PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Measuring effective coverage of maternal and child health services in Cambodia: a retrospective analysis of Demographic and Health Surveys from 2005 to 2014
AUTHORS	Kim, Minkyung; Kim, Soon Ae; Oh, Juhwan; Kim, Chae Eun; Arsenault, C

VERSION 1 – REVIEW

REVIEWER	Nguyen, Phuong St Luke's International University, Graduate School of Public Health
REVIEW RETURNED	15-Mar-2022

GENERAL COMMENTS	General comments ========== The manuscript describes the effective coverage of maternal and child health services in Cambodia using secondary data. The manuscript is not well written and some issues of this study need to be clarified. It would be great to re-review the revised version in the next round. Major comments ---------- 1. This study only simply describes coverages of the indicators with some additional indicators proposed previously. It does not use any statistical analysis to give a conclusion on the changes in coverages over time. Thus, the conclusion in the improvement of coverage is not scientific-based. This is the critical limitation of this study. 2. The use of the term "Equity" is not appropriate. The authors should clearly emphasize the difference between "equity" and "equality". 3. Similarly, the study did not use any specific inequality indicator to access INEQUALITY but a visualization. For example, some widely used and accepted inequality indicators are the Relative index of inequality, the Slope index of inequality, and the Concentration index of inequality. Specific comments ========== 1. Abstract: • What uncertainty do the authors mean by "range 75.6% - 84.6%"? Please be specific in the term. 2. Introduction

	• The authors should describe some information of the previous studies related to maternal and child health in Cambodia. What is the existing evidence? 3. Methods • Regarding the measurement of indicators (both crude and effective coverage), it will be clearer if the authors use a table with the number of indicators, indicator names, definitions and measurements, and the sources. • Equity measurement: Again, the authors should use the term "inequality" instead. For visualization check, previous work proposed a framework to access the pattern in inequality. Nguyen PT, Rahman MS, Le PM, Nguyen HV, Vu KD, Nguyen HL, Dao ATM, Khuong LQ, Hoang MV, Gilmour S. Trends in, projections of, and inequalities in reproductive, maternal, newborn and child health service coverage in Vietnam 2000-2030: A Bayesian analysis at national and sub-national levels. Lancet Reg Health West Pac. 2021 Jul 30;15:100230. doi: 10.1016/j.lanwpc.2021.100230. PMID: 34528011; PMCID: PMC8342952. • Statistical analysis: There is no statistical analysis in this study. 4. Discussion • Please add some comparisons to other countries, especially to neighboring countries. For example, please make a discussion with a similar study in Vietnam. Nguyen PT, Rahman MS, Le PM, Nguyen HV, Vu KD, Nguyen HL, Dao ATM, Khuong LQ, Hoang MV, Gilmour S. Trends in, projections of, and inequalities in reproductive, maternal, newborn and child health service coverage in Vietnam 2000-2030: A Bayesian analysis at national and sub-national levels. Lancet Reg Health West Pac. 2021 Jul 30;15:100230. doi: 10.1016/j.lanwpc.2021.100230. PMID: 34528011; PMCID: PMC8342952. • Please provide some information on whether human resources (both quantity and quality) could be impacted by the healthcare service coverage and quality? • COVID-19 has proposed critical barriers to accessing healthcare services. Please make a discussion on the situation in Cambodia and comparison with neighboring countries. • Please provide some information on current national policy in Cambodia? Is there any national plan or health program? What is the lack of policies and what policy recommendation this paper could give?

REVIEWER	Marthias, Tiara The University of Melbourne, Nossal Institute for Global Health
REVIEW RETURNED	27-Mar-2022

GENERAL COMMENTS	Effective coverage of maternal and child health services in Cambodia from 2005 to 2014 Comments to authors: Abstract: - In the results: “The poorest and less educated women experienced a greater improvement in effective coverage” □ in

	cases of such low baseline, it is not surprising if improvement is largest in the poorest or less educated women. This requires further critique, e.g. even if the improvement is largest, does the inequity still exist? And how large? - Please move the strength and limitation to the discussion section, unless BMJ Open's guideline instructs it. Introduction: - Can the authors please add more background info on the burden of maternal and child morbidity/mortality in Cambodia? - Line 19-20: Several studies: the effective coverage would be lower than crude coverage, given crude coverage is a subset of quality-adjusted coverage. - Could the authors also consider recent publications by Amouzou et als? Methods: - Can the authors please clarify how N (need) was defined? Is it the number of women with live birth in the past 5 years preceding the survey? - Page 6, line 6-8: "Quality-adjusted delivery care was defined as the proportion of women who delivered at a health facility and who reported that someone examined them or asked questions about their health before being discharged" □ would it be possible to include variables that are directly associated with quality of delivery care, e.g., whether the delivery was attended by SBA and at health facility, was monitored using partograph, as well as other components of quality delivery? Could also consider EC variables by Amouzou et al (2018) - Page 6, line 20: Was the wealth index calculated using PCA? Could also refer to DHS Methods report Results: - Page 7, line 14: 27.1% fever cases seem very high. Any explanation for this? - Figure 3: Interesting to see that for childhood fever, the crude coverage decreased, but EC increased between 2010 and 2014. Any explanation for this? Could also re-check the variable definition or any differences between DHS waves.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Dr. Phuong Nguyen, St Luke's International University

