**Supplementary materials**

**Supplementary Tables**

**Supplementary Table S1.** Aggregated characteristics of participating healthcare facilities

**Supplementary Table S2.** Characteristics of each participating healthcare facility

**Supplementary Table S3.** Effect of introducing quality of care standards on labour companionship and provider self-reported provision of RMC

**Supplementary Table S4:** Baseline and endline characteristics of participating women, health workers, and observations by group and country

**Supplementary File**

**Supplementary SF1.** Reflexivity Statement

## Supplementary Tables

**Supplementary Table S1.** Characteristics of participating health care facilities

| | Bangladesh | | | | Ghana | | | | Tanzania | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Intervention | | Control | | Intervention | | Control | | Intervention | | Control | |
| Variables | **Baseline N=5** | **Endline N=5** | **Baseline N=10** | **Endline N=10** | **Baseline N=8** | **Endline N=8** | **Baseline N=8** | **Endline N=8** | **Baseline N=6** | **Endline N=6** | **Baseline N=6** | **Endline N=6** |
| ***Type of facility*** | | | | | | | | | | | | |
| Health centre | 4 | 4 | 8 | 8 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| Hospital | 1 | 1 | 2 | 2 | 5 | 5 | 5 | 5 | 2 | 2 | 2 | 2 |
| ***Facility ownership*** | | | | | | | | | | | | |
| Government | 5 | 5 | 10 | 10 | 6 | 6 | 7 | 7 | 4 | 4 | 3 | 3 |
| Private/FBO/NGO | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 3 |
| ***Facility Designation*** | | | | | | | | | | | | |
| BEmONC | 4 | 1 | 2 | 1 | 4 | 5 | 5 | 5 | 2 | 2 | 2 | 2 |
| CEmONC | 1 | 3 | 8 | 9 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| Missing | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Number of beds*** | | | | | | | | | | | | |
| <50 | 1 | 0 | 6 | 1 | 5 | 5 | 5 | 6 | 5 | 4 | 2 | 3 |
| 50-100 | 3 | 4 | 4 | 8 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 1 |
| >100 | 1 | 1 | 0 | 1 | 2 | 1 | 3 | 0 | 1 | 2 | 2 | 2 |
| Missing | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 |
| ***The facility admits patients overnight*** | | | | | | | | | | | | |
| Yes | 5 | 5 | 10 | 10 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 |
| No | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

**Supplementary Table S2.** Characteristics of each participating healthcare facility

| Facility code | Number of beds | Governance | Level of care | Total births in 2016 (singletons and multiples) | Maternity care model |
|---|---|---|---|---|---|
| Bangladesh | | | | | |
| *Intervention* | | | | | |
| A | 250 | Public | Tertiary hospital | 1126 | Obstetrician-led |
| B | 50 | Public | Primary Health Care Center | 773 | Shared |
| C | 31 | Public | Primary Health Care Center | 555 | Shared |
| D | 50 | Public | Primary Health Care Center | 67 | Shared |
| E | 50 | Public | Primary Health Care Center | 50 | Shared |
| *Control* | | | | | |
| F | 100 | Public | Secondary hospital | 830 | Obstetrician-led |
| G | 100 | Public | Secondary hospital | 414 | Obstetrician-led |
| H | 50 | Public | Primary Health Care Center | 360 | Shared |
| I | 50 | Public | Primary Health Care Center | 368 | Shared |
| J | 31 | Public | Primary Health Care Center | 363 | Shared |
| K | 31 | Public | Primary Health Care Center | 302 | Shared |
| L | 31 | Public | Primary Health Care Center | 110 | Shared |
| M | 31 | Public | Primary Health Care Center | 253 | Shared |
| N | 31 | Public | Primary Health Care Center | 212 | Shared |
| O | 31 | Public | Primary Health Care Center | 186 | Shared |
| P | 343 | Public-NGO/FBO | District Hospital | 5016 | Shared Model of Care |
| Ghana | | | | | |
| *Intervention* | | | | | |
| A | 226 | Public | Regional Hospital | 3789 | Shared Model of Care |
| B | 70 | Public | District Hospital | 1207 | Shared Model of Care |
| C | 17 | Public | Primary Health Care Center | 456 | Midwife-led care |
| D | 10 | Public | Primary Health Care Center | 288 | Midwife-led care |

