

## THE EFFECTIVENESS OF CEMONC ON MATERNAL MORTALITY: SYSTEMATIC LITERATURE REVIEW

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### Abstract

The Implementation of Comprehensive Emergency Obstetric and Newborn Care (CEmONC) or known as PONEK in Indonesia since 2005 is expected to reduce the Maternal Mortality Ratio (MMR). Based on the latest MMR survey it still looks quite high (305 deaths per 100.000 live births in 2015). Indonesia must reach the SDGs target in 2030 (70 deaths per 100,000 live births). The number of district hospitals that capable for CEmONC is low (25%), a government hospital that provides CEmONC (86%), the ability to provide blood transfusions is low (55%), adequate blood supply (41% Government Hospital and 13% Private Hospital). The Purpose of this Systematic Literature Review is to identify the effectiveness of the CEmONC on maternal mortality. This Systematic Literature Review of 7 articles, obtained from 3 databases (PubMed, Scencedirect, Proquest). Inclusion criteria (CEmONC Health Workers, CEmONC Hospital, patients, articles from 2009-2018, Full text, quantitative study design). Critical Appraisal with Joanna Brigs. From the 7 articles reviewed by Dumont et al (2017), Lindtjorn et al (2017), Nyamtena et al (2017), Maru et al (2017) prove the effectiveness of quality CEmONC services reduces maternal mortality and increases institutional labor. The Wilunda et al (2015) study, Ntambue et al (2017), and Tembo et al (2017) prove that poor CEmONC services are associated with high maternal complications and mortality. The existence of good quality CEmONC hospitals can effectively reduce maternal mortality, poor access and quality of CEmONC increase obstetric complications and maternal mortality. Periodic evaluations are needed by relevant government agencies to maintain the quality of CEmONC.

**Keywords:** CEmONC, maternal, mortality

### 1. INTRODUCTION

Improving indicators of maternal health, newborns and children are one of the most important global health challenges in developing countries [1,2]. Indicators for good quality of maternal health can be seen from the incidence of Maternal Mortality Rate (MMR) [3,4]. Of the 75 priority countries (95% of global maternal and child deaths) 41 countries did not achieve MDG's 4th target [5]. One of these countries is Indonesia, with MMR 305/100,000 live births in 2015, while MDG's 2015 target is 102/100,000 live births [6]. Health development in Indonesia is continued with the Sustainable Development Goals (SDGs) with a target of reducing maternal mortality to less than 70 deaths per 100,000 live births [7,8]. The Ministry of Health of the Republic of Indonesia launched a Maternal and Neonatal Survival (EMAS) program that is expected to reduce MMR and IMR by 25% [9]. The program seeks to reduce MMR and IMR through improving the quality of obstetric and neonatal emergency services at a minimum in 150 CEmONC hospitals and 300 BEmONC health center and strengthening efficient and effective referral systems between health center and hospitals [10,11]. The days and weeks following childbirth-the postnatal period-are a critical phase in the lives of mothers and newborn babies [12]. Most maternal and infant deaths occur in the first month after birth [13]. Almost half of the

postnatal maternal deaths occur within the first 24 hours [14], and 66% occur during the first week [15]. The main factors that influence mortality are referral factors and the quality of health services in the district hospital emergency case management [16,17], interventions need to be provided at obstetric care facilities through BEmONC or CEmONC [18]. Signal functions for emergency obstetric and newborn care (EmONC) are the major interventions for averting maternal and neonatal mortalities [19]. The readiness of the facilities is essential to provide all the basic and comprehensive signal functions for EmONC [20], to ensure emergency services from the designated facilities [21]. A designated CEmONC facility should have nine specific signal functions, such as (i) administering parenteral antibiotics, (ii) administering uterotonic drugs for active management of the third stage of labour and prevention of postpartum haemorrhage, (iii) use of parenteral anticonvulsants for the management of pre-eclampsia/ eclampsia, (iv) manual removal of placenta, (v) removal of retained products (e.g. manual vacuum extraction, dilatation, and curettage), (vi) performing assisted vaginal delivery (AVD), i.e. vacuum extraction or forceps delivery, (vii) performing basic neonatal resuscitation), (viii) performing CS delivery, and (ix) BT services to be available for 24 hours a day, 7 days a week [22--25]. The number of hospitals in district/city hospitals capable of CEmONC has only reached 25% and government hospital CEmONC service readiness has only reached 86%. The ability of the hospital in blood transfusions is generally low (readiness average of 55%), especially in the component of adequate blood supply (41% of Government Hospital and 13% of Private Hospital). Hospitals that fulfill all comprehensive surgical readiness are still very few (8% Government Hospital and 33% Private Hospital) [26,27]. Comprehensive EmONC (CEmONC) is a part of the referral system in maternal emergencies which plays an important role in reducing MMR [28]. In its implementation, CEmONC services are considered to be less than optimal, the cause is a lack of clarity in the management of incoming referrals and lack of availability of Human Resources [29]. The lack of knowledge and skills by midwives and doctors in providing maternity care, especially emergency obstetric care [30], causing the services of obstetric emergencies to be not optimal, this contributes directly to maternal mortality [31,32]. The importance of the role and function of the CEmONC to reduce the Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR), and no reviews have been found about the effectiveness of CEmONC on reducing mortality, CEmONC effectiveness assessment in maternal health status and reducing maternal mortality in some country. The Purpose of this Systematic Literature Review is to identify the effectiveness of the CEmONC on maternal mortality.

