

Safe delivery

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Description of condition and intervention

Maternal deaths occur primarily during and following pregnancy and childbirth related complications. These deaths are preventable or treatable. Major complications accounting for about 75% of all maternal deaths include severe bleeding (mainly after childbirth), infections (after childbirth), high blood pressure during pregnancy, complications from delivery and unsafe abortion. Access to timely management and quality care in pregnancy, during and following childbirth offers solutions to prevent or manage complications that could arise in any of these stages. However, this is not so in resource-constrained settings which have the highest share of maternal mortality. Estimates report that nearly 295,000 maternal deaths occurred during and subsequent to pregnancy and childbirth in 2017. Most of these deaths (94%) were in low-resource settings, and occur primarily Sub-Saharan Africa and Southern Asia. (Source: WHO 2021)

Specific interventions are delivered as part of basic emergency obstetric and comprehensive emergency obstetric care. Basic services include administering parenteral antibiotics, administering uterotonic drugs, administering anticonvulsants for preeclampsia and eclampsia, manually remove placenta, perform assisted vaginal delivery. The comprehensive services include perform surgery (like caesarean section), perform blood transfusion in addition to those mentioned under basic services (Bailey P, Lobis S, Maine D, Fortney JA 2009). In this evidence brief, we enlist the various interventions related to safe delivery including skilled birth attendance (low risk deliveries), basic and comprehensive services related to safe delivery of more medium and high risk pregnancies. We assess the effects and costs of these interventions being analysed in FairChoices: DCP Analytical tool. The interventions are as follows:

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Skilled birth attendance, (low risk women)

Basic management of labor (BEMOC)

Administering antibiotics

Administering uterotonic drugs (oxytocin)

Administering anticonvulsants (magnesium sulphate)

Manual removal of the placenta and retained products

Assisted vaginal delivery (vacuum, forceps)

Comprehensive management of labor and labor complications-(CEMOC)

BEMOC interventions, and

Caesarean section

Safe blood transfusion

International guidelines

Organization	Indications/recommendations	Applicability in LIC & Lower MIC settings
World Health Organization 2009	Monitoring emergency obstetric care	Yes
World Health Organization 2018	Intrapartum care for a positive childbirth experience	Yes

Intervention attributes

Type of interventions & Delivery platform

Table 1: Type of interventions & delivery platform

Intervention	Type	Delivery platform
1. Skilled birth attendance, (low risk pregnancies)	Diagnostic	Community
2. BEMOC: Administering antibiotics	Curative	Health centre
3. BEMOC: Administering uterotonic drugs (oxytocin) and vitamin K	Curative	Health centre
4. BEMOC: Administering anticonvulsants (magnesium sulphate)	Curative	Health centre

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5. BEMOC: Manual removal of the placenta, including controlled cord traction	Curative	Health centre
6. BEMOC: Assisted vaginal delivery (vacuum, forceps)	Curative	Health centre
7. CEMOC: Administering antibiotics	Curative	First-level hospital
8. CEMOC: Administering uterotonic drugs (oxytocin) and vitamin K	Curative	First-level hospital
9. CEMOC: Administering anticonvulsants (magnesium sulphate)	Curative	First-level hospital
10. CEMOC: Manual removal of the placenta, including controlled cord traction	Curative	First-level hospital
11. CEMOC: Assisted vaginal delivery (vacuum, forceps)	Curative	First-level hospital
12. CEMOC: Caesarean section	Curative	First-level hospital
13. CEMOC: Safe blood transfusion	Curative	First-level hospital

Equity

In addition to considerations like cost-effectiveness and health systems factors, dimensions of equity can be relevant for priority setting. The opportunity for a long and healthy life varies according to the severity of a health condition that individuals might have, so there are inequities in individuals' opportunities for long and healthy lives based on the health conditions they face. Metrics used to estimate the severity of illness at an individual level can be used to help prioritize those with less opportunity for lifetime health. FairChoices: DCP Analytics Tool uses Health adjusted age of death (HAAD), which is a metric that estimates the number of years lived from birth to death, discounting years lived with disability. A high HAAD thus represents a disease less severe in terms of lifetime health loss, while a low HAAD represents a disease that is severe on average, causing early death or a long period of severe disability. It is also possible to estimate the distribution of HAAD across individuals with a health condition. FairChoices shows for each intervention an average HAAD value of the conditions that are affected by respective interventions that have health effects. Additionally, a plot shows HAAD values for around 290 conditions (Johansson KA et al 2020).

Time dependence

High level of urgency. Treatment outcomes highly affected by some days or hours of delay.

Population in need of interventions

We present details on population in need for individual interventions in the table below; however, in the analysis we use estimates at an aggregated level for basic and comprehensive obstetric care (mentioned in Table 3).