| Facility code | Number of beds | Governance | Level of care | Total births in 2016 (singletons and multiples) | Maternity care model |
|---|---|---|---|---|---|
| E | 8 | Public | Primary Health Care Center | 277 | Midwife-led care |
| F | 7 | Public | Primary Health Care Center | 269 | Midwife-led care |
| G | 6 | Public-NGO/FBO | Primary Health Care Center | 131 | Midwife-led care |
| *Control* | | | | | |
| H | 164 | Public | District Hospital | 1561 | Shared Model of Care |
| I | 119 | Public | District Hospital | 867 | Shared Model of Care |
| J | 110 | Public | District Hospital | 1728 | Shared Model of Care |
| K | 28 | Public | Primary Health Care Center | 443 | Midwife-led care |
| L | 25 | Public | Primary Health Care Center | 523 | Midwife-led care |
| M | 17 | Public-NGO/FBO | Primary Health Care Center | 303 | Midwife-led care |
| N | 9 | Public | Primary Health Care Center | 86 | Midwife-led care |
| O | 5 | Public | Primary Health Care Center | 137 | Midwife-led care |
| Tanzania | | | | | |
| *Intervention* | | | | | |
| A | 150 | Public | District Hospital | 1482 | Shared |
| B | 37 | NGO/FBO | FBO Hospital | 1566 | Shared |
| C | 30 | Public | Primary Health Care Center | 95 | Shared |
| D | 28 | NGO/FBO | Primary Health Care Center | 126 | Shared |
| E | 24 | Public | Primary Health Care Center | 52 | Shared |
| F | 13 | Public | Primary Health Care Center | 52 | Shared |
| *Control* | | | | | |
| G | 450 | NGO/FBO | FBO Hospital | 1600 | Shared |
| H | 130 | Public | District Hospital | 658 | Shared |
| I | 80 | NGO/FBO | Primary Health Care Center | 320 | Shared |
| J | 50 | Private | Primary Health Care Center | 157 | Shared |
| K | 26 | Public | Primary Health Care Center | 227 | Shared |

| Facility code | Number of beds | Governance | Level of care | Total births in 2016 (singletons and multiples) | Maternity care model |
|---|---|---|---|---|---|
| L | 26 | Public | Primary Health Care Center | 232 | Shared |

NGO: Non-government organization; FBO: Faith-based organization; Midwife-led care model was selected to describe settings where the midwife plans, organize and delivers care to healthy women with uncomplicated or 'low-risk' pregnancies. Some antenatal and/or intrapartum and/or postpartum care may be provided in consultation with medical staff as appropriate. Within these models, midwives are, however, in partnership with the woman, the lead professional with responsibility for assessment of her needs, planning her care, referral to other professionals as appropriate, and for ensuring provision of maternity services. Obstetrician-provided care model was selected where the primary providers of care for most childbearing women (including low-risk) is an obstetrician. An obstetrician (not necessarily the one who provides care) is present for the birth, and nurses follow obstetrician's directions. Shared models of care involve shared responsibility for the organisation and delivery of care, throughout initial booking to the postnatal period, is shared between different health professionals.

**Supplementary Table S3.** Effect of introducing quality of care standards on labour companionship and provider self-reported provision of RMC

| | Pre-intervention | | Post-intervention | | Difference-in-Difference adjusted[1] (95% CI) |
|---|---|---|---|---|---|
| | Intervention | Control | Intervention | Control | |
| RMC practices | % | % | % | % | |
| **Bangladesh** | **N=53** | **N=105** | **N=92** | **N=166** | |
| **Heath workers interviews** | | | | | |
| HW self-reported provision of RMC (means; SD) | 4.1 (0.16) | 4.2 (0.10) | 4.0 (0.61) | 3.8 (0.07) | -0.27 (-0.90;3.7) |
| **Ghana** | **N=44** | **N=42** | **N=63** | **N=59** | |
| **Heath workers interviews** | | | | | |
| HW self-reported provision of RMC (means; SD) | 4.2 (0.53) | 4.1 (0.5) | 4.2 (0.9) | 4 (0.8) | 0.1 (-0.3;0.5) |
| **Tanzania** | **N=41** | **N=40** | **N=55** | **N=58** | |
| **Heath workers interviews** | | | | | |
| HW self-reported provision of RMC (means; SD) | 3.4 (0.13) | 4.0 (0.1) | 4.2 (0.12) | 3.9 (0.09) | **0.84*** (0.21;1.47) |

Note: HW: health worker. [1]Adjusted by clustering effect at the facility level. *Denoted <0.05; ** Denoted <0.01; ***Denoted <0.001.

