0.94	.827	1.05	.567	1.40*	.017	0.91	.683
Region 4	0.66	.190	0.92	.721	2.17***	.000	1.41*	.015	1.00	.990
Region 5	1.25	.503	0.84	.452	0.99	.898	1.30*	.049	0.65	.167
Region 6			0.53**	.004	2.01***	.000			0.77	.270
Region 7			1.57	.056					1.36	.122
Region 8									0.81	.358
Region 9									0.95	.866
Region 10									0.75	.246
Region 11									0.73	.264
Region 12									0.57	.052
Region 13									0.48**	.003
Region 14									1.00	.990
Residence (ref=urban)										
Rural	0.98	.928	0.82	.138	0.90	.167	1.19	.101	0.90	.328
Household wealth quintile (ref=poorest)										
Poorer	1.33	.085	1.36	.072	1.38***	.000	1.24*	.026	1.31**	.006
Middle	1.26	.242	1.91***	.000	2.07***	.000	1.48***	.000	1.53**	.006
Richer	2.72**	.003	2.10***	.000	2.52***	.000	1.68***	.000	2.08***	.000
Richest	3.07**	.002	2.48***	.001	3.29***	.000	1.75***	.000	1.86**	.008
Observations	2,938		3,292		17,935		5,371		3,783	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A15 Weekly internet use and other factors associated with 4 or more antenatal care visits among women age 15–49 with a live birth in the past 5 years. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses internet at least once per week	1.02	.966	1.64*	.029	1.31*	.035	2.03***	.000	1.25	.216
Sexually active in past year	1.31	.642	1.43	.053	0.95	.804	0.74	.131	0.82	.502
Age (ref=15–19)										
20–29	0.85	.639	1.28	.233	1.09	.386	0.87	.582	0.81	.265
30–39	1.10	.825	1.68*	.029	1.29*	.017	0.97	.914	1.06	.790
40–49	0.81	.665	1.01	.987	1.34*	.015	0.89	.685	0.98	.942
Number of children (ref=0)										
1–2	2.11	.185	6.12***	.000	1.05	.822	1.42	.452	2.83*	.048
3–5	1.78	.343	3.84***	.001	0.86	.424	1.04	.928	1.96	.190
5+	1.61	.474	2.77*	.027	0.82	.339	0.75	.541	1.47	.462
Desire for children (ref=wants no more)										
Wants within 2 years	0.68	.078	1.14	.444	0.95	.472	1.01	.929	1.12	.468
Wants after 2 years or more	0.86	.486	1.79***	.000	1.05	.501	0.96	.590	0.88	.407
Wants but unsure of timing	0.74	.229	1.65	.539	0.86	.213	0.88	.602	0.85	.564
Undecided	0.78	.280	0.79	.496	0.77*	.012	0.96	.898	1.24	.451
Sterile/infecund	1.68	.447	0.72	.109	0.78	.233	1.12	.499	0.68	.460
Education (ref=none)										
Primary	0.87	.456	1.55**	.002	2.05***	.000	1.05	.617	1.28*	.021
Secondary	1.16	.540	2.14***	.000	2.88***	.000	1.06	.691	1.64***	.001
Higher	7.8**	.007	6.80***	.000	3.96***	.000	1.46	.140	3.43*	.027
Employment (ref=does not work)										
Works but not for cash	1.24	.370	1.30	.059	1.15	.120	1.01	.933	1.04	.755
Works for cash	1.23	.309	1.14	.301	1.52***	.000	0.93	.409	1.08	.510
Marital status (ref=not married)										
Married/cohabiting	1.24	.420	2.19	.249	1.38	.078	1.60***	.003	0.72	.524
Formally married	0.64	.157			1.63**	.035	1.34	.143	0.52	.233
Region (ref=region 1)										
Region 2	0.52*	.028	0.46***	.000	1.09	.316	1.60***	.001	0.80	.412
Region 3	0.70	.285	0.95	.840	1.05	.587	1.44**	.009	0.87	.555
Region 4	0.66	.189	0.88	.586	2.19***	.000	1.43*	.014	0.95	.837
Region 5	1.25	.496	0.85	.482	0.98	.872	1.32*	.037	0.57	.080
Region 6			0.54**	.006	2.05***	.000			0.68	.116
Region 7			1.61*	.045					1.42	.082
Region 8									0.77	.265
Region 9									0.88	.660
Region 10									0.65	.093
Region 11									0.67	.162
Region 12									0.51*	.021
Region 13									0.41***	.000
Region 14									0.87	.598
Residence (ref=urban)										
Rural	0.99	.971	0.82	.142	0.90	.168	1.21	.071	0.87	.215
Household wealth quintile (ref=poorest)										
Poorer	1.32	.087	1.35	.081	1.38***	.000	1.28*	.011	1.30**	.008
Middle	1.25	.261	1.88***	.000	2.07***	.000	1.56***	.000	1.53**	.007