## **2. METHODS**

In the process of searching for articles in several databases, the keywords used were "Comprehensive Emergency Obstetric and Newborn Care" and "Maternal Mortality". The article used as a reference is a review/ systematic review to develop keywords to get specific articles. After the author gets specific keywords, these keywords are used to search for papers in the Pubmed, Proquest and Sciencedirect databases. Keywords used in PubMed ((comprehensive) AND "obstetric neonatal care"), Proquest (("obstetric care") AND maternal mortality), and sciencedirect (effectiveness of Comprehensive Emergency Neonatal Obstetric Services). Article search uses a reference list of several articles related to the topic. Searches are limited to several criteria, namely publish in the last 10 years so that the management displayed in the article is the latest, in English, no criteria for the specific country to be addressed.

From the search results in 3 databases and reference lists, the number of articles was 1479. Then some similar/duplicate articles were deleted and 947 articles were obtained. Of the 453 articles conducted based on the title/abstract relating to the theme, 103 relevant articles were

obtained. Filtering was then carried out to obtain appropriate articles related to the effectiveness of CEmONC and maternal mortality (10), of the 10 full-text articles identified were filtered for the contents of the article. From the results of filtering the contents of the article, the suitability of the population, methods, and results by following the inclusion and exclusion criteria, as well as the critical appraisal of the 10 articles found 7 articles that will be used for Systematic Literature Review. This review specifically wants to know, "How about the effectiveness of the existence of CEmONC against maternal mortality?" The framework used is PICO (Population, Intervention, Comparison, Outcome).

Table 1. Research Framework

Element	Inclusion	Exclusion
<b>Population</b>	1) CEmONC Hospital 2) Health Workers at CEmONC	The hospital that does not provide CEmONC services
<b>Intervention</b>	The hospital was upgraded to CEmONC	
<b>Comparison</b>	The hospital that does not provide CEmONC services	
<b>Outcome</b>	1) Maternal Mortality 2) Positive impact regarding the reduction in maternal mortality	Neonatal Mortality

In conducting Critical appraisal, the tool chosen is Joana Briggs checklist. In the Critical Appraisal stage, there are 10 articles which are in line with the topic of the effectiveness of CEmONC services. Most of the articles in the research method used Cross-Sectional, Cohort, Randomized Controlled Trial, Quasi Experiment, and Case-Control. Each method is carried out with a Critical Appraisal with a checklist that varies according to the research method. After the selected critical appraisal is carried out there are 7 articles based on the author's assessment that they are of good quality with indexed Scopus with the standard Q1.