**Supplementary Table S4.** Baseline and endline characteristics of participating women, health workers, and observations by group and country

| Variables | Bangladesh | | | | Ghana | | | | Tanzania | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline | | Endline | | Baseline | | Endline | | Baseline | | Endline | |
| | Intervention | Control | Intervention | Control | Intervention | Control | Intervention | Control | Intervention | Control | Intervention | Control |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| Interviewed women | N=126 | N=169 | N=111 | N=157 | N=210 | N=171 | N=291 | N=232 | N=86 | N=88 | N=86 | N=100 |
| Age in years | | | | | | | | | | | | |
| Less than 20 | 32.5 | 17.8 | 27.7 | 23.1 | 14.3 | 12.3 | 15.4 | 16.5 | 17.6 | 17.1 | 15.1 | 18.0 |
| 20-34 | 60.3 | 76.3 | 66.1 | 69.9 | 71.9 | 72.5 | 71.6 | 70.6 | 69.4 | 73.9 | 69.8 | 78.0 |
| 35 o more | 7.1 | 5.9 | 6.3 | 7.1 | 13.8 | 15.2 | 13.0 | 13.0 | 12.9 | 9.1 | 15.1 | 4.0 |
| Education level | | | | | | | | | | | | |
| Primary incomplete/no schooling | 31.0 | 30.8 | 29.7 | 27.5 | 34.3 | 32.8 | 28.5 | 27.7 | 5.9 | 12.5 | 11.6 | 13.0 |
| Primary complete | 44.4 | 36.6 | 40.5 | 36.9 | 25.2 | 25.2 | 18.2 | 19.1 | 68.2 | 69.3 | 68.6 | 52.0 |
| Middle/Secondary | 24.6 | 32.5 | 29.7 | 35.6 | 35.2 | 38.6 | 41.2 | 43.3 | 18.8 | 17.1 | 17.4 | 33.0 |
| Post-secondary education | NA | NA | NA | NA | 5.2 | 3.5 | 12.0 | 10.0 | 7.1 | 1.1 | 2.3 | 2.0 |
| Number of deliveries (including this one) | | | | | | | | | | | | |
| 1 | 50.8 | 53.9 | 56.3 | 51.3 | 32.4 | 30.4 | 35.3 | 33.8 | 42.6 | 39.8 | 33.7 | 39.0 |
| 2-3 | 42.1 | 39.1 | 40.2 | 41.0 | 47.6 | 42.7 | 39.4 | 45.0 | 36.5 | 42.1 | 43.0 | 48.0 |
| 4 or more | 7.1 | 7.1 | 3.6 | 7.7 | 20.0 | 26.9 | 25.3 | 21.2 | 21.2 | 18.2 | 23.3 | 13.0 |
| Interviewed health workers | N=53 | N=105 | N=92 | N=166 | N=44 | N=42 | N=63 | N=59 | N=41 | N=40 | N=55 | N=58 |
| Age in years | | | | | | | | | | | | |
| <30 | 20.8 | 16.2 | 25.0 | 20.5 | 40.9 | 45.2 | 41.3 | 42.4 | 26.8 | 45.0 | 29.1 | 39.7 |
| 30 and <40 | 34.0 | 47.6 | 42.4 | 50.0 | 29.5 | 26.2 | 39.7 | 34.2 | 36.6 | 27.5 | 36.4 | 32.8 |
| >=40 | 45.3 | 36.2 | 32.6 | 29.5 | 29.5 | 28.6 | 19.0 | 23.4 | 36.6 | 27.5 | 34.6 | 27.6 |
| Professional role | | | | | | | | | | | | |
| Nurse | 47.2 | 63.8 | 62.0 | 62.1 | 18.2 | 14.3 | 25.8 | 17.7 | 29.3 | 25.0 | 29.1 | 17.2 |
| Midwife | 3.8 | 1.9 | 10.9 | 19.9 | 65.9 | 73.8 | 56.5 | 63.2 | 43.9 | 30.0 | 47.3 | 46.6 |
| Doctor | 32.1 | 26.7 | 17.4 | 16.3 | 4.5 | 7.1 | 0 | 3.5 | 17.1 | 27.5 | 5.6 | 12.1 |