Richer	2.63**	.004	2.04***	.000	2.53***	.000	1.88***	.000	2.02***	.000
Richest	2.89**	.005	2.32***	.001	3.33***	.000	1.91***	.000	1.81*	.011
Observations	2,938		3,292		17,935		5,371		3,783	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A16 Mobile phone ownership and other factors associated with iron supplementation during most recent pregnancy among women age 15–49 with a live birth in the past 5 years. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Owns a mobile phone	2.06*	.010	1.33	.056	1.60***	.000	1.52***	.000	2.58***	.000
Age (ref=15–19)										
20–29	0.84	.624	1.04	.914	0.98	.771	1.00	.990	0.52	.108
30–39	1.30	.549	0.74	.384	0.89	.251	1.09	.746	0.36*	.043
40–49	1.43	.465	0.28**	.007	0.90	.397	0.88	.622	0.46	.153
Number of children (ref=0)										
1–2	0.90	.914	1.53	.511	1.17	.318	2.05	.066	0.61	.636
3–5	0.29	.197	1.04	.954	1.21	.249	1.80	.144	0.43	.403
5+	0.27	.218	0.81	.761	1.22	.274	1.33	.486	0.53	.528
Desire for children (ref=wants no more)										
Wants within 2 years	0.32***	.000	1.28	.316	0.99	.905	0.70*	.025	0.64	.115
Wants after 2 years or more	2.09*	.019	1.37	.209	1.18*	.018	0.84*	.039	1.17	.509
Wants but unsure of timing	1.13	.730	0.88	.843	1.00	.965	0.74	.145	0.62	.097
Undecided	1.81	.109	0.75	.612	0.76**	.006	1.10	.775	1.00	.992
Sterile/infecund	0.24***	.001	0.75	.166	0.97	.878	0.77	.142	0.65	.679
Education (ref=none)										
Primary	1.37	.078	1.13	.411	2.11***	.000	1.04	.702	1.38	.305
Secondary	0.97	.940	2.86***	.000	2.90***	.000	1.21	.231	1.01	.980
Higher	0.83	.864	4.50***	.001	3.94***	.000	0.87	.581	11.42*	.026
Employment (ref=does not work)										
Works but not for cash	2.61***	.000	1.24	.231	1.42***	.000	0.82	.115	1.07	.806
Works for cash	3.40***	.000	1.18	.395	1.57***	.000	0.77*	.017	1.13	.647
Marital status (ref=not married)										
Married/cohabiting	1.24	.534	3.06*	.017	1.56**	.003	1.41**	.004	2.36	.093
Formally married	1.12	.817			1.36	.067	1.07	.689	1.34	.692
Region (ref=region 1)										
Region 2	0.76	.484	0.68	.126	1.99***	.000	2.02***	.000	1.94	.371
Region 3	0.99	.979	1.25	.418	1.48***	.000	1.51**	.007	0.90	.856
Region 4	0.74	.528	0.78	.438	3.49***	.000	2.83***	.000	1.02	.977
Region 5	0.39**	.010	0.91	.728	0.51***	.000	1.40*	.031	0.56	.335
Region 6			0.76	.374	0.72*	.016			1.10	.875
Region 7			1.82*	.039					4.91	.105
Region 8									1.70	.594
Region 9									2.81	.233
Region 10									1.56	.500
Region 11									0.78	.729
Region 12									0.77	.674
Region 13									0.40	.128
Region 14									1.77	.369
Residence (ref=urban)										
Rural	2.17**	.005	0.89	.513	0.88	.145	1.05	.741	1.57*	.047
Household wealth quintile (ref=poorest)										
Poorer	0.67*	.034	1.63*	.021	1.26**	.006	1.54***	.000	1.49*	.035
Middle	1.36	.286	1.94**	.003	1.99***	.000	1.30*	.019	2.36*	.015
Richer	2.31	.073	1.38	.170	2.23***	.000	1.65***	.000	5.55**	.003
Richest	3.13*	.031	2.50*	.020	1.73***	.000	1.45*	.035	7.24**	.004
Observations	4,267		4,005		21,792		6,167		4,703	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A17 Use of mobile phone for financial transactions and other factors associated with iron supplementation during most recent pregnancy among women age 15–49 with a live birth in the past 5 years. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses phone for financial transactions	2.80*	.026	1.85	.218	0.79*	.011	1.60***	.000	1.28	.410
Age (ref=15–19)										
20–29	0.80	.544	1.04	.893	0.99	.941	1.01	.961	0.57	.150
30–39	1.23	.652	0.74	.396	0.91	.384	1.11	.693	0.41	.071
40–49	1.35	.538	0.29**	.008	0.93	.550	0.89	.680	0.52	.219
Number of children (ref=0)										
