論文題目　Assessment of multidimensional quality of maternal and newborn care in Nepal: Secondary data analysis
(ネパールにおける母子保健ケアの質の評価: 二次データ分析)

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Background During the Millennium Development Goals (MDGs) era, progress has been made in maternal and child health (MCH) worldwide. However, the reduction was slower than expected, and many countries need further acceleration to achieve the Sustainable Development Goals (SDGs) targets by 2030. The lesson learned from MDGs was that increasing the utilization of facility delivery did not necessarily result in improving MCH outcomes. In the SDGs, newborn health, one of the child health fields, became an independent indicator. Ensuring high-quality care will be key to improving maternal and newborn health in low- and middle-income countries (LMICs). The maternal and newborn care quality is a multidimensional concept, including three dimensions: 1) provision of care, 2) the experience of care and 3) human and physical resources. Improving the quality of a whole health system can lead to better health outcomes.

Nonetheless, the quality of multidimensional maternal and newborn care has not been systematically examined yet. Limited evidence exists on the association between the quality of care and newborn and perinatal deaths. Therefore, I conducted this study to provide evidence to strengthen health systems and reduce preventable maternal and newborn deaths. The study objectives were 1) to measure the district-level quality of maternal and newborn care in Nepal by three dimensions: the provision of care, the experience of care and human and physical resources, 2) to assess the extent to which women's socio-demographic characteristics can explain these quality differences in Nepal, and 3) to examine the association between the maternal and newborn care quality and newborn and perinatal deaths in Nepal.

Methods This study was conducted by a secondary data analysis using Nepal Service Provision Assessments (SPA) in 2015 and Nepal Demographic and Health Surveys (DHS) in 2016. From SPA, I used facility inventory survey data from 623 facilities offering delivery care for dimensions 1) and 3). For dimension 2), I used data from 1,509 interviews with antenatal care (ANC) clients and 1,544 observations of ANC consultation at 180 facilities handling ANC. From DHS, I used data from 5,038 women who reported having given birth in the five years preceding the survey.

Outcome variables were newborn and perinatal deaths. Exposure variables were three dimensions of district-level maternal and newborn care quality scores. For this study, I calculated each district's mean, median and maximum quality score based on 16 quality indicators from SPA. Covariates were women's socio-demographic characteristics, health and obstetric characteristics. I

applied the administrative boundary method to link the two surveys.

I created box plots of the quality scores to describe 1) the means and distributions of quality scores in three dimensions, 2) the mean scores of indicators that the quality scores consisted of, 3) the mean and distributions of the quality scores by the type of health facilities, and 4) the means and the distributions of these scores by district-level characteristics. I also conducted bivariate analyses to examine the difference in the quality scores among the different types of health facilities and districts with different characteristics for the box plots 3) and 4). I conducted one-way ANOVA for the box plots 3), and I conducted t-tests for the box plots 4). To compare the quality scores by characteristics of districts (level of urbanity, educational attainment, and wealth index), districts were dichotomized into two categories by the share of women with characteristics in each district. For inferential analysis, I used binary logistic regression models to examine the association between the quality of care and newborn and perinatal deaths. I ran separate regression models for mean, median and maximum quality scores. I also analyzed facility and non-facility delivery cases separately as sub-sample analysis.

Results The health facility-level quality extensively varied in all dimensions throughout Nepal. The levels of quality varied across 16 indicators. The means of the following indicators were high at greater than 0.80: oxytocin use for hemorrhage (mean=0.83), perception of pregnant women (mean=0.85), water (mean=0.86) and infection control (mean=0.84). Magnesium sulphate for eclampsia (mean=0.17) and visual aids use during a consultation (mean=0.05) were low at less than 0.2. The quality scores in all dimensions extensively varied across the different types of health facilities in Nepal. The median quality of dimension 1) was higher at government hospitals and NGO/private (not-for-profit)/mission-based health facilities than other health facilities. The median quality score in dimension 2) was slightly higher at private hospitals and NGO/private (not-for-profit)/mission-based health facilities than other types of health facilities. The median quality of dimension 3) was higher at government hospitals, private hospitals and NGO/private (not-for-profit)/mission-based health facilities than other health facilities.

The quality scores in all dimensions were likely higher in districts with higher percentage of women living in "urban" category, lower percentage of women in "no education" category and lower percentage of women in "poorest" category.