Table 2: Population in need of interventions

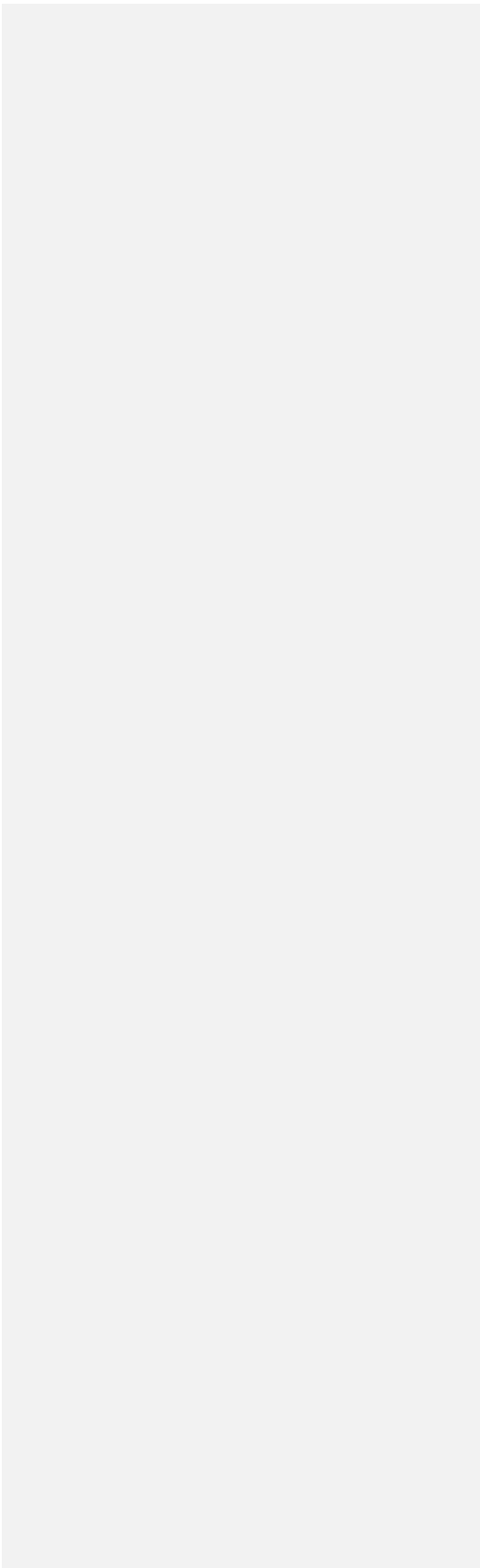
Intervention	Treated population		Affected population		Disease state addressed
	Treated age	Treated fraction	Affected age	Affected fraction	
Skilled birth attendance (low risk)	10 to 54 years; pregnant female	1			
Antibiotics	10 to 54 years; pregnant female	1			
Uterotonic drugs (oxytocin) and vitamin K	10 to 54 years; pregnant female	1	10 to 54 years	0.27	Indirect maternal deaths
Anticonvulsants (magnesium sulphate)	10 to 54 years; pregnant female	1	10 to 54 years	1	Maternal hypertensive disorders
Manual removal of placenta	10 to 54 years; pregnant female	1	10 to 54 years	0.04	Maternal hypertensive disorders
Assisted vaginal delivery (vacuum, forceps)	10 to 54 years; pregnant female	1	10 to 54 years	1	Maternal obstructed labor and uterine rupture
Caesarean section	10 to 54 years; pregnant female	1	10 to 54 years	1	Maternal obstructed labor and uterine rupture

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Intervention effect and safety



Calculation for efficacy of BEMOC/CEMOC

In the modelled analysis, we considered the efficacy of BEMOC/CEMOC at an aggregated package level consisting of multiple obstetric interventions and actions (at Level 2) to assess the cost-effectiveness. This may be justified since all obstetric interventions here are well-established standard of care interventions and accepted by international clinical guidelines. It may not be relevant to assess incremental effects of each single intervention to consider exclusion or inclusion of these in benefit packages. The relative mortality reduction of BEMOC/CEMOC was computed by considering maternal mortality ratio (MMR) of an average middle-income country to the MMR of a low-income country with high MMR (as a proxy for control with no or less access/quality of obstetric care). China with MMR of 29 (latest available for year 2017) was taken as country example for MIC and Somalia with MMR of 829 (year 2017) as country example for LIC. Thus, relative risk reduction in maternal mortality with introduction of BEMOC/CEMOC health interventions was calculated as $1 - (29/829) = 0.966$. Similarly, we considered the effect of BEMOC/CEMOC on neonatal encephalopathy due to birth asphyxia and trauma and considered the abovementioned approach to calculate relative risk reduction on neonatal mortality as $1 - (3.86/36.86) = 0.89$. Here, neonatal mortality rate for China is 3.86 (year 2019) and for Somalia is 36.86 (2019).

