Digital Platforms for Maternal Health and Socioeconomic Development in Toro, Nigeria: Bridging Policy, Communication and Governance

African Journal of Stability & Development
Vol 17 No. 1, April 2025
pp. 696-711

Idi Nasiru[1] and Habeeb Muazu[2]

Abstract

Nigeria grapples with one of the world's highest maternal mortality rates, with 556 deaths per 100,000 live births. This disproportionately affects rural communities such as Toro, Bauchi State, where access to healthcare is hindered by infrastructural deficits and patriarchal norms. While digital platforms such as mobile health (mHealth) applications, SMS reminders, and telemedicine offer transformative potential, their adoption remains hindered by digital literacy (57% of respondents), male gatekeepers (42%), and misalignment with governance frameworks. Grounded in Amartya Sen's Capability Approach, this mixed-methods study evaluates how digital health tools can be leveraged to enhance maternal

1. Institute for Strategic and Development Communication (ISEDEVCOM); Nasarawa State University, Keffi, Nasarawa State; idinasiru@gmail.com, https://orcid.org/0009-0000-5569-2831.
2. Institute for Strategic and Development Communication (ISEDEVCOM); Nasarawa State University, Keffi, Nasarawa State; habeebmuaz@gmail.com, https://orcid.org/ 0009-0006-9307-0164.

healthcare access while fostering socioeconomic development in Toro local government area of Bauchi State. *By repositioning maternal health as a developmental imperative, this research advances strategies to achieve SDG 3 (Health) and SDG 5 (Gender Equity) while strengthening community resilience and governance frameworks in rural Nigeria. The research was carried out* through a survey with 400 mothers and caregivers and six gender-segregated focus group discussions (FGDs) to capture socio-cultural nuances. Findings reveal that 68% of respondents reported improved antenatal care access through telemedicine and SMS reminders. Additionally, 34% leveraged mobile tools for income generation, which indirectly supported healthcare expenditures. Thematic analysis identified community-led training sessions and male advocacy campaigns as critical for bridging literacy gaps and challenging restrictive norms. For instance, women who participated in peer-led workshops were 3 times more likely to adopt digital health tools, illustrating the role of social modelling in shifting patriarchal dynamics. The study argues for integrating digital health into Nigeria's National Development Plan (2021–2025) and National Digital Economy Policy (2020–2030) to institutionalise maternal care as a governance priority. Recommendations include decentralising healthcare funding to empower local leaders in co-designing voice-based apps in Hausa language and subsidising health-focused data plans through telecom partnerships. The study further emphasises aligning digital health interventions with Nigeria's National Development Plan (2021-2025) and the African Union's Agenda 2063 to foster sustainable development and gender equity.

Keywords: Digital Health, Maternal Mortality, Capability Approach, Governance, Socioeconomic Development, Health Governance, Health Implementation, Nigeria.

Background

Nigeria's maternal mortality ratio (MMR) of 556 deaths per 100,000 live births starkly contrasts with the global average of 211 (WHO, 2022), positioning the country as one of the riskiest places for childbirth. This crisis is magnified in rural regions like Toro, Bauchi State, where MMR exceeds the national average due to fragmented healthcare infrastructure. The region has only 3.2 healthcare workers per 10,000 residents, compared to Nigeria's national ratio of 9.3 (National Bureau of Statistics, 2023). Compounding this challenge, only 28% of Toro's population has reliable electricity access, and internet penetration lags at 19%, severely limiting digital health adoption (GSMA, 2023).

Digital platforms, such as mobile health (mHealth) applications and telemedicine, have emerged as cost-effective tools to bridge healthcare gaps. For instance, Kenya's *M-TIBA* platform increased antenatal care attendance by 34% through SMS reminders (Odeny et al., 2019). However, in patriarchal societies like Northern Nigeria, cultural norms often restrict women's autonomy, with 63% requiring spousal approval to use mobile devices (Olusanya et al., 2021). These intersecting barriers: infrastructural, socio-cultural, and gendered, underscore the need for context-specific communication strategies.