1–2	0.85	.871	1.52	.521	1.17	.326	2.06	.066	0.58	.613
3–5	0.29	.192	1.02	.973	1.20	.262	1.82	.137	0.41	.385
5+	0.27	.208	0.75	.685	1.19	.320	1.35	.467	0.49	.489
Desire for children (ref=wants no more)										
Wants within 2 years	0.33***	.000	1.29	.299	1.00	.940	0.70*	.025	0.68	.176
Wants after 2 years or more	2.10*	.019	1.36	.223	1.18*	.017	0.85	.052	1.19	.481
Wants but unsure of timing	1.13	.738	0.88	.850	1.01	.952	0.75	.167	0.63	.094
Undecided	1.86	.102	0.74	.594	0.76**	.006	1.16	.676	1.01	.975
Sterile/infecund	0.25**	.002	0.74	.145	0.95	.771	0.77	.154	0.66	.694
Education (ref=none)										
Primary	1.40	.051	1.16	.328	2.23***	.000	1.05	.661	1.51	.187
Secondary	0.99	.981	2.98***	.000	3.29***	.000	1.18	.298	1.19	.693
Higher	0.88	.909	4.62***	.000	5.13***	.000	0.83	.450	12.79*	.021
Employment (ref=does not work)										
Works but not for cash	2.69***	.000	1.26	.198	1.40***	.000	0.83	.125	1.04	.892
Works for cash	3.60***	.000	1.18	.379	1.62***	.000	0.76*	.012	1.20	.495
Marital status (ref=not married)										
Married/cohabiting	1.22	.566	2.99*	.016	1.55**	.004	1.43**	.003	2.21	.130
Formally married	1.15	.777			1.42*	.036	1.07	.678	1.29	.744
Region (ref=region 1)										
Region 2	0.79	.562	0.68	.136	1.97***	.000	2.02***	.000	2.13	.290
Region 3	1.00	.994	1.25	.417	1.44***	.000	1.52**	.005	1.00	.995
Region 4	0.75	.548	0.78	.448	3.55***	.000	2.99***	.000	1.08	.908
Region 5	0.37**	.006	0.91	.725	0.50***	.000	1.41*	.027	0.54	.317
Region 6			0.75	.375	0.76*	.042			1.10	.880
Region 7			1.79*	.043					5.09	.103
Region 8									1.86	.531
Region 9									3.12	.200
Region 10									1.49	.546
Region 11									0.75	.694
Region 12									0.76	.667
Region 13									0.42	.163
Region 14									1.82	.355
Residence (ref=urban)										
Rural	2.18**	.004	0.89	.508	0.86	.066	1.06	.678	1.50	.072
Household wealth quintile (ref=poorest)										
Poorer	0.69*	.044	1.63*	.021	1.31**	.001	1.54***	.000	1.64**	.008
Middle	1.45	.188	1.98**	.002	2.19***	.000	1.33**	.009	2.86**	.002
Richer	2.43*	.048	1.41	.145	2.63***	.000	1.68***	.000	7.25***	.001
Richest	3.12*	.044	2.61*	.019	2.20***	.000	1.45*	.031	9.47**	.002
Observations	4,267		4,005		21,792		6,167		4,703	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A18 Weekly internet use and other factors associated with iron supplementation during most recent pregnancy among women age 15–49 with a live birth in the past 5 years. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses internet at least once per week	2.06	.219	3.17**	.004	1.21	.196	0.84	.429	1.70	.271
Age (ref=15–19)										
20–29	0.85	.653	1.04	.906	0.99	.912	1.04	.876	0.58	.161
30–39	1.34	.509	0.75	.410	0.91	.344	1.15	.585	0.41	.075
40–49	1.44	.461	0.30**	.009	0.92	.502	0.92	.759	0.52	.228
Number of children (ref=0)										
1–2	0.88	.890	1.51	.532	1.17	.324	1.90	.111	0.59	.622
3–5	0.29	.190	1.03	.969	1.21	.246	1.69	.204	0.41	.395
5+	0.27	.211	0.74	.663	1.21	.296	1.26	.587	0.50	.501
Desire for children (ref=wants no more)										
Wants within 2 years	0.32***	.000	1.27	.337	0.99	.902	0.72*	.041	0.68	.166
Wants after 2 years or more	2.05*	.022	1.34	.244	1.18*	.019	0.84*	.049	1.17	.505
Wants but unsure of timing	1.09	.814	0.87	.832	1.01	.951	0.76	.191	0.60	.078
Undecided	1.83	.106	0.73	.585	0.76**	.007	1.13	.726	1.01	.991
Sterile/infecund	0.24**	.002	0.74	.140	0.95	.793	0.77	.141	0.66	.696
Education (ref=none)										
Primary	1.40*	.049	1.16	.330	2.24***	.000	1.08	.480	1.48	.220
Secondary	1.06	.885	2.87***	.000	3.22***	.000	1.34	.075	1.12	.781
Higher	0.73	.772	3.71**	.002	4.27***	.000	1.10	.742	9.97	.053
