The landscape of caesarean sections in low-resource settings:

Who, where, and why?

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Francesca L. Cavallaro
Oona M.R. Campbell

July 27 2017
Outline

A. Multi-country analysis: sub-Saharan Africa and Southeast Asia
   1. Data and methods
   2. Where do caesareans occur and what are the levels?
   3. Who is performing caesarean sections?
   4. Who is delivering by caesarean section?
   Q&A

B. Country case studies
   1. Bangladesh time trends and caesarean indications
   2. Tanzania time trends and facility metrics
   Q&A
Methods

• Nationally representative Demographic & Health Surveys (2002-2016)
• Countries: 34 sub-Saharan Africa, 10 South/Southeast Asia
• Sample of women age 15-49
• Circumstances of most recent live birth in recall period
• Women’s self-report
• Maternal healthcare Markets Evaluation Team (MET) @ LSHTM standardised survey response options
Three main questions

Malawi 2010

Who assisted with the delivery of (NAME)?

- Anyone else?
- PROBE FOR THE TYPE(S) OF PERSON(S) AND RECORD ALL MENTIONED.
- IF RESPONDENT SAYS NO ONE ASSISTED, PROBE TO DETERMINE WHETHER ANY ADULTS WERE PRESENT AT THE DELIVERY.

<table>
<thead>
<tr>
<th>HEALTH PERSONNEL</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCTOR/CLINICAL OFFICER</td>
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<td>NURSE/MIDWIFE</td>
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<td>PATIENT ATTNDT</td>
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<tr>
<td>OTHER PERSON</td>
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<tr>
<td>TRADITIONAL BIRTH ATTENDANT</td>
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<tr>
<td>RELATIVE/FRIEND</td>
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<tr>
<td>OTHER</td>
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<tr>
<td>NO ONE</td>
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</tr>
</tbody>
</table>

Was (NAME) delivered by caesarean section?

- YES ...... 1
- NO ...... 2

Was (NAME) delivered by caesarean, that is, did they cut your belly open to take the baby out?
Where? Locations and rates

Vertical error bars represent variation between urban and rural areas
Country rates

Vertical error bars represent variation between urban and rural areas
- Red boxes highlight countries with ratio of urban/rural ≥ 4
Difference in rates by sector

- Public sector higher
- Non-public sector higher

Countries listed from top to bottom:
1. Namibia
2. Comoros
3. Sierra Leone
4. Gabon
5. Tanzania
6. Kenya
7. Lesotho
8. Zimbabwe
9. Niger
10. Rwanda
11. Burkina Faso
12. Zambia
13. Mozambique
14. Benin
15. Madagascar
16. Swaziland
17. Ghana
18. Nigeria
19. Cote d’Ivoire
20. Ethiopia
21. Gambia
22. Cameroon
23. Guinea
24. Uganda
25. Liberia
26. Chad
27. Malawi
28. Senegal
29. Burundi
30. Mali
31. DRC
32. Congo-B
33. Togo
34. Sao Tome
35. Bangladesh
36. India
37. Philippines
38. Nepal
39. Maldives
40. Cambodia
41. Pakistan
42. Indonesia
43. Timor-Leste

Note: Non-public sector rates are shown on the left side of the graph, and public sector rates are shown on the right side. The x-axis represents various countries, and the y-axis shows the difference in rates.
Who performs caesarean sections?

Distribution of caesarean sections by category of provider

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Who performs caesarean sections?

Distribution of caesarean sections by category of provider

- SBA: Doctor
- SBA: other than doctor
- Non-SBA

Countries and their respective distributions of caesarean sections performed by different categories of providers.
• Compared % with non-doctor SBA by facility ownership

• Sub-Saharan Africa (n=20):
  • 18 countries had a higher % of non-doctor SBA caesareans in public compared to non-public facilities
    Widest difference in Namibia: public (39%) and non-public (3%)

• In South/Southeast Asia (n=8):
  • Four countries had higher percentages in public
    Widest difference in India: public (7%) and non-public (3%)
  • Four countries in non-public facilities
    Widest difference in Indonesia: public (10%) and non-public (23%)
Who delivers by caesarean section?