| Variables | Bangladesh | | | | Ghana | | | | Tanzania | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline | | Endline | | Baseline | | Endline | | Baseline | | Endline | |
| | Intervention | Control | Intervention | Control | Intervention | Control | Intervention | Control | Intervention | Control | Intervention | Control |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| Other | 17.0 | 7.6 | 9.8 | 1.8 | 11.4 | 4.8 | 17.7 | 14.0 | 9.8 | 17.5 | 18.2 | 24.1 |
| Number of years in current position | | | | | | | | | | | | |
| <=5 | 67.9 | 57.2 | 73.9 | 77.7 | 25.0 | 16.7 | 14.3 | 22.0 | 87.8 | 75.0 | 61.8 | 72.4 |
| >5 -10 | 5.7 | 9.5 | 12.0 | 7.8 | 9.1 | 16.7 | 15.9 | 10.2 | 4.9 | 10.0 | 18.2 | 15.5 |
| >10 | 26.4 | 33.3 | 14.2 | 14.5 | 65.9 | 66.7 | 69.8 | 67.8 | 7.3 | 15.0 | 20.0 | 12.1 |
| Gender | | | | | | | | | | | | |
| Female | 66.0 | 77.1 | 83.7 | 87.4 | 88.6 | 81.0 | 80.6 | 80.7 | 78.1 | 65.0 | 76.4 | 70.7 |
| Male | 34.0 | 22.9 | 16.3 | 12.7 | 11.4 | 19.0 | 19.4 | 22.8 | 21.9 | 35.0 | 23.6 | 29.3 |
| Observations during labour and childbirth | N=167 | N=221 | N=189 | N=271 | N=76 | N=58 | N=154 | N=129 | N=65 | N=55 | N=68 | N=59 |
| Level of healthcare facility | | | | | | | | | | | | |
| Health centre | 53.9 | 58.6 | 62.0 | 67.9 | 14.5 | 17.2 | 24.2 | 23.7 | 27.7 | 41.8 | 30.9 | 40.7 |
| Hospital | 46.1 | 41.4 | 38.0 | 32.1 | 85.5 | 82.8 | 75.8 | 76.3 | 72.3 | 58.2 | 69.1 | 59.3 |
| Day of the week | | | | | | | | | | | | |
| Monday to Friday | 74.7 | 71.0 | 85.4 | 86.4 | 65.8 | 75.9 | 78.7 | 80.0 | 67.7 | 72.7 | 75.0 | 81.4 |
| Saturday or Sunday | 25.3 | 29.0 | 14.6 | 13.7 | 34.2 | 25.1 | 21.3 | 20.0 | 32.3 | 27.3 | 25.0 | 18.6 |
| Moment of arrival | | | | | | | | | | | | |
| Day | 66.1 | 60.5 | 71.35 | 63.1 | 47.4 | 46.5 | 42.2 | 54.3 | 64.6 | 50.9 | 64.7 | 55.9 |
| Night | 33.6 | 37.4 | 28.6 | 36.9 | 43.4 | 41.4 | 47.8 | 45.7 | 35.4 | 49.1 | 35.3 | 44.1 |
| Missing | 0 | 0 | 0 | 0 | 9.2 | 12.1 | 24.2 | 0 | 0 | 0 | 0 | 0 |
| Maternal age in years | | | | | | | | | | | | |
| Less than 20 | 18.6 | 17.6 | 16.1 | 20.3 | 9.2 | 10.3 | 14.0 | 20.6 | 18.5 | 12.7 | 10.3 | 13.6 |
| 20-34 | 77.3 | 76.6 | 76.6 | 73.4 | 63.2 | 56.9 | 51.0 | 61.0 | 67.7 | 72.7 | 75.0 | 78.0 |
| 35 o more | 4.2 | 5 | 7.3 | 6.27 | 15.8 | 25.9 | 20.4 | 11.5 | 0 | 0 | 0 | 0 |

Note: Bangladesh did not measure post-secondary education as a separate category; the highest education level category was intermediate/secondary or higher.