Employment (ref=does not work)										
Works but not for cash	2.70***	.000	1.26	.209	1.40***	.000	0.83	.132	1.05	.871
Works for cash	3.71***	.000	1.19	.367	1.62***	.000	0.78*	.027	1.21	.474
Marital status (ref=not married)										
Married/cohabiting	1.19	.612	2.88*	.019	1.55**	.004	1.33*	.020	2.11	.159
Formally married	1.14	.787			1.41*	.041	1.06	.714	1.24	.783
Region (ref=region 1)										
Region 2	0.76	.489	0.70	.160	1.97***	.000	2.01***	.000	1.98	.361
Region 3	1.01	.985	1.28	.349	1.43***	.000	1.49**	.008	0.98	.968
Region 4	0.76	.568	0.74	.343	3.48***	.000	2.80***	.000	1.03	.963
Region 5	0.36**	.005	0.95	.839	0.50***	.000	1.39*	.035	0.50	.267
Region 6			0.78	.437	0.73*	.026			1.02	.980
Region 7			1.87*	.027					5.19	.102
Region 8									1.75	.580
Region 9									2.94	.229
Region 10									1.36	.650
Region 11									0.69	.619
Region 12									0.70	.585
Region 13									0.38	.131
Region 14									1.66	.447
Residence (ref=urban)										
Rural	2.13**	.006	0.91	.571	0.86	.079	1.03	.843	1.48	.084
Household wealth quintile (ref=poorest)										
Poorer	0.70	.056	1.61*	.024	1.31**	.001	1.62***	.000	1.63**	.009
Middle	1.50	.158	1.91**	.003	2.19***	.000	1.45***	.001	2.74**	.004
Richer	2.76*	.025	1.33	.210	2.61***	.000	2.02***	.000	6.63**	.002
Richest	3.58*	.016	2.32*	.035	2.04***	.000	1.98***	.000	8.11**	.001
Observations	4,267		4,005		21,792		6,167		4,703	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A19 Mobile phone ownership and other factors associated with seeking medical treatment for child illness (fever, acute respiratory infection, or diarrhea) among children under age 5. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Owns a mobile phone	1.93**	.006	1.29*	.043	1.26	.122	1.05	.827	1.14	.056
Age (ref=15–19)										
20–29	1.09	.750	1.32	.518	1.32	.311	0.85	.608	1.16	.307
30–39	1.65	.091	1.48	.366	1.26	.510	0.92	.810	1.00	.982
40–49	1.08	.840	1.39	.498	1.50	.358	0.52	.328	1.11	.569
Number of children (ref=1–2)										
3–5	0.55***	.002	0.82	.144	0.83	.353	1.15	.570	0.99	.836
5+	0.61*	.039	0.64*	.029	0.84	.555	0.81	.673	1.01	.941
Education (ref=none)										
Primary	1.01	.944	1.06	.725	1.61**	.002	1.09	.740	1.46***	.000
Secondary	0.78	.178	1.39	.116	1.30	.293	1.50	.081	1.45***	.001
Higher	1.02	.973	1.71	.229	0.84	.659	1.07	.814	1.52*	.021
Employment (ref=does not work)										
Works but not for cash	1.55*	.031	1.21	.269	0.59*	.014	0.87	.513	1.18	.140
Works for cash	1.57**	.010	0.96	.750	0.80	.166	0.79	.301	1.54***	.000
Sex of child (ref=male)										
Female	0.90	.403	0.95	.538	1.01	.966	0.97	.892	0.94	.207
Child's current age (ref= < 1 year)										
1 year	0.72	.103	1.46*	.011	1.24	.140	1.23	.440	1.23*	.014
2 years	0.64	.060	1.21	.232	0.91	.550	1.71	.077	1.24*	.011
3 years	0.81	.338	1.08	.622	0.71	.063	1.11	.691	1.08	.351
4 years	0.70	.120	1.26	.229	0.71	.094	1.12	.723	1.09	.326
Marital status (ref=not married)										
Married/cohabiting	1.00	.985	0.96	.800	0.85	.678			0.92	.713
Formally married	0.94	.815	0.61*	.028	0.57	.319	0.15*	.033	1.21	.485
Region (ref=region 1)										
Region 2	0.51***	.001	1.14	.553	0.82	.614	0.97	.926	1.87***	.000
Region 3	0.73	.205	1.29	.222	0.51*	.028	0.37**	.007	2.59***	.000
Region 4	0.73	.141	0.89	.567	0.66	.213	0.56	.095	1.03	.794
Region 5	0.52**	.003	1.24	.335	0.97	.920	1.00	.999	1.88***	.000
Region 6					0.81	.527	0.75	.356	0.75	.067
Region 7					1.44	.339	0.49	.057		
Region 8					0.69	.337				
Region 9					1.31	.425				
Region 10					1.80	.121				
Region 11					0.64	.181				
Region 12					0.57	.206				