- Nine risk factors for maternal and newborn complications:
  - Woman’s age 35+ years
  - Woman’s age <16 years
  - Primiparity (first live birth)
  - Grand multiparity (birth order 6+)
  - Preceding birth interval <12 months
  - Multiple gestation
  - Received no antenatal care
  - Preceding live birth in recall period resulted in neonatal death
  - Caesarean section(s) in recall period

- Comparison of three groups:
  - All births
  - Facility-based births
  - Caesarean births
Who delivers by caesarean section?

• All women with births
  • Most common risk factors:
    • Primiparity (median across countries 22%)
    • Grand multiparity (20%)
    • Age 35+ (18%)
    • The median percentage with one or more risk factors was 56%, ranging from 46% (Malawi) to 79% (Ethiopia)

• Women delivering by caesarean section
  • Across countries more likely to have had one or more risk factors (median 71%) compared to all women with births (56%)
Who delivers by caesarean section?

Median ratio of % among women with caesarean sections versus all women with births.

Range of ratios across 44 countries

9 (3-27)
### Ethiopia 2011

<table>
<thead>
<tr>
<th>Category</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All births</strong></td>
<td>20.6</td>
<td></td>
<td>43.6</td>
<td></td>
<td>24.0</td>
<td>11.8</td>
</tr>
<tr>
<td><strong>Facility births</strong></td>
<td>37.8</td>
<td></td>
<td>46.9</td>
<td></td>
<td>12.2</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Caesarean births</strong></td>
<td>21.2</td>
<td></td>
<td>68.8</td>
<td></td>
<td>8.3</td>
<td>1.8</td>
</tr>
</tbody>
</table>

- **None**: Grey
- **1**: Yellow
- **2**: Orange
- **3 to 6**: Brown

Who delivers by caesarean section?

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A. Multi-country analysis: sub-Saharan Africa and Southeast Asia

1. Data and methods
2. Where do caesareans occur and what are the levels?
3. Who is performing caesarean sections?
4. Who is delivering by caesarean section?

Q&A
Bangladesh c-section rates by residence (urban/rural)

- Urban 9.2% in 2000, 14.1% in 2004, 28.7% in 2010, 40.3% in 2014
- Rural 1.7% in 2000, 2.4% in 2004, 13.6% in 2010, 18.8% in 2014

Annual number of c-sections and national c-section rates over time.
Bangladesh csection rates by wealth (poorest/richest)