Figure 1 PRISMA Flow

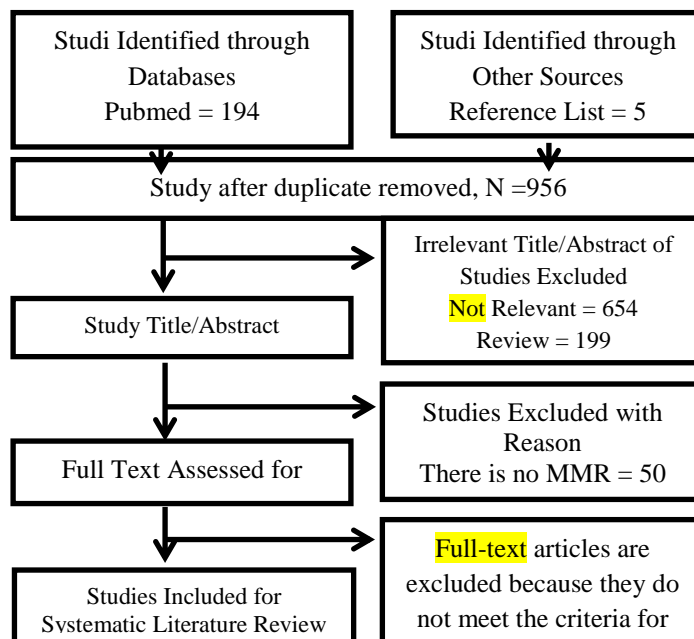


Table 2. Data Extraction

NO	Title/Author/ Years/Grade	Aim	Research Design	Method	Participants	Results
1	Quality of care, risk management, and technology in obstetrics to reduce hospital-based maternal mortality in Senegal and Mali (QUARITE): a cluster-randomized trial (Dumont et al., 2013) Q1	This study conducted a trial to assess the effects of multifaceted interventions to promote maternal mortality review and training in emergency obstetric care in referral hospitals with high maternal mortality rates in Senegal and Mali.	Pragmatic Cluster-RCT	Observation	46 hospitals	Hospital-based maternal mortality was reduced by 15% in Mali and Senegal 2 years after intervention. This effect is limited to capital hospitals and districts. Significant reductions in MMR in the capital and district hospitals reflect the combined effects of all components above the intervention.
2	Reducing Maternal Deaths in Ethiopia: Results of an Intervention Programme in Southwest Ethiopia (Lindtjorn et al., 2017) Q1	This implementation study aims to reduce maternal mortality which analyzes the results of interventions conducted in three districts (called woreda) in Southwest Ethiopia (Arba Minch Zuria, Bonke and Dirashe Woredas), which has a monitoring system to measure maternal mortality.	Case-Control	Observation	3 hospitals and 63 health centers in Gamo Gofa Zone	There was the highest increase in institutional labor in districts with CEmONC services in Dirashe (19.5%; P <0.001), and Arba Minch Zuria (8.3%; P <0.001), compared to districts with only BEmONC services, Bonke (3.5%); P <0.001). MMR decreased 64% during the intervention period, (477 to 219 deaths per 100,000 KH (OR 0.46; 95% CI 0.24 ± 0.88). The decrease in MMR was higher for Woreda with the functions of CEmONC, Dirashe (67%) and Arba Minch Zuria (63%) than at Bonke Woreda with BEmONC function only (32%).

<p>3 Enhancing Maternal and Perinatal Health in Under-Served Remote Areas in Sub-Saharan Africa: A Tanzanian Model (Nyamtema et al., 2016) Q1</p>	<p>To determine the effectiveness of interventions and the performance of supported health facilities data were collected based on the year of introduction of CEmONC services at each health center (i.e. one year before and after service introduction)</p>	<p>Quasi Eksperimen</p>	<p>Observation</p>	<p>10 hospitals</p>	<p>After launching CEmONC services from 2009 to 2014, deliveries by health workers increased in hospitals that had been upgraded to CEmONC in rural areas. The average number of deliveries per month increased by 151% and midwifery referrals decreased from 9% to 3% (<math>p = 0.03</math>) in the health center. A total of 43,846 vaginal deliveries and 2,890 Caesarea (SC) section operations were performed at the CEmONC Hospital, this made the average proportion of all births at 128% obstetric neonatal emergency facilities and population-based SC rates at 9%. In general, health centers statistically have a significantly lower maternal mortality ratio than district hospitals (each <math>p &lt; 0.00</math> and <math>&lt; 0.02</math>). Of all deaths (maternal and neonatal), 84% to 96% are considered avoidable.</p>
<p>4 Impact of the roll-out of comprehensive emergency obstetric care on the institutional birth rate in rural Nepal (Maru et al., 2017) Q1</p>	<p>Exploring the attitudes of women living in the study area in obtaining obstetric care, from facilities that are undergoing a transition from BEmONC to CEmONC</p>	<p>Cohort Study</p>	<p>Observation</p>	<p>231 postpartum mothers (98 and 133 women before and after expansion)</p>	<p>Institutional birth rates increased after the implementation of CEmONC (from 30 to 77%, in both hospitals (OR 2.5) and low-level facilities (OR 4.6, <math>p &lt; 0.01</math> for all). Logistic regression showed that the availability of obstetric care comprehensive emergency (OR 5.6), confidence that the hospital is the safest location of birth (OR 44.8),</p>