Region 13					1.80	.052				
Region 14					1.05	.880				
Residence (ref=urban)										
Rural	0.71	.180	1.44	.053	1.21	.291	0.69*	.043	0.86	.101
Household wealth quintile (ref=poorest)										
Poorer	1.36*	.034	0.99	.937	0.99	.950	1.39	.172	1.18	.086
Middle	1.75**	.006	1.25	.150	1.30	.263	3.42***	.000	1.31**	.006
Richer	3.73***	.001	1.85***	.001	1.59	.087	2.25**	.004	1.59***	.000
Richest	3.37**	.009	1.86**	.008	1.77	.080	2.23*	.017	2.58***	.000
Observations	1,990		2,101		1,967		1,176		9,564	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A20 Use of mobile phone for financial transactions and other factors associated with seeking medical treatment for child illness (fever, acute respiratory infection, or diarrhea) among children under age 5. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses phone for financial transactions	1.30	.326	0.75	.326	1.37*	.031	1.27	.086	1.50*	.028
Age (ref=15–19)										
20–29	1.14	.625	0.85	.598	1.16	.304	1.34	.485	1.34	.292
30–39	1.79*	.043	0.90	.782	1.00	.980	1.53	.327	1.24	.540
40–49	1.16	.659	0.53	.336	1.11	.566	1.42	.465	1.51	.358
Number of children (ref=1–2)										
3–5	0.55**	.003	1.14	.590	0.99	.863	0.82	.140	0.83	.339
5+	0.59*	.032	0.80	.660	1.01	.946	0.63*	.028	0.85	.590
Education (ref=none)										
Primary	1.03	.887	1.10	.719	1.48***	.000	1.07	.665	1.60**	.003
Secondary	0.85	.387	1.53	.065	1.47***	.000	1.40	.110	1.21	.459
Higher	1.14	.802	1.09	.770	1.41	.062	1.69	.245	0.74	.436
Employment (ref=does not work)										
Works but not for cash	1.56*	.027	0.87	.532	1.17	.163	1.22	.236	0.59*	.015
Works for cash	1.67**	.005	0.79	.304	1.54***	.000	0.96	.782	0.80	.171
Sex of child (ref=male)										
Female	0.89	.393	0.97	.888	0.94	.202	0.95	.552	1.01	.929
Child's current age (ref= <1 year)										
1 year	0.72	.096	1.21	.472	1.20*	.016	1.46*	.011	1.22	.169
2 years	0.64	.070	1.71	.078	1.24**	.010	1.21	.237	0.89	.474
3 years	0.82	.369	1.10	.712	1.08	.346	1.09	.588	0.70	.060
4 years	0.74	.179	1.13	.712	1.09	.323	1.26	.228	0.69	.065
Marital status (ref=not married)										
Married/cohabiting	0.95	.814			0.91	.676	0.96	.812	0.83	.642
Formally married	0.92	.773	0.14*	.029	1.21	.476	0.62*	.032	0.57	.323
Region (ref=region 1)										
Region 2	0.50***	.001	0.97	.916	1.87***	.000	1.15	.517	0.91	.808
Region 3	0.74	.218	0.38**	.007	2.57***	.000	1.31	.199	0.54*	.049
Region 4	0.71	.106	0.56	.100	1.03	.843	0.91	.652	0.69	.259
Region 5	0.49***	.001	1.00	.994	1.86***	.000	1.26	.302	1.07	.862
Region 6			0.75	.370	0.73*	.044			0.88	.692
Region 7			0.50	.062					1.34	.453
Region 8									0.72	.396
Region 9									1.44	.297
Region 10									1.92	.091
Region 11									0.64	.177
Region 12									0.61	.286
Region 13									2.01*	.028
Region 14									1.14	.687
Residence (ref=urban)										
Rural	0.65	.085	0.69*	.043	0.86	.096	1.42	.059	1.24	.231
Household wealth quintile (ref=poorest)										
Poorer	1.42*	.017	1.41	.156	1.20	.061	0.99	.963	1.01	.950
Middle	1.89**	.002	3.49***	.000	1.35**	.002	1.28	.103	1.33	.208
Richer	4.16***	.000	2.30**	.003	1.66***	.000	1.91***	.001	1.63	.067
Richest	3.90**	.005	2.31*	.011	2.57***	.000	1.92**	.004	1.76	.079
Observations	1,990		1,176		9,564		2,101		1,967	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A21 Weekly internet use and other factors associated with seeking medical treatment for child illness (fever, acute respiratory infection, or diarrhea) among children under age 5. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value								
Uses internet at least once per week	1.74	.222	0.83	.526	1.83**	.004	1.54	.241	1.13	.587