- Richest 19.1%
  - 2000: 12.3%
  - 2014: 54.1%

- Poorest 0.2%
  - 2000: 0.4%
  - 2014: 2.7%

- Richest 40.9%
  - 2000: 12.3%
  - 2014: 54.1%

- Poorest 2.7%
  - 2000: 0.4%
  - 2014: 7.3%
Key trends

- Facility deliveries increased from 10% in 2000 to 39% in 2014, and the private sector share of facility deliveries rose from 1/3 to 2/3.
- Facility caesarean rate doubled from 33% to 63% (faster increase in private than public facilities).
- 99% of caesareans are performed by doctors.
### DHS caesarean questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>435 Was (NAME) delivered by caesarean section, that is, did they cut your belly open to take the baby out?</td>
<td>YES 1  NO 2 (SKIP TO 435i)</td>
</tr>
<tr>
<td>435A What day of the week was the birth delivered by caesarean section?</td>
<td>SUNDAY 01  MONDAY 02  TUESDAY 03  WEDNESDAY 04  THURSDAY 05  FRIDAY 06  SATURDAY 07</td>
</tr>
<tr>
<td>435B At what time of day was the caesarean section or operation done?</td>
<td>06:01 AM TO 09:00 AM 01  09:01 AM TO 12:00 NOON 02  12:01 PM TO 02:00 PM 03  02:01 PM TO 04:00 PM 04  04:01 PM TO 06:00 PM 05  06:01 PM TO 09:00 PM 06  09:01 PM TO 12:00 AM 07  12:01 AM TO 03:00 AM 08  03:01 AM TO 06:00 AM 09</td>
</tr>
<tr>
<td>435C How many days before the delivery was the decision to have caesarean section made?</td>
<td>THE DAY OF DELIVERY 1  THE DAY BEFORE DELIVERY 2  2 - 7 DAYS BEFORE DELIVERY 3  8 - 30 DAYS BEFORE DELIVERY 4  30+ DAYS BEFORE DELIVERY 5</td>
</tr>
<tr>
<td>435D Who proposed first to have the birth delivered by caesarean section, you, a family member or a doctor?</td>
<td>RESPONDENT 1  FAMILY MEMBER 2  DOCTOR 3 (SKIP TO 435F)</td>
</tr>
<tr>
<td>435E Were you or your family told the reasons for having the operation?</td>
<td>YES 1  NO 2 (SKIP TO 435G)</td>
</tr>
<tr>
<td>435F What were the reasons for making the decision to have the operation?</td>
<td>CONVENIENCE A  DO NOT WANT TO GO THROUGH LABOR PAIN B  MAL PRESENTATION C  PREMATURER BABY D  CORD PROLAPSED E  MULTIPLE BIRTHS F  FAILURE TO PROGRESS IN LABOR G  PRE-ECLAMPSIA H  DIABETES I  PREVIOUS C/S J  LESS PRESSURE ON BABY'S BRAIN K  OTHER COMPLICATIONS DURING DELIVERY L  OTHER X</td>
</tr>
<tr>
<td>435G Any other reason? CIRCLE ALL MENTIONED.</td>
<td></td>
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</tbody>
</table>
Day and time of caesareans

Public facilities

<table>
<thead>
<tr>
<th>Day</th>
<th>12am-9am</th>
<th>9am-6pm</th>
<th>6pm-12am</th>
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</thead>
<tbody>
<tr>
<td>Sunday</td>
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<td>Monday</td>
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<td>Saturday</td>
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</tbody>
</table>

Non-public facilities

<table>
<thead>
<tr>
<th>Day</th>
<th>12am-9am</th>
<th>9am-6pm</th>
<th>6pm-12am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
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<td>Monday</td>
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<tr>
<td>Saturday</td>
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</tbody>
</table>
Circumstances around caesareans

• 71% of caesareans were first suggested by the doctor (22% by a family member, 7% by the woman)
• 98% of women were told the reason for the caesarean, when suggested by a doctor
• Mean length of stay = 6.7 days post-caesarean
• Mean cost = USD 261 (higher in non-public facilities), compared to USD 59 for vaginal delivery
### Reasons for caesareans

- Most women (69%) report a single reason for caesarean; 26% report two reasons (usually one of which is “other”)

<table>
<thead>
<tr>
<th>Reported reason for caesarean</th>
<th>%</th>
<th>Timing of decision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day of (%)</td>
</tr>
<tr>
<td>Other complications during delivery</td>
<td>32.7</td>
<td>54.2</td>
</tr>
<tr>
<td>Malpresentation</td>
<td>32.5</td>
<td>42.0</td>
</tr>
<tr>
<td>Failure to progress in labour</td>
<td>17.3</td>
<td>59.6</td>
</tr>
<tr>
<td>Previous caesarean section</td>
<td>15.4</td>
<td>12.6</td>
</tr>
<tr>
<td>Cord prolapsed</td>
<td>1.9</td>
<td>44.2</td>
</tr>
<tr>
<td>Multiple births</td>
<td>0.4</td>
<td>16.9</td>
</tr>
<tr>
<td><strong>All caesareans</strong></td>
<td><strong>45.2</strong></td>
<td><strong>12.6</strong></td>
</tr>
</tbody>
</table>
Key findings – Bangladesh case study