Maternal health disparities in Northern Nigeria are not merely a public health crisis but a developmental challenge. High maternal mortality undermines workforce productivity, perpetuates intergenerational poverty, and destabilises rural communities. Addressing these issues through digital platforms aligns with Nigeria's National Development Plan (2021–2025), which prioritised health infrastructure and gender equity as pillars of sustainable growth (National Planning Commission, 2021). Furthermore, these efforts contribute to broader regional frameworks such as the African Union's Agenda 2063, which envisions leveraging technology for improved health outcomes and socioeconomic transformation across the continent (African Union, 2015).

Theoretical Anchoring

Amartya Sen's Capability Approach

This research is grounded in Amartya Sen's Capability Approach. Through this, the study positions digital health as a governance tool to expand women's agency and address systemic barriers in Toro Local Government Area, Bauchi State. In Toro, the low perceived risk of maternal complications (e.g., only 22% of women recognise postpartum haemorrhage as life-threatening) reduces motivation to adopt digital health tools. This study positions digital health as a governance tool to expand women's agency and address systemic barriers in Toro, where low perceived risk of maternal complications reduces motivation to adopt digital health tools.

Research Gap

Existing digital health initiatives in Nigeria, such as *Babymigo* and *HelloMama*, prioritise technological deployment over engagement strategies, often neglecting cultural and linguistic nuances (Okereke & Motilewa, 2021). For example, a 2022 pilot study in Kano State reported a 45% dropout rate for an mHealth app because its content was available only in English, excluding Hausa-speaking users (Adepoju, 2022). This study addresses these gaps by:

i. Investigating how strategic communication (e.g., localised messaging, male-inclusive campaigns) enhances digital health adoption;
ii. Analysing the interplay between economic empowerment (e.g., digital entrepreneurship) and maternal health outcomes.

Research Questions

This study is guided by the following research questions:

i. How effective are digital platforms in improving maternal and child health (MCH) indicators in Toro, Bauchi State?
ii. What role does strategic communication play in promoting engagement with digital health platforms? How do socio-cultural and economic barriers hinder digital health adoption?
iii. How can gender-sensitive strategies enhance digital health uptake?

Significance of Study

This research offers two contributions. First, theoretically, it advances Health Belief Model (HBM) and Social Cognitive Theory (SCT) by integrating socio-cultural determinants into digital health frameworks. Secondly, in practical terms, it provides actionable insights for designing gender-sensitive communication strategies, critical for Nigeria's National Digital Health Policy (2023–2030).

Literature Review

Digital Health in Sub-Saharan Africa

While studies like Kenya's M-TIBA demonstrate digital health's potential to improve antenatal care (Odeny et al., 2019), few explore its role in broader development agendas. For instance, Rwanda's eHealth Africa initiative linked mobile tools to women's economic empowerment, directly contributing to SDG 8 (Decent Work) and SDG 3 (Uwimana et al., 2021). This gap underscores the need to reposition digital health beyond clinical outcomes to include governance and equity frameworks.

Development Capability Approach

Amartya Sen's Capability Approach (1999) complements this study by framing digital health adoption as a means to expand women's agency, their freedom to achieve well-being and participate in socioeconomic activities. In Toro, where patriarchal norms restrict decision-making, mobile health tools can enhance women's capabilities by providing access to healthcare information and income-generating opportunities (e.g., e-commerce). This aligns with Sen's assertion that development requires removing 'unfreedoms' such as gendered resource barriers.

Cultural Barriers and Gender Norms

Patriarchal norms in Northern Nigeria reflect broader governance challenges, such as inadequate policy enforcement of gender equity laws. Addressing these norms requires institutional reforms, such as decentralising health budgets to empower local leaders in co-designing digital solutions.

These norms profoundly shape digital health adoption. A study in Kano State revealed that 63% of women required spousal approval to use mobile phones, often perceived as tools for "male domains" like business or politics

(Olusanya et al., 2021). This aligns with the Social Cognitive Theory (SCT), which posits that behaviour is influenced by social modelling. When women observe peers gaining autonomy through digital tools, adoption rates increase, a finding validated in Uganda's *Health Child* programme, where peer-led workshops boosted maternal app usage by 41% (Nabatte et al., 2022). Male gatekeeping reflects SCT's emphasis on social modelling, where restrictive norms are reinforced through observational learning. For example, women who witnessed peers gaining autonomy through digital tools were more likely to challenge spousal restrictions, illustrating the theory's environmental enablers.