Age (ref=15–19)										
20–29	1.15	.617	0.85	.603	1.15	.315	1.35	.472	1.32	.313
30–39	1.83*	.033	0.92	.816	1.00	.991	1.52	.326	1.26	.514
40–49	1.19	.606	0.52	.328	1.12	.539	1.42	.461	1.52	.340
Number of children (ref=1–2)										
3–5	0.55**	.004	1.13	.603	0.99	.929	0.84	.190	0.84	.370
5+	0.60*	.034	0.79	.646	1.01	.934	0.65*	.034	0.83	.538
Education (ref=none)										
Primary	1.04	.824	1.09	.742	1.48***	.000	1.08	.631	1.62***	.001
Secondary	0.86	.428	1.53	.071	1.48***	.000	1.44	.079	1.31	.238
Higher	1.00	.997	1.14	.643	1.35	.105	1.43	.498	0.82	.621
Employment (ref=does not work)										
Works but not for cash	1.55*	.029	0.88	.537	1.17	.145	1.22	.233	0.60*	.013
Works for cash	1.67**	.004	0.80	.330	1.55***	.000	0.97	.802	0.80	.187
Sex of child (ref=male)										
Female	0.90	.398	0.97	.902	0.94	.194	0.95	.532	1.01	.945
Child's current age (ref= < 1 year)										
1 year	0.72	.102	1.23	.446	1.20*	.017	1.48**	.009	1.27	.102
2 years	0.64	.062	1.73	.075	1.24**	.009	1.22	.220	0.92	.606
3 years	0.82	.367	1.12	.669	1.08	.355	1.11	.534	0.72	.079
4 years	0.75	.198	1.13	.711	1.09	.308	1.28	.191	0.72	.113
Marital status (ref=not married)										
Married/cohabiting	0.96	.852			0.93	.740	0.93	.661	0.85	.680
Formally married	0.94	.832	0.14*	.029	1.22	.457	0.62*	.029	0.58	.337
Region (ref=region 1)										
Region 2	0.50***	.001	0.97	.931	1.87***	.000	1.14	.545	0.83	.633
Region 3	0.74	.210	0.37**	.006	2.57***	.000	1.30	.213	0.52*	.032
Region 4	0.72	.112	0.57	.103	1.03	.827	0.90	.603	0.67	.214
Region 5	0.49***	.001	0.99	.978	1.83***	.001	1.24	.331	0.94	.868
Region 6			0.74	.348	0.75	.059			0.81	.528
Region 7			0.48	.054					1.45	.339
Region 8									0.70	.345
Region 9									1.34	.381
Region 10									1.71	.154
Region 11									0.61	.139
Region 12									0.56	.202
Region 13									1.78	.058
Region 14									1.04	.903
Residence (ref=urban)										
Rural	0.65	.082	0.684**	.039	0.86	.093	1.44*	.048	1.21	.282
Household wealth quintile (ref=poorest)										
Poorer	1.43*	.014	1.39	.171	1.20	.060	1.03	.857	1.02	.929
Middle	1.91**	.002	3.47***	.000	1.35**	.002	1.34*	.048	1.36	.182
Richer	4.07***	.000	2.30**	.003	1.66***	.000	2.11***	.000	1.67	.061
Richest	3.81**	.005	2.34*	.011	2.49***	.000	2.12***	.001	1.85	.057
Observations	1,990		1,176		9,564		2,101		1,967	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A22 Mobile phone ownership and other factors associated with seeking help when experiencing physical or sexual violence in last 12 months among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value	OR	p value	OR	p value	OR	p value
Owns a mobile phone	0.99	.944	1.25	.182	0.86	.181	1.16	.266	0.94	.824
Age (ref=15–19)										
20–29	1.16	.559	1.00	.994	0.90	.471	0.92	.775	1.32	.544
30–39	1.40	.230	1.20	.600	1.04	.829	1.07	.848	1.35	.590
40–49	1.18	.604	1.02	.957	1.11	.635	1.01	.973	3.03	.081
Number of children (ref=0)										
1–2	1.22	.451	0.66	.181	1.12	.473	1.12	.637	1.05	.928
3–5	1.00	1.000	0.53	.061	1.19	.332	1.07	.804	1.32	.634
5+	1.21	.629	0.52	.201	1.09	.709	1.08	.841	0.87	.835
Respondent witnessed father beat mother (ref=no)	1.54**	.002	1.45*	.033	1.35**	.003	0.96	.721	1.14	.768
Perpetrator of violence (ref=not intimate partner)										
Intimate partner	2.16***	.000	1.50*	.011	1.52***	.000	1.60***	.000	1.08	.811
Accepting of wife beating (ref=0 scenarios)										
1–2 scenarios	1.31	.060	0.92	.565	0.95	.579	0.92	.550	0.82	.460
3+ scenarios	0.60	.111	0.52	.398	0.70*	.027	1.17	.424	0.74	.501
Education (ref=none)										
Primary	1.22	.306	0.77	.212	0.96	.780	1.21	.357	0.71	.388