**Supplementary SF1.** Reflexivity Statement

**1. How does this study address local research and policy priorities?**

Our study was designed to evaluate the impact of using the maternal and child health quality of care standards to locally develop an implementation strategy to improve measures of Respectful Maternity Care. This issue is of significant priority worldwide, most notably in low- and middle-income countries where health professionals often work in overburdened and under-resourced environments. This study was designed in collaboration with local researchers and agreement and with substantial input from national and sub-national local authorities from Bangladesh, Ghana and Tanzania.

**2. How were local researchers involved in study design?**

This study was designed collaboratively by researchers from Bangladesh, Ghana and Tanzania, with overall coordination by AM based in Ghana and TH based the US. The researchers were involved in the study's design, conduct, monitoring, data management, analysis, and interpretation. Most authors, including the first author, are based in LMIC, and only three out of sixteen (TH, IJ, and VP) are in HIC.

**3. How has funding been used to support the local research team?**

UNICEF funded this study and covered all the costs of conducting the study, as well as investments in the infrastructure and equipment of the hospitals to create enabling environments to practice change.

**4. How are the research staff who conducted data collection acknowledged?**

The teams responsible for conducting the study in each country are co-authors of this publication.

**5. Do all members of the research partnership have access to study data?**

All members of the partnership have access to data.

**6. How was data used to develop analytical skills within the partnership?**

All three countries have data centres and researchers trained in data management and analysis.

**7. How have research partners collaborated in interpreting study data?**

The first draft of the manuscript was circulated to all co-authors who provided their input. A new edited version was generated, incorporating all the co-authors' suggestions. Finally, all co-authors approved the submission.

**8. How were research partners supported to develop writing skills?**

Veronica Pingray (doctoral candidate in Epidemiology) drafted the manuscript with the supervision and guidance of two senior researchers (AM and TH) and the input and approval of all co-authors.

**9. How will research products be shared to address local needs?**

This study will be published in a journal as open access. UNICEF has developed a post-publication dissemination plan. This will include the dissemination among leaders in global health, including researchers, programme officers, policymakers and implementers based in LMICs.

**10. How is the leadership, contribution and ownership of this work by LMIC researchers recognised within the authorship?**

AM is the first author since he coordinated the research and for that reason, he is the first author. VP corrected the databases, analysed the data and drafted the manuscript. She is a mid-level career researcher pursuing her PhD in perinatal epidemiology. Her work is acknowledged as a joint first author. All other authors reviewed and approved the manuscript and are co-authors. The authorship team is predominantly based in LMICs. TH is the senior co-author (based in HIC) given her seniority level and because she supervised, advised and made decisions during the study and the development of the manuscript.

11. **How have early career researchers across the partnership been included within the authorship team?**

We have included early career researchers (VP and IJ) among the co-authors. They worked hard under the supervision of senior authors, and VP is the first joint co-author.

**12. How has gender balance been addressed within the authorship?**

Seven authors are male (AM, SKM, JW, FY, PM, SE, MZM and DM), and nine authors are female (VP, TH, SK, FG, PW, FK, MV, NB, IJ)

**13. How has the project contributed to the training of LMIC researchers?**

All authors in low- and middle-income countries are senior researchers. Research funding provided financial support to the three sites to set up and hire local research teams. The study coordinator (AM) and the senior researchers trained the local teams.

**14. How has the project contributed to improvements in local infrastructure?**

According to local situational analyses based on the baseline data collected by the study, UNICEF funded structural changes in some maternity hospitals, equipment and the purchase of supplies. In all three countries, there were substantial investments in the participating centres.

**15. What safeguarding procedures were used to protect local study participants and researchers?**

Local ethics committees reviewed and approved the study, and informed consent was obtained from participants before data collection.