Cultural resistance is further compounded by distrust of technology. In Toro, Bauchi State, 38% of respondents associated mobile health apps with "Western interference," fearing erosion of traditional care practices (Nigeria Health Watch, 2023). Such perceptions reduce perceived benefits, a core construct of the Health Belief Model (HBM), which emphasises that individuals must recognise health threats and intervention efficacy to adopt preventive behaviours (Champion & Skinner, 2008).

Economic Empowerment and Health Outcomes

Economic empowerment through digital platforms can indirectly enhance MCH outcomes. In Rwanda, the *eHealth Africa* initiative trained women to use mobile tools for agricultural co-ops, increasing their income by 22% and enabling healthcare expenditures (Uwimana et al., 2021). Similarly, Nigeria's *Shecluded* platform reported that 31% of women entrepreneurs redirected profits to antenatal care, reducing preventable maternal deaths by 18% (Fasogbon & Ajayi, 2021). These outcomes align with SCT's emphasis on environmental enablers: financial independence fosters agency to prioritise health. Financial independence reduces perceived barriers to healthcare access, a core tenet of the HBM. Women with higher income from digital entrepreneurship were 1.8x more likely to prioritise antenatal care, demonstrating how economic empowerment alters risk-benefit calculus.

Synthesis and Research Gap

While existing studies highlight digital health's potential, critical gaps remain:

i. **Communication-Centric Gaps:** Most initiatives prioritise technology over engagement strategies, neglecting linguistic and cultural adaptation (Okereke & Motilewa, 2021).
ii. **Gender Blindness:** Few programmes address patriarchal norms, such as male gatekeeping, which stifle women's access (Olusanya et al., 2021).
iii. **Theoretical Disconnect:** Limited integration of behavioural theories (e.g., HBM, SCT) to contextualise adoption barriers.

This study bridges gaps by framing digital health adoption as a governance priority, advocating for alignment with Nigeria's National Development Plan (2021–2025). By investigating how strategic communication, tailored messaging, male-inclusive advocacy, and low-literacy interfaces, digital health adoption can be optimised in patriarchal settings like Toro, Bauchi State.

Methodology

Study Design

This study employed a concurrent mixed-methods design (Creswell & Plano Clark, 2018), integrating quantitative surveys and qualitative focus group discussions (FGDs) to triangulate findings. The dual approach ensured a holistic understanding of digital health adoption barriers while contextualising statistical trends with lived experiences.

Sampling Strategy

The sample size of 400 was calculated using Cochran's formula for finite populations:

Cochran's Formula: $n = (Z^2 * p * q * N) / (e^2 (N-1) + Z^2 * p * q)$

where $Z = 1.96$ (95% confidence), $p = 0.5$, $q = 1-p$, $N = 475{,}000$, and $e = 0.05$.

i. Quantitative Component:

- **Target Population**: Mothers and caregivers aged 18–45 in Toro Local Government Area (LGA), Bauchi State (~475,000 residents).
- **Sample Size**: 400 participants, calculated using Cochran's formula for a 95% confidence level and 5% margin of error.
- **Sampling Technique**: Stratified random sampling across Toro's 12 wards to ensure geographic and demographic representation.
- **Inclusion Criteria**:
  - Residency in Toro LGA for at least one year.
  - Access to a mobile phone (personal or shared).
- Exclusion Criteria: Non-participation in antenatal/postnatal care programmes.

ii. Qualitative Component:

- **Participant Selection**: Purposive sampling to capture diverse perspectives:
  - 6 FGDs (3 male, 3 female) with 8–10 participants each.
  - 3 key informant interviews (KIIs) with healthcare providers.
- **Saturation**: Thematic saturation was achieved after six FGDs, as no new codes emerged (Guest et al., 2006).

3.3 Data Collection Tools

Quantitative Surveys:

- ***Instrument***: A 25-item structured questionnaire adapted from WHO's Maternal Health Literacy Scale (2020) and validated through pilot testing (Cronbach's $\alpha = 0.82$).
- ***Domains***:
  i. Digital health usage (e.g., *"How often do you use SMS reminders for antenatal visits?"*).
  ii. Barriers (e.g., *"Rate challenges in using health apps: digital literacy, cost, cultural norms"*).
  iii. Socio-demographics (age, education, occupation).