• Much faster rise in caesarean rate among richest than poorest women, and in facility caesarean rate in non-public than public facilities

• Relatively low facility delivery rates and high caesarean rate in facilities

• Self-reported information – caution needed in interpretation, especially for reasons for caesarean
Trends over time

Tanzania csection rates by residence (urban/rural)

Annual number of csections
National csection rate

Urban 4.9%
Rural 1.6%

Urban 7.2%
Rural 2.6%

Urban 8.1%
Rural 2.9%

Urban 10.2%
Rural 4.0%

Urban 12.6%
Rural 4.5%
Trends over time

Tanzania csection rates by wealth (poorest/richest)

- **1996**: Richest 5.5%, Poorest 0.9%
- **1997**: Richest 8.0%, Poorest 1.0%
- **1998**: Richest 8.0%, Poorest 1.0%
- **1999**: Richest 8.9%, Poorest 1.5%
- **2000**: Richest 8.9%, Poorest 1.5%
- **2001**: Richest 12.9%, Poorest 2.3%
- **2002**: Richest 12.9%, Poorest 2.3%
- **2003**: Richest 12.9%, Poorest 2.3%
- **2004**: Richest 16.6%, Poorest 2.9%
- **2005**: Richest 16.6%, Poorest 2.9%
- **2006**: Richest 16.6%, Poorest 2.9%
- **2007**: Richest 16.6%, Poorest 2.9%
- **2008**: Richest 16.6%, Poorest 2.9%
- **2009**: Richest 16.6%, Poorest 2.9%
- **2010**: Richest 16.6%, Poorest 2.9%
- **2011**: Richest 16.6%, Poorest 2.9%
- **2012**: Richest 16.6%, Poorest 2.9%
- **2013**: Richest 16.6%, Poorest 2.9%
- **2014**: Richest 16.6%, Poorest 2.9%
- **2015**: Richest 16.6%, Poorest 2.9%
- **2016**: Richest 16.6%, Poorest 2.9%

- **National csection rate**
  - **1996**: 5.5%
  - **1997**: 8.0%
  - **1998**: 8.9%
  - **1999**: 12.9%
  - **2000**: 16.6%
  - **2001**: 16.6%
  - **2002**: 16.6%
  - **2003**: 16.6%
  - **2004**: 16.6%
  - **2005**: 16.6%
  - **2006**: 16.6%
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  - **2008**: 16.6%
  - **2009**: 16.6%
  - **2010**: 16.6%
  - **2011**: 16.6%
  - **2012**: 16.6%
  - **2013**: 16.6%
  - **2014**: 16.6%
  - **2015**: 16.6%
  - **2016**: 16.6%
Key trends

• Facility delivery rate increased from 50% in 1996 to 68% in 2015-16
• Facility caesarean rate doubled from 4.7% to 10.3%, faster increase in private sector facilities
• One fifth of facility births occur in private facilities
• 10-14% of caesareans are performed by provider other than doctor/AMO
SPA methodology

• Service Provision Assessments (SPA) are nationally representative surveys of health facilities (public, private for-profit, FBO, parastatal)
  • Infrastructure
  • Equipment
  • Staffing

• “Does this facility offer any of the following client services?”
### SPA questions

**ASK TO BE SHOWN THE LOCATION IN THE FACILITY WHERE CESAREAN DELIVERY ARE DONE**

**FIND THE PERSON MOST KNOWLEDGEABLE ABOUT PROVISION OF SUCH SERVICES IN THE FACILITY.**

INTRODUCE YOURSELF, EXPLAIN THE PURPOSE OF THE SURVEY AND ASK THE FOLLOWING QUESTIONS.