<p>5 Availability, utilization, and quality of maternal and neonatal health care services in the Karamoja region, Uganda: a health facility-based survey  (Wilunda et al., 2015) Q1</p>	<p>To determine the availability of maternal and infant health services at various levels of the health unit; to assess its utilization, and to determine the quality of services provided.</p>	<p>Cross-sectional</p>	<p>- Observation - Interview</p>	<p>Health Facilities/ Staff (facility inventory checklist and maternity nurse/midwife interview)</p>	<p>safety priority in decision mMMRng (OR 7.7), and higher-income (OR 1.1) predicting birth institution (p 1 0.01 for all). There are gaps in the availability of important infrastructure, equipment, supplies, medicines, and staff for the care of mothers and newborns, especially at CEmONC. The use of antenatal, intrapartum and postnatal care services is still low. There are gaps in the quality of care received throughout these services. Two hospitals, each located in the study district, meet the CEmONC Hospital requirements. None of the health centers studied met the criteria as BEmONC. Vaginal labor with extraction and management of placental retention is the service most often lost. The direct obstetric case death rate is 3%, the needs met for emergency obstetric care are 9.9%, and 1.7% of births are expected to be done by cesarean section.</p>
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1<sup>st</sup> International Respati Health Conference (IRHC) [Juli 2019]

<p>6 Emergency obstetric and neonatal care availability, use, and quality: a cross-sectional study in the city of Lubumbashi, the Democratic Republic of the Congo.</p> <p>(Ntambue et al., 2017) Q1</p>	<p>To assess the availability, use, and quality of emergency obstetric and neonatal care in Lubumbashi.</p>	<p>Cross-Sectional</p>	<p>- Observation - Interview</p>	<p>53 hospitals</p>	<p>The quality of care for women who give birth at health facilities that offer CEmONC is not good. Maternal mortality was reported because DOC (3.9%) was higher than the acceptable level (<math>\leq 1\%</math>). This reflects the lack of supplies, medicines and equipment, and the lack of skilled CEmONC staff.</p>
<p>7 Signal functions for emergency obstetric care as an intervention for reducing maternal mortality: a survey of public and private health facilities in Lusaka District, Zambia (Tembo et al., 2017) Q1</p>	<p>Evaluate the availability and benefits of fulfilling the criteria for emergency neonatal obstetric care providers in private and public health facilities in the Zambia Lusaka District</p>	<p>Cross-Sectional</p>	<p>Observation</p>	<p>35 hospitals (25.7% private and 74.3% government)</p>	<p>MMR in Zambia is 398 / 100,000 KH. In the study, it was found that health facilities that provided emergency obstetric neonatal services were low. Of the 35 health facilities (25.7% private and 74.2% public) assessed, only 22 (62.8%) served 24 hours a day, 7 days a week and had provided obstetric care 3 months before the survey.</p> <p>Pre-eclampsia/eclampsia and stagnant labor cause most direct complications, while postpartum hemorrhage is the main cause of maternal death. Overall, 3 (8.6%) and 5 (14.3%) from each health facility have provided BEmONC and CEmONC services. All facilities obtain blood products from the only blood bank at the government referral hospital.</p>

### **3. RESULTS AND DISCUSSION**

This review identified 7 relevant articles, taken from the last 10 years. CEmONC Hospital is a referral hospital that provides 24-hour services for maternal and neonatal emergencies. The existence of CEmONC is very helpful in reducing MMR if accompanied by health workers and adequate facilities and infrastructure. CEmONC services began to be introduced in Indonesia in 2005, the existence of CEmONC was expected to be able to reduce the Maternal Mortality Rate (MMR). (Guidelines for Organizing CEmONC, 2008). In the last 10 years, MMR in Indonesia has not experienced a significant decline. The findings indicate the presence of CEmONC hospitals that are of effective quality in reducing maternal mortality, poor access and quality of CEmONC increases obstetric complications and maternal mortality. Periodic evaluations are needed to maintain the quality of CEmONC.