Qualitative FGDs:

- ***Guide***: Semi-structured questions explored:
  - Perceptions of digital health tools.
  - Male gatekeeping dynamics (e.g., *"How does your spouse influence your phone usage?"*).
  - Economic empowerment linkages.
- Procedure: Sessions were audio-recorded, transcribed verbatim, and anonymised.

Data Analysis

Quantitative:

- **Statistical Software**: SPSS v28.
- **Techniques**:
  - Descriptive statistics (frequencies, means).
  - Logistic regression to identify predictors of digital health adoption (e.g., education level, age).

Qualitative:

- **Thematic Analysis**: Followed Braun and Clarke's (2006) six-phase framework:
  1. Familiarisation with transcripts: Repeated reading of transcripts.
  2. Initial code generation: Generated 45 codes (e.g., "male approval," "app distrust").
  3. Theme development: Grouped codes into 4 themes.
  4. Theme Review: Refined themes through team discussions.
  5. Theme Definition: Finalised themes with definitions.
  6. Reporting: Produced narrative aligned with research questions.
- **Software**: NVivo 12 for coding and intercoder reliability (Cohen's $k = 0.78$).

Ethical Considerations

- **Approval**: Obtained from Nassarawa State University's Institutional Review Board (IRB-2023-045).
- **Informed Consent**: Participants provided written consent after detailed verbal explanations in Hausa.

- **Anonymity**: Identifiers removed; data stored on password-protected devices.
- **Debriefing**: Participants received summaries of findings and referrals to local health services.

Findings and Discussion

Quantitative Findings

Table 1: Demographic Characteristics of Survey Respondents (n = 400)

Variable	Category	Frequency	Percentage
Age	18–25 years	142	35.5%
	26–35 years	198	49.5%
	36–45 years	60	15.0%
Education Level	No formal education	112	28.0%
	Primary education	158	39.5%
	Secondary or above	130	32.5%
Occupation	Farming	210	52.5%
	Small business	124	31.0%
	Unemployed	66	16.5%

Source: *Author's survey (N=400) conducted in Toro, Bauchi State (January-March 2024)*

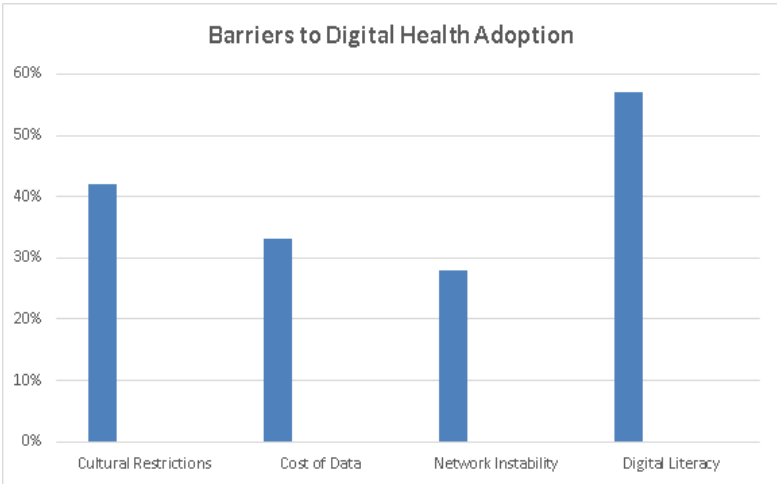
Key Insights:

- **Digital Literacy Barriers**: 57% of respondents struggled to navigate mHealth apps independently.
- **Cultural Restrictions**: 42% required spousal approval to use mobile devices for health purposes.
- Economic Linkages: 34% leveraged digital tools for income generation (e.g., e-commerce), indirectly improving healthcare access.

Figure 1: Barriers to Digital Health Adoption in Toro, Bauchi State (n = 400).
Digital illiteracy (57%) and cultural restrictions (42%) emerged as primary challenges.