In dimension 1), the mean quality score had a significant association with lower number of newborn deaths in all delivery cases (OR=0.03, 95% CI 0.00-0.76) and the sub-sample analysis of facility delivery cases only (OR=0.04, 95% CI 0.00-0.86). However, the mean quality score did not have a significant association in the sub-sample analysis of non-facility delivery cases only (OR=0.18, 95% CI 0.01-4.81). The maximum quality score in dimension 1) had a significant association with lower number of newborn deaths in the analysis of all delivery cases (OR= 0.09, 95% CI 0.01-0.58). In the subsample analysis of facility delivery cases only, the maximum quality

score in dimension 1) did not show a significant association with newborn deaths (OR=0.14, 95% CI 0.00-5.27). In the analysis of non-facility delivery cases only, the maximum quality score in dimension 1) had a marginal but not significant association with newborn deaths (OR= 0.09, 95% CI 0.02-1.02). The quality scores in dimensions 2) and 3) had no significant association with newborn deaths in neither the analysis using the mean quality scores (all cases, dimension 2): OR=0.61, 95% CI 0.04-10.39; all cases, dimension 3): OR=2.96, 95% CI 0.30-29.00) nor the analysis using the maximum quality scores (all cases, dimension 2): OR=0.57, 95% CI 0.12-2.66; all cases, dimension 3): OR=1.7, 95% CI 0.13-23.22). In all dimensions, the quality scores had no significant association with perinatal deaths in neither the analysis using the mean quality scores (all cases, dimension 1): OR=0.32, 95% CI 0.03-3.86; all cases, dimension 2): OR=0.61, 95% CI 0.04-10.39; all cases, dimension 3): OR=2.96, 95% CI 0.30-29.00) nor the analysis using the maximum quality scores (all cases, dimension 1): OR=0.23, 95% CI 0.04-1.31, all cases, dimension 2): OR=0.56, 95% CI 0.12-2.73, all cases, dimension 3): OR=1.16, 95% CI 0.10-13.25).

Discussions This study first described the quality of care that women and newborns receive by three dimensions: provision of care, the experience of care, and human and physical resources. Moreover, this study then explained the characteristics of vulnerable districts and systematically examined the association between the levels of the quality of care and newborn and perinatal deaths in Nepal by three dimensions. By linking two nationally representative data from health facilities (SPA) and women (DHS), I investigated the district-level quality of the health system.

The health facility-level quality extensively varied in all dimensions throughout Nepal. The levels of quality varied across 16 indicators, such as parenteral oxytocin use for hemorrhage and visual aids use during a consultation. This study also showed the gap in the quality scores by the type of health facilities. Public primary level facilities were likely to have lower-quality scores than other health facilities in dimensions 1) and 3). Public health facilities had a slightly lower score than other health facilities in dimension 2). The quality score in dimension 1) varied extensively among private hospitals, and the quality score in dimension 3) extensively varied among primary health care centers. This study showed these tendencies in the quality by the type of health facilities.

This study detected the characteristics of the vulnerable districts with lower quality scores in all dimensions: districts with more women living in rural areas, with lower socio-economic status, with lower educational attainment. Moreover, this study showed the outliers health facilities and districts with extremely high-/low-quality scores than others in the same. Geographical factors may affect these outlier facilities and districts. However, the available data in this study could not explain the exact reason behind these outliers.

This study showed a significant association between the quality score in dimension 1) and lower number of newborn deaths but no significant association between the quality score in dimension 2) and dimension 3). I compared the analyses using all delivery cases, the subsample

analysis of facility delivery and non-facility delivery cases only. From the comparison, the mean quality score in dimension 1) may be more related to reducing newborn deaths in facility delivery cases. On the other hand, the maximum quality score in dimension 1 may be more related to reducing non-facility delivery cases. Since the quality indicators in dimension 1 were based on BEmOC functions, increasing the average quality of BEmOC at district-level may reduce newborn deaths among facility delivery cases. Also, having at least one health facility to handle high-quality BEmOC in each district might reduce newborn deaths among non-facility delivery cases. The quality scores in dimensions 2) and 3) had no significant association with newborn deaths.

After being adjusted for covariates, all dimensions of the quality scores had no significant association with perinatal deaths. However, unadjusted model in dimension 1 showed negative associations between the maximum quality score and perinatal deaths in all delivery cases and sub-sample analysis of non-facility delivery cases. Factors other than basic delivery care may largely be attributed to perinatal deaths, such as ANC, family planning and comprehensive emergency obstetric care. Also, the sensitiveness of the indicator may have affected the result.

Conclusions This study showed that enhancing the quality of care provision at its average and highest levels in each district may reduce newborn deaths but no perinatal deaths. The quality of other stages of the continuum of care, such as ANC and advanced maternal and newborn care, may explain this reason. On the other hand, this study showed that the quality of the care experiences and human and physical resources had no significant association with newborn and perinatal deaths. Rather than investing in raising the quality of resources, improving the quality to handle BEmOC may lead to a better neonatal health outcome.

Moreover, this study described the situation of the quality of care that women and newborns received by three dimensions. The quality gap existed among the different types of health facilities, such as primary level and other facilities and public and private facilities. This study detected the characteristics of vulnerable districts with lower quality scores in all dimensions: districts with more women living in rural areas, with lower socio-economic status and with lower educational attainment. These descriptions will be key to improving the quality of care in Nepal.

The government needs to accelerate its role as a coordinator to ensure high-quality basic maternity care, regardless of the type of health facilities. The vulnerable districts should be prioritized to improve the quality. Researchers should correctly choose which indicators to incorporate depending on the health outcomes to achieve when measuring the quality of care. Future studies should investigate the detailed positive birth experience and child health outcomes in LMICs. Furthermore, future studies should investigate the quality of other parts of the continuum of care and perinatal health with reliable data. **(1878 words)**