<table>
<thead>
<tr>
<th>Question</th>
<th>YES.</th>
<th>NO.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2501 Does the facility have a health worker who can perform Cesarean delivery present at the facility or on call 24 hours a day (including weekends and on public holidays)?</td>
<td>1</td>
<td>2</td>
<td>2504</td>
</tr>
<tr>
<td>2502 Is there a duty schedule or call list for 24-hr staff assignment?</td>
<td>YES.</td>
<td>24-HOUR DUTY SCHEDULE NOT MAINTAINED.</td>
<td>2504</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2503 May I see the duty schedule or call list for 24-HR staff assignment?</td>
<td>SCHEDULE OBSERVED.</td>
<td>SCHEDULE REPORTED, NOT SEEN.</td>
<td>2504</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2504 Does this facility have an anesthetist present in the facility or on call 24 hours a day (including weekends and on public holidays)?</td>
<td>YES.</td>
<td>NO.</td>
<td>2507</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2505 Is there a duty schedule or call list?</td>
<td>YES.</td>
<td>24-HOUR DUTY SCHEDULE NOT MAINTAINED.</td>
<td>2507</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2506 May I see the duty schedule or call list?</td>
<td>SCHEDULE OBSERVED.</td>
<td>SCHEDULE REPORTED, NOT SEEN.</td>
<td>2507</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2507 Has Cesarean section been performed in this facility during the past 3 months?</td>
<td>YES.</td>
<td>NO.</td>
<td>2510</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2507A How many C-sections were performed at this facility during the past 3 completed months?</td>
<td># OF C-SECTIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DON'T KNOW.</td>
<td>.9998</td>
<td></td>
</tr>
</tbody>
</table>
Facility type and sector

Facilities reporting to provide caesareans

- 35.6% Public hospital
- 25.8% Private hospital
- 26.6% FBO hospital
- 10.3% Health centres
- 27.5% Other

Caesareans

- 65.5% Public hospital
- 25.8% Private hospital
- 3.8% FBO hospital
- 5.0% Health centres
- 5.0% Other
Delivery volume

Caesareans per month
- 60-500
- 30-60
- 10-30
- <10
- None

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## Staffing & infrastructure

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Facilities reporting to provide caesareans</th>
<th>Full-time doctor (%)</th>
<th>Full-time anaesthetist (%)</th>
<th>24hr provider and anaesthetist (%)</th>
<th>Piped water and consistent electricity (%)</th>
<th>All CEmOC signal functions (%)</th>
<th>All general anaesthesia equipment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public hospital</td>
<td>112</td>
<td>94</td>
<td>79</td>
<td>86</td>
<td>59</td>
<td>55</td>
<td>34</td>
</tr>
<tr>
<td>Private hospital</td>
<td>31</td>
<td>94</td>
<td>90</td>
<td>74</td>
<td>55</td>
<td>26</td>
<td>61</td>
</tr>
<tr>
<td>FBO hospital</td>
<td>84</td>
<td>81</td>
<td>92</td>
<td>88</td>
<td>37</td>
<td>41</td>
<td>66</td>
</tr>
<tr>
<td>All hospitals</td>
<td>227</td>
<td>89</td>
<td>85</td>
<td>85</td>
<td>50</td>
<td>46</td>
<td>49</td>
</tr>
<tr>
<td>All health centres</td>
<td>44</td>
<td>54</td>
<td>84</td>
<td>44</td>
<td>34</td>
<td>19</td>
<td>30</td>
</tr>
<tr>
<td>Overall (facilities)</td>
<td>271</td>
<td>79</td>
<td>85</td>
<td>74</td>
<td>46</td>
<td>38</td>
<td>44</td>
</tr>
<tr>
<td>Overall (caesareans)</td>
<td>-</td>
<td>92</td>
<td>87</td>
<td>91</td>
<td>49</td>
<td>62</td>
<td>46</td>
</tr>
</tbody>
</table>
Minimum readiness criteria:
- Piped water into facility and consistent electricity
- All general anaesthesia equipment available
- 24hr caesarean provider and anaesthetist rota
Minimum readiness by zone