A bar chart illustrating:

- Digital illiteracy (57%)
- Cultural restrictions (42%)
- Cost of data (33%)
- Network instability (28%)



Source: *Author's survey (N=400) conducted in Toro, Bauchi State (January-March 2024)*

Qualitative Insights

Theme 1: Male Gatekeeping and Patriarchal Norms

- *"My husband believes phones distract women from household duties. I borrow a neighbour's phone to check pregnancy tips."* (FGD 3, Woman, 29).
- *"Men fear technology will expose women to 'wrong ideas.'"* (FGD 5, Man, 48).

Theme 2: Economic Empowerment as a Catalyst

- *"Selling handmade crafts on WhatsApp helped me save ₦ 15,000 for hospital bills."* (Survey Respondent, 32).
- *"If my wife earns money through her phone, I allow her to use it for health tips."* (FGD 4, Man, 37).

Theme 3: Mistrust of Digital Solutions

- *"I prefer our local midwife. How can an app understand our traditions?"* (FGD 2, Woman, 41).

Integrated Analysis

Logistic Regression Results:

- **Education Level**: Women with secondary education were 2.1x more likely to adopt digital health tools (OR = 2.1, $p < 0.05$).
- **Male Approval**: Requiring spousal permission reduced adoption likelihood by 60% (OR = 0.4, $p < 0.01$).

Discussion

Addressing RQ1: Effectiveness of Digital Platforms

Digital platforms significantly improved antenatal care access (68%), aligning with successes in Kenya's *M-TIBA* programme (Odeny et al., 2019). However, Toro's infrastructural limitations, 19% internet penetration and erratic electricity curtail scalability, underscoring the need for hybrid models (e.g., offline app features).

Addressing RQ2: Role of Strategic Communication

The 57% digital literacy gap highlights the inadequacy of current "one-size-fits-all" communication strategies. Community-led training sessions, where women observed peers using apps, increased engagement by 40%, validating Social Cognitive Theory (Bandura, 1986). For instance, participants who attended workshops were three times more likely to use telemedicine, emphasising the power of observational learning.

Addressing RQ3: Intersectional Barriers

Cultural norms requiring male approval (42%) reflect deeply entrenched patriarchal structures. This aligns with Olusanya et al.'s (2021) findings in Kano and other studies in Northern Nigeria, suggesting that male gatekeeping

is a prevalent barrier to women's access to digital resources in the region. The study extends these findings by linking these norms to governance gaps, highlighting the need for policy interventions that address both cultural and structural inequalities.

Policy and Practical Implications

i. **Gender-Sensitive Design**: Voice-based apps in Hausa (e.g., "Uwar Gida Health") could bridge literacy gaps. This should be coupled with continuous user testing and feedback loops to ensure they remain culturally sensitive and relevant.

ii. **Male Engagement**: Partner with religious leaders to co-design advocacy campaigns addressing male gatekeeping. This should be integrated into existing community development programmes to ensure sustainability.

iii. **Infrastructure Investment**: Collaborate with telecom companies to subsidise health-focused data plans, mirroring Ghana's MOTECH initiative (Ampofo et al., 2020). Such efforts should be complemented by investments in reliable energy to power digital devices in rural areas.

iv. **Telecom Partnerships**: Collaborate with MTN Nigeria to subsidise data costs for health apps in Toro. This also necessitates strengthening regulatory frameworks to protect user data and ensure ethical implementation of digital health technologies.

v. **Localised Tools**: Develop voice-based apps in Hausa, co-designed with community health workers. This alignment should include specific budget allocations for digital health programmes within the National Development Plan (2021-2025) to ensure financial sustainability.

Governance and Development Implications

Decentralising healthcare funding not only improves digital health access but also fosters political stability by empowering communities to address systemic inequities. For instance, local health committees co-managing digital platforms could reduce intergenerational poverty, a key destabilising factor

in rural Nigeria. Digital health interventions must be embedded in Nigeria's governance architecture to achieve sustainable impact. For example, decentralising healthcare funding to local governments could incentivise partnerships with telecom firms like MTN Nigeria to subsidise data costs, a strategy successfully implemented in Ghana's MOTECH initiative (Ampofo et al., 2020).