Secondary	1.02	.886	0.64	.072	1.14	.336	1.06	.826	1.78	.156
Higher	0.94	.863	1.47	.287	1.03	.888	0.72	.504	1.39	.698
Employment (ref=does not work)										
Works but not for cash	0.61*	.015	1.42	.084	1.04	.781	0.80	.232	0.70	.251
Works for cash	1.31	.091	1.08	.687	1.13	.285	1.37	.068	1.09	.790
Marital status (ref=not married)										
Married/cohabiting	1.00	.997	0.73	.541	0.82	.241	1.00	.981	0.38	.067
Formally married	1.40	.296	0.90	.855	1.54	.052	1.50	.140	1.15	.837
Region (ref=region 1)										
Region 2	0.47***	.001	0.41**	.004	2.12***	.000	1.33	.214	0.37	.062
Region 3	0.65*	.049	0.55*	.033	1.75***	.000	1.07	.763	1.00	.999
Region 4	0.70	.122	1.16	.609	1.99***	.000	0.98	.922	1.82	.404
Region 5	0.40***	.000	0.48**	.007	2.99***	.000	1.46	.090	0.65	.428
Region 6			0.75	.362	0.67*	.012			1.10	.883
Region 7			0.71	.233					0.63	.286
Region 8									1.79	.308
Region 9									1.60	.388
Region 10									0.54	.232
Region 11									2.48	.155
Region 12									0.85	.803
Region 13									0.61	.371
Region 14									0.32	.087
Residence (ref=urban)										
Rural	0.96	.839	0.69*	.032	0.92	.368	0.88	.476	1.19	.503
Household wealth quintile (ref=poorest)										
Poorer	0.75	.120	1.18	.520	1.10	.564	0.84	.353	0.84	.625
Middle	0.79	.263	1.00	.985	1.07	.702	0.82	.325	0.74	.409
Richer	1.27	.338	0.92	.777	1.15	.437	0.78	.290	0.69	.426
Richest	1.35	.319	1.05	.879	1.15	.487	1.05	.868	1.10	.844
Observations	1,840		1,055		3,802		1,330		560	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A23 Use of mobile phone for financial transactions and other factors associated with seeking help when experiencing physical or sexual logistic violence in last 12 months among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value	OR	p value	OR	p value	OR	p value
Uses phone for financial transactions	1.21	.408	0.51	.071	0.89	.415	1.30	.085	0.91	.805
Age (ref=15–19)										
20–29	1.12	.658	0.99	.985	0.88	.394	0.89	.665	1.33	.529
30–39	1.32	.332	1.17	.661	1.02	.915	1.03	.933	1.34	.586
40–49	1.11	.746	0.98	.951	1.08	.713	0.97	.929	3.03	.082
Number of children (ref=0)										
1–2	1.21	.451	0.64	.153	1.13	.451	1.12	.644	1.05	.930
3–5	1.01	.969	0.52	.057	1.19	.329	1.08	.797	1.31	.648
5+	1.24	.595	0.49	.174	1.10	.667	1.08	.822	0.87	.833
Respondent witnessed father beat mother (ref=no)	1.54**	.002	1.45*	.033	1.35**	.003	0.96	.720	1.13	.787
Perpetrator of violence (ref=not intimate partner)										
Intimate partner	2.17***	.000	1.48*	.016	1.53***	.000	1.61***	.000	1.09	.791
Accepting of wife beating (ref=0 scenarios)										
1–2 scenarios	1.33*	.046	0.94	.656	0.95	.596	0.92	.537	0.82	.466
3+ scenarios	0.61	.124	0.52	.391	0.70*	.030	1.17	.408	0.75	.513
Education (ref=none)										
Primary	1.21	.323	0.79	.250	0.94	.661	1.20	.395	0.71	.379
Secondary	0.98	.922	0.72	.172	1.11	.443	1.02	.936	1.78	.143
Higher	0.86	.689	1.74	.124	1.03	.889	0.67	.431	1.44	.677
Employment (ref=does not work)										
Works but not for cash	0.61*	.015	1.48	.054	1.04	.793	0.80	.214	0.70	.258
Works for cash	1.30	.109	1.13	.546	1.12	.322	1.35	.081	1.10	.768
Marital status (ref=not married)										
Married/cohabiting	1.02	.945	0.71	.489	0.82	.229	1.01	.971	0.38	.063
Formally married	1.41	.285	0.84	.765	1.52	.057	1.49	.141	1.16	.829
Region (ref=region 1)										
Region 2	0.47***	.001	0.40**	.004	2.11***	.000	1.33	.220	0.36*	.042
Region 3	0.65*	.048	0.57*	.046	1.77***	.000	1.06	.776	0.99	.978
Region 4	0.69	.118	1.15	.628	1.99***	.000	0.99	.958	1.78	.410
Region 5	0.40***	.000	0.47**	.005	2.99***	.000	1.46	.090	0.64	.388
Region 6			0.75	.356	0.68*	.014			1.10	.881