Model assumptions

Table 3: Summary of model parameters and values used in FairChoices – DCP Analytical Tool

Category	Model parameter	Notes
Interventions	BEMOC interventions CEMOC interventions	Health centre for BEMOC First level hospital for CEMOC
Cost parameters		
Treated population	Pregnant women	Global Burden of Disease Study 2019
Gender	Female	
Age	10 to 54 years	
Treated fraction	BEMOC:0.25 CEMOC:0.1*	*Magnitude of obstructed labour as 10% in Ethiopia reported in a meta-analysis by Ayenew AA 2021
Effect parameters		
Affected population	Pregnant women Births	
Affected gender	Female Both	
Affected fraction age	10 to 54 years Births	
Affected fraction	1 1	
Comparison	No intervention	
Mortality Reduction for maternal mortality		
BEMOC interventions	0.97**	
CEMOC interventions	0.97**	
Mortality Reduction for neonatal mortality		
BEMOC interventions	0.89	
CEMOC interventions	0.89	

**Rounded to two decimal places

Intervention cost

The cost of accessing home-delivery care for low-risk women (SBA) is estimated to be 8 USD per affected pregnancy in 2008 in India. The cost for basic management of labor (BEMOC), including administering antibiotics, uterotonic drugs (oxytocin), and anticonvulsants (magnesium sulphate) when needed, manual removal of the placenta and retained products, and assisted vaginal delivery (vacuum, forceps) is estimated 84 per affected pregnancy USD in 2008 in India. The cost for BEMOC was calculated as the sum of the mean costs for elective, difficult vaginal deliveries at health facilities (USD 30 and USD 54, respectively.) For comprehensive management of labour and labour complications-(CEMOC), including the basic interventions defined above, caesarean section (C/S) and, Safe blood transfusion, the cost is estimated to be 278 USD per affected pregnancy in 2008 in India. The cost CEMOC was calculated as the sum of the mean costs for elective birth in health facilities (USD 30) and C/S (USD248) (Iyengar SD et al 2009).

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Appendix

Literature Review for effectiveness & safety

This literature search is an example of Level 1 search for intervention inputs taken from DCP3 or generated in an ad hoc manner (e.g., quick google search found one study of cervical cancer screening cost-effectiveness that was used to create an effectiveness parameter for that intervention).

Level of evidence of efficacy studies:

1. low (expert opinions, case series, reports, low-quality case control studies)
2. moderate (high quality case control studies, low quality cohort studies)
3. high (high quality cohort studies, individual RCTs)
4. very high (multiple RCTs, meta-analysis, systematic review, clinical practice guidelines)

Supplementary information on effect on individual interventions:

Intervention	Effect and safety (outcome highlighted in bold)	Certainty of evidence
<p>Skilled birth attendance, (low risk women)</p> <p>&</p> <p>Uterotonic drugs (oxytocin) and vitamin K</p>	<p>12% significant reduction in perinatal mortality with the intervention (RR = 0.88; 95% CI: 0.82 – 0.95) (Yakoob, M.Y., Ali, M.A., Ali, M.U. et al 2011)</p> <p>Probability of success with oxytocin to prevent postpartum haemorrhage ≥500ml in vaginal birth (normal or assisted) is 0.908 (95% CI: 0.891 to 0.925). Probability of success to prevent postpartum haemorrhage ≥1000ml in vaginal birth (normal or assisted) is 0.977 (95% CI: 0.971 to 0.997). (Gallos 2019)</p> <p>Probability of success with oxytocin to prevent postpartum haemorrhage ≥500ml in caesarean section (planned or emergency) is 0.401 (95% CI: 0.256 to 0.547). Probability of success with oxytocin to prevent postpartum haemorrhage ≥1000ml in caesarean section (planned or emergency) is 0.895 (95% CI: 0.858 to 0.932). (Gallos 2019)</p> <p>Based on a WHO analysis of maternal deaths (Say 2014), haemorrhage accounted for 27.1% (19.9–36.4) of maternal deaths in developing countries. Henceforth, we calculated relative reduction in maternal deaths due to control of postpartum haemorrhage ≥500ml is = $((1 - ((0.908) * (0.401)))) * 0.271 = 0.172$</p>	See appendix
Skilled birth attendance, (low risk pregnancies)	A meta-analysis by Yakoob, M.Y., Ali, M.A., Ali, M.U. et al 2011 on community-based skilled birth attendance based on two before-after studies showed a 23% significant reduction in stillbirths (RR = 0.77; 95% CI: 0.69 – 0.85).	