#### **3.1. The availability of good quality CEmONC can reduce Maternal Mortality and increase Institutional Labor**

According to the results of a study in Senegal and Mali by Dumont et al (2013), it was found that maternal-based maternal mortality was reduced by 15% in Mali and Senegal after 2 years of being placed in CEmONC in the region [33]. Several studies support this finding. The effectiveness of CEmONC's existence was proven in the State of Tanzania by WhiteBibbon Alliance (2016), CEmONC proved to be able to save the lives of 75% of women killed by pregnancy, and 25% due to childbirth. The availability of CEmONC services is also able to make women choose safe labor by trained health personnel, as evidenced within 3 years (2013-2015) deliveries in health facilities increased from 30% to 60% [40]. The Bosomprah et al (2016) study shows that the ratio of maternal mortality in Ghana declined from 760 in 1990 to 380 in 2013 (a decrease of around 49%) with an average annual decline of 2.9%, the achievement of which is not separated from the role of CEmONC which is of good quality, only one or more basic functions that are not available are served at some CEmONC [41]. Fournier et al (2009)'s study shows that the Mali national maternity referral system increases midwifery coverage and reduces the risk of maternal death due to obstetric complications. MMR decreased more among women referred for emergency obstetric care than those who came to CEmONC without a referral. Almost half of the reduction in deaths (47.5%) is caused by a decrease in deaths caused by bleeding [42].

The results of a study in Southwest Ethiopia by Lindtjorn et al (2017) showed that the increase in institutional labor was highest in districts with CEmONC services in Dirashe (19.5%;  $P < 0.001$ ), and Arba Minch Zuria (8.3%;  $P < 0.001$ ), compared to districts with only BEmONC services, Bonke (3.5%);  $P < 0.001$ ). MMR decreased 64% during the intervention period, (477 to 219 deaths per 100,000 KH (OR 0.46; 95% CI 0.24 ± 0.88). The decrease in MMR was higher for Woreda with the function of CEmONC, Dirashe (67%) and Arba Minch Zuria (63%) than in Bonke Woreda with BEmONC function only (32%) [34]. Some other studies that strengthen this finding are studies by Pacagnella et al (2014) in Brazil which say that late obstetric emergency care increases complications and death Maternal significantly, as well as research (Soma-Pillay & Pattinson, 2016) which states that late access to care was identified in 83% of cases near death. Delay inpatient admission, delay in referral/treatment and sub-standard care were the main factors of patients died of obstetric bleeding, hypertension/pre-eclampsia, and medical conditions requiring emergency surgery [43]. Research by Fakhri et al (2015) showed that MMR at Tanzan was quite high, 454 per 100,000 live births, maternal mortality was very high among women who gave birth at the facility. It was found that 9% of the 43 hospitals serving childbirth acted as CEmONC, this number had met the standard. Most CEmONCs are in urban areas, this is a serious problem where



obstetric emergency patients in small islands and remote areas find it difficult to access comprehensive obstetric emergency services [44].

The results of a study by Nyamterna et al (2016) study in Sub-Saharan Africa, it was found that maternal mortality was much lower in hospitals that were intervened as CEmONC hospitals compared to district hospitals that were not intervened. Also, it was found that referral for obstetric complications decreased and delivery at health facilities increased [35]. Some other studies that strengthen this finding, a study by Owens et al., (2015) found that of the 10 health facilities surveyed only 6 carried out CEMONC, while 4 did not carry out the basic functions of obstetric emergency care (BEmONC), the BEmONC and CEmONC service contributed to high MMR. the city of Zambia Sub-Saharan Africa. MMR in Sub-Saharan Africa remains the highest. MMR Zambia only dropped 7% between 1990-2010 [45].

The results of the study (Maru et al., 2017) found that institutional birth rates increased after the implementation of the CEmONC (from 30 to 77%, OR 7.7) in both hospitals (OR 2.5) and low-level facilities (OR 4.6,  $p < 0.01$  for all) with the belief that the hospital is the safest location of birth (OR 44.8), priority for safety in decision MMR (OR 7.7), and higher-income (OR 1.1) predicting the birth of the institution ( $p < 0.01$  for all) [36]. Several other studies support this finding, a study by Chowdhury et al (2017) who suggested that Bangladesh has several CEmONC facilities that exceed the minimum standard. With these findings, it is not surprising that MMR in Bangladesh has experienced a significant decline in several years, even though Bangladesh is not able to achieve MDG's target of 143 / 100,000 KH, but the achievement of MMR in 2015 is quite satisfying, namely 176 / 100,000 KH [46].