Percent facilities meeting 3 minimum criteria

Percent caesareans in facilities meeting 3 minimum criteria

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Key findings – Tanzania case study

• Over 90% of caesareans in Tanzania are conducted in public or faith-based organisation hospitals

• Half of caesareans are done in high volume facilities, 5% are done in facilities with less than 10 caesareans per month

• Only 25% of caesareans are done in facilities meeting 3 minimum readiness criteria

• Service readiness varies across facility types and geographical zones
B. Country case studies
   1. Bangladesh time trends and caesarean indications
   2. Tanzania time trends and facility metrics

Q&A
Discussion

Additional slides
## Reasons for caesareans

<table>
<thead>
<tr>
<th>Reported reason for caesarean</th>
<th>N (%)</th>
<th>Timing of decision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day of (%)</td>
</tr>
<tr>
<td>Cord prolapsed</td>
<td>1.9</td>
<td>44.2</td>
</tr>
<tr>
<td>Failure to progress in labour</td>
<td>17.3</td>
<td>59.6</td>
</tr>
<tr>
<td>Other complications during delivery</td>
<td>32.7</td>
<td>54.2</td>
</tr>
<tr>
<td>Less pressure on baby's brain</td>
<td>6.3</td>
<td>61.9</td>
</tr>
<tr>
<td>Pre-eclampsia</td>
<td>2.4</td>
<td>37.5</td>
</tr>
<tr>
<td>Malpresentation</td>
<td>32.5</td>
<td>42.0</td>
</tr>
<tr>
<td>Premature baby</td>
<td>2.1</td>
<td>41.6</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.6</td>
<td>6.4</td>
</tr>
<tr>
<td>Convenience</td>
<td>9.4</td>
<td>45.3</td>
</tr>
<tr>
<td>Avoid labour pain</td>
<td>7.0</td>
<td>40.1</td>
</tr>
<tr>
<td>Multiple births</td>
<td>0.4</td>
<td>16.9</td>
</tr>
<tr>
<td>Previous caesarean section</td>
<td>15.4</td>
<td>12.6</td>
</tr>
<tr>
<td>Other</td>
<td>4.4</td>
<td>44.8</td>
</tr>
<tr>
<td>All caesareans</td>
<td></td>
<td><strong>45.2</strong></td>
</tr>
</tbody>
</table>
Among providers interviewed, qualification of providers reporting to provide delivery care and surgery [no survey weights/not representative of all providers]

<table>
<thead>
<tr>
<th>Qualification</th>
<th>N</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>generalist medical doctor</td>
<td>103</td>
<td>9.91</td>
</tr>
<tr>
<td>specialist medical doctor</td>
<td>42</td>
<td>4.04</td>
</tr>
<tr>
<td>assistant medical officer</td>
<td>210</td>
<td>20.21</td>
</tr>
<tr>
<td>clinical officer</td>
<td>180</td>
<td>17.32</td>
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<tr>
<td>assistant clinical officer</td>
<td>44</td>
<td>4.23</td>
</tr>
<tr>
<td>registered nurse</td>
<td>130</td>
<td>12.51</td>
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<tr>
<td>enrolled nurse</td>
<td>197</td>
<td>18.96</td>
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<tr>
<td>nurse assistant/attendant</td>
<td>123</td>
<td>11.84</td>
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<tr>
<td>laboratory technologist</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>laboratory technician</td>
<td>2</td>
<td>0.19</td>
</tr>
<tr>
<td>laboratory assistant</td>
<td>2</td>
<td>0.19</td>
</tr>
<tr>
<td>other</td>
<td>5</td>
<td>0.48</td>
</tr>
</tbody>
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