Region 7			0.71	.228					0.63	.295
Region 8									1.78	.305
Region 9									1.57	.393
Region 10									0.53	.206
Region 11									2.46	.153
Region 12									0.83	.775
Region 13									0.60	.336
Region 14									0.31	.078
Residence (ref=urban)										
Rural	0.97	.869	0.67*	.023	0.93	.417	0.90	.563	1.19	.491
Household wealth quintile (ref=poorest)										
Poorer	0.75	.112	1.20	.487	1.09	.620	0.83	0.322	0.85	.630
Middle	0.78	.236	1.03	.905	1.03	.868	0.81	0.300	0.74	.429
Richer	1.23	.418	0.97	.918	1.09	.597	0.77	0.229	0.70	.428
Richest	1.28	.407	1.12	.739	1.10	.616	1.00	0.990	1.09	.847
Observations	1,840		1,055		3,802		1,330		560	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

Appendix Table A24 Weekly internet use and other factors associated with seeking help when experiencing physical or sexual violence in last 12 months among women age 15–49. Odds ratios from separate multivariable logistic regressions

	Liberia		Nepal		Nigeria		Rwanda		Senegal	
	OR	p value	OR	p value	OR	p value	OR	p value	OR	p value
Uses internet at least once per week	0.94	.815	1.04	.902	0.96	.780	1.40	0.305	1.74	.099
Age (ref=15–19)										
20–29	1.17	.545	1.01	.972	0.87	.364	0.96	0.893	1.25	.618
30–39	1.41	.241	1.21	.581	1.01	.967	1.11	0.764	1.29	.627
40–49	1.19	.598	1.01	.974	1.07	.758	1.06	0.876	2.86	.083
Number of children (ref=0)										
1–2	1.22	.452	0.67	.187	1.13	.455	1.11	0.652	1.06	.903
3–5	1.00	.989	0.54	.065	1.19	.323	1.07	0.811	1.40	.552
5+	1.21	.631	0.51	.191	1.10	.654	1.08	0.832	0.89	.852
Respondent witnessed father beat mother (ref=no)	1.54**	.002	1.46*	.030	1.35**	.003	0.95	0.703	1.12	.819
Perpetrator of violence (ref=not intimate partner)										
Intimate partner	2.16***	.000	1.49*	.015	1.53***	.000	1.60***	0.001	1.06	.857
Accepting of wife beating (ref=0 scenarios)										
1–2 scenarios	1.31	.060	0.93	.614	0.95	.589	0.93	0.572	0.82	.452
3+ scenarios	0.60	.111	0.52	.385	0.70*	.030	1.17	0.418	0.75	.514
Education (ref=none)										
Primary	1.22	.305	0.80	.268	0.95	.677	1.22	0.338	0.65	.282
Secondary	1.03	.842	0.66	.096	1.10	.469	1.05	0.864	1.43	.354
Higher	0.96	.919	1.52	.254	1.00	.986	0.59	0.364	1.07	.937
Employment (ref=does not work)										
Works but not for cash	0.61*	.015	1.45	.064	1.04	.801	0.81	0.235	0.70	.248
Works for cash	1.31	.089	1.09	.679	1.11	.362	1.38	0.061	1.15	.668
Marital status (ref=not married)										
Married/cohabiting	1.00	.995	0.75	.578	0.82	.229	0.99	0.979	0.36*	.042
Formally married	1.39	.304	0.92	.896	1.51	.061	1.51	0.136	1.08	.910
Region (ref=region 1)										
Region 2	0.47***	.001	0.41**	.004	2.10***	.000	1.35	0.196	0.44	.109
Region 3	0.65*	.047	0.57*	.041	1.76***	.000	1.09	0.710	1.01	.984
Region 4	0.70	.121	1.18	.559	1.98***	.000	0.99	0.972	2.09	.292
Region 5	0.40***	.000	0.48**	.006	2.99***	.000	1.48	0.080	0.67	.469
Region 6			0.76	.392	0.67*	.012			1.15	.821
Region 7			0.73	.252					0.75	.512
Region 8									1.96	.251
Region 9									1.83	.272
Region 10									0.57	.287
Region 11									2.60	.144
Region 12									0.86	.827
Region 13									0.64	.427
Region 14									0.33	.101
Residence (ref=urban)										
Rural	0.96	.838	0.69*	.030	0.93	.409	0.87	0.451	1.25	.382
Household wealth quintile (ref=poorest)										
Poorer	0.75	.117	1.20	.478	1.09	.618	0.87	0.443	0.84	.619
Middle	0.79	.251	1.03	.924	1.03	.872	0.86	0.453	0.66	.269
Richer	1.27	.347	0.96	.882	1.08	.633	0.84	0.425	0.60	.267
Richest	1.37	.304	1.13	.727	1.09	.666	1.11	0.684	0.88	.794
Observations	1,840		1,055		3,802		1,330		560	

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$