### **3.2. Poor CEmONC services are associated with high obstetric complications and maternal mortality**

The results of the study by Wilunda et al (2015) show that maternal mortality in Uganda is related to gaps in the availability of important infrastructure, equipment, supplies, medicines, and staff for the care of mothers and newborns, especially in health centers. Access to remote obstetric neonatal emergency services and the lack of skilled health personnel in emergency neonatal obstetric management are serious problems that need to be addressed to reduce maternal mortality [37]. Several studies related to this finding. A study by Miltenburg et al (2017) in the Magu district of Tanzania found that the performance of emergency obstetric services was not following established standards, and none of the health facilities carried out their functions as CEmONC, this was due to a lack of human resources and a poorly functioning health care system. As a result, 20% of obstetric emergency conditions cannot be served optimally [47].

The study by Ntambue et al (2016) in Lubumbashi stating that regions with poor quality CEmONC hospitals (lack of supplies, medicines and equipment, and lack of skilled staff) had maternal deaths due to obstetric complications by 3%, this figure exceeds from an acceptable level of  $\leq 1\%$  [38]. Several other studies support this finding. The results of this study are similar to those of research (Robert Clive Pattinson, Makin Pillay, Van der Broek, & Moodley, 2015) suggesting that the ability of several health facilities available to carry out CEmONC functions is very poor in some of the districts studied. safe is not available consistently in many health facilities that deliver labor. It was found that less than 48% of 63 District Hospitals were able to fully implement the nine CEmONC functions [48]. Roy et al (2017) suggest that although MMR in Bangladesh has decreased by 40% in a few years, Bangladeshi MMR is higher than some other countries in South Asia. The main causes of MMR in Bangladesh are bleeding and eclampsia/preeclampsia which can be managed in health facilities that function. It was found that less than 60% of the CEmONC were

placed in the sub-district area, and the implementation of the nine CEmONC functions was found to be low [49].

The results of a study in Zambia by Tembo et al (2017), found that the high MMR in Zambia is closely related to health facilities that provide emergency obstetric neonatal services. Of the 35 health facilities, only 3 (8.6%) provided BEmONC services and 5 (14.3%) provided CEmONC services, and all of these facilities obtained blood products from the only blood bank in the government referral hospital [39]. Several other studies support this finding, a study by Utz et al (2015) suggested that out of 32 health facilities surveyed 18 carried out CEmONC and 14 as BEmONC. Of the 18 CEmONC, only 4 (21%) were able to serve all nine service functions. There were 26 maternal deaths from 1,428 women with obstetric complications, the overall mortality rate for the district was 1.75% [50]. The Baguiya et al (2016) study in Guinea states that the ratio of maternal mortality is estimated at 610 maternal deaths for every 100,000 live births during the period 2005-2010. After the evaluation, of the 81 hospitals surveyed only 15 were functioning as emergency obstetric neonatal referral hospitals, the need for BEmONC CEmONC was 12.2%, but those who were able to serve 7.1%. There is one CEmONC which is responsible for serving 745,415 residents. While the maximum population for one CEmONC is 500,000 (WHO, UNFPA, UNICEF, AMDD 2009 'Monitoring Emergency Obstetric care, a Handbook') [51].

Limitations in this Systematic Literature Review are very limited articles that will be analyzed and there are several articles with cross-sectional study design. This is due to limited time and source of search.

#### 4. CONCLUSION

The effectiveness of the CEmONC service is proven by several studies that have been carried out a systematic literature review. From 7 articles reviewed by researchers, it can be concluded that the study by Dumont et al (2017), Lindtjorn et al (2017), Nyamtena et al (2017), and Maru et al (2017) prove the existence of good quality CEmONC effective in reducing maternal mortality and increase institutional labor. The study by Wilunda et al (2015), Ntambue et al (2017), and Tembo et al (2017) found that poor CEmONC services were associated with high obstetric complications and maternal mortality. Attention is needed in all aspects, both from internal and external factors. Some of the components that support the quality of CEmONC services are the availability of health personnel who are following competencies, facilities, infrastructure, reliable management, and access to receiving CEmONC services.

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