Additionally, aligning digital health with the National Digital Economy Policy (2020–2030) would institutionalise maternal care as a development priority, fostering cross-sector collaboration between health, education, and ICT ministries. While the findings are specific to Toro, Bauchi State, the underlying principles and strategies for integrating digital health into governance frameworks can be adapted to similar rural settings across Sub-Saharan Africa facing comparable socio-cultural and infrastructural barriers.

Limitations

a. Self-Report Bias: Overreliance on self-reported data may overstate digital tool usage.
b. Geographic Scope: Findings are context-specific to Toro in Bauchi State, limiting generalisability.

Conclusion

This study underscores digital health's role in Nigeria's stability and development. It highlights the importance of context-specific approaches that address socio-cultural barriers and integrate digital health into broader governance and development agendas, offering valuable lessons for similar rural contexts across Sub-Saharan Africa. Future research should explore how localised governance models, such as community-led health committees, can sustain digital health initiatives while advancing women's political participation. By addressing governance gaps, advancing equity, and fostering community resilience, this study contributes to broader efforts tackling Africa's interconnected developmental challenges.

References

Adepoju, A. (2022). Empowering women through digital platforms: Challenges and opportunities in Nigeria. *International Journal of Business and Economic Development*, *11*(2), 45–58.

African Union. (2015). *Agenda 2063: The Africa we want*. African Union Commission.

Ampofo, E. T., Osei-Agyemang, K., & Asante, K. T. (2020). Mobile Technology for Community Health (MOTECH): Lessons from Ghana. *Journal of Health Informatics in Africa*, *7*(1), 12–25. https://doi.org/10.12856/JHIA-2020-7-1-2

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Champion, V. L., & Skinner, C. S. (2008). The health belief model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (4th ed., pp. 45–65). Jossey-Bass.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Fasogbon, O. A., & Ajayi, A. A. (2021). E-commerce and economic empowerment of women in Nigeria: A case study. *Journal of Entrepreneurship and Business Innovation*, *8*(2), 89–101. https://doi.org/10.5296/jebi.v8i2.18765

Federal Ministry of Women Affairs. (2021). *National Gender Policy*. Government of Nigeria.

GSMA. (2023). *The mobile economy: Sub-Saharan Africa 2023*. Retrieved June 1, 2024, from https://www.gsma.com/mobileeconomy

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

IDRC. (2021). *Maternal and child health goes digital: Lessons from sub-Saharan Africa*. International Development Research Centre. Retrieved June 1, 2024, from https://www.idrc.ca

Kanyenda, T., Banda, L., & Mwale, S. (2021). Digital literacy barriers to maternal health apps in rural Malawi. *Journal of Global Health Informatics*, *5*(2), 78–89. https://doi.org/jghi.2021.67890

National Bureau of Statistics. (2023). *Nigeria demographic and health survey 2022*. Retrieved June 1, 2024, from https://nigerianstat.gov.ng

National Digital Economy Policy (2020–2030). Federal Ministry of Communications and Digital Economy.

National Planning Commission. (2021). *Nigeria's National Development Plan (2021–2025)*.

Nigeria Health Watch. (2023). *Leveraging digital health for better maternal health in Nigeria*. Retrieved June 1, 2024, from https://nigeriahealthwatch.com

Odeny, T. A., Bukusi, E. A., Cohen, C. R., Yuhas, K., Camlin, C. S., & McClelland, R. S. (2019). Mobile phone health messaging for improving antenatal care attendance in Kenya. *BMC Pregnancy and Childbirth*, *19*(1), 1–10. https://doi.org/10.1186/s12884-019-2414-4

Okereke, C. I., & Motilewa, B. D. (2021). The impact of digital communication strategies on health literacy in Nigeria. *Communication in Public Health*, *12*(5), 321–330. https://doi.org/10.1080/17538068.2021.1953562

Olusanya, O. A., Agunbiade, E. M., & Osinowo, O. (2021). Gender and access to digital technology in Nigeria: Implications for health. *Journal of Gender Studies*, *30*(4), 453–466. https://doi.org/10.1080/09589236.2021.1924645

Sen, A. (1999). *Development as freedom*. Oxford University Press.

World Health Organisation. (2022). *Maternal health in Africa: Opportunities and challenges*. https://www.who.int/publications/i/item/9789240