Comments to the Author:

General comments

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The manuscript describes the effective coverage of maternal and child health services in Cambodia using secondary data. The manuscript is not well written, and some issues of this study need to be clarified. It would be great to re-review the revised version in the next round.

Response: Thank you, we have revised the writing.

Major comments

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1. This study only simply describes coverages of the indicators with some additional indicators proposed previously. It does not use any statistical analysis to give a conclusion on the changes in coverages over time. Thus, the conclusion in the improvement of coverage is not scientific-based. This is the critical limitation of this study.

Response: Thank you for raising this concern. We have improved the description of the statistical analyses used (lines 161-166). We also performed logistic regressions to estimate inequality in effective coverage across three measures of social position. The resulting risk ratios support the paper's conclusions.

Moreover, we have revised the conclusion based on results from the statistical analyses (lines 336-339).

2. The use of the term "Equity" is not appropriate. The authors should clearly emphasize the difference between "equity" and "equality".

Response: Thank you for raising this issue. In the methods and results sections, we have replaced the term "equity" with "inequality".

3. Similarly, the study did not use any specific inequality indicator to access INEQUALITY but a visualization. For example, some widely used and accepted inequality indicators are the Relative index of inequality, the Slope index of inequality, and the Concentration index of inequality.

Response: Thank you for this suggestion. In the revised paper, we used logistic regressions to estimate risk ratios in effective coverage in the 2014 CDHS and contrast the top and bottom wealth quintiles, urban vs rural area, and the most vs. least educated women. The methodology of these calculations can be found in lines 171-174. Additionally, we have summarized the findings in the results section in lines 214-217 and 222-225.

Results are shown in supplemental table 3. We have also shared the code to estimate risk ratios on GitHub repository: https://github.com/mkkim1/RiskRatio_Cambodia.git

Specific comments

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1. Abstract:

- What uncertainty do the authors mean by "range 75.6% - 84.6%"? Please be specific in the term.

Response: We have clarified the text by removing the term 'range'. Instead, we included separate average crude and effective coverage for maternal health services (ANC and facility delivery) and sick childcare (diarrhea, pneumonia, and fever) (lines 42-48).

2. Introduction

- The authors should describe some information of the previous studies related to maternal and child health in Cambodia. What is the existing evidence?

Response: We have added a persistent inequality in accessing maternal and child health services in Cambodia despite promising improvement in mortality rates (lines 88-90).(1,2)

3. Methods

- Regarding the measurement of indicators (both crude and effective coverage), it will be clearer if the authors use a table with the number of indicators, indicator names, definitions and measurements, and the sources.

Response: Thank you for this suggestion. We have added a supplemental table 1 describing indicator definitions and measurement strategy in the Cambodia Demographic Health Survey for crude coverage, effective coverage, and measures of socioeconomic positions .(3)

- Equity measurement: Again, the authors should use the term "inequality" instead. For visualization check, previous work proposed a framework to access the pattern in inequality.

Nguyen PT, Rahman MS, Le PM, Nguyen HV, Vu KD, Nguyen HL, Dao ATM, Khuong LQ, Hoang MV, Gilmour S. Trends in, projections of, and inequalities in reproductive, maternal, newborn and child health service coverage in Vietnam 2000-2030: A Bayesian analysis at national and sub-national levels. Lancet Reg Health West Pac. 2021 Jul 30;15:100230. doi: 10.1016/j.lanwpc.2021.100230. PMID: 34528011; PMCID: PMC8342952.

Response: We have revised the entire text using the term ‘inequality’ when needed.

- Statistical analysis: There is no statistical analysis in this study.

Response: We have improved the description of the statistical analyses used. We also performed regression analyses to estimate risk ratios as measures of inequality in effective coverage in 2014. Although most analyses are descriptive, they are appropriate to understand the state of quality of care in Cambodia.

4. Discussion

- Please add some comparisons to other countries, especially to neighboring countries. For example, please make a discussion with a similar study in Vietnam.

Nguyen PT, Rahman MS, Le PM, Nguyen HV, Vu KD, Nguyen HL, Dao ATM, Khuong LQ, Hoang MV, Gilmour S. Trends in, projections of, and inequalities in reproductive, maternal, newborn and child health service coverage in Vietnam 2000-2030: A Bayesian analysis at national and sub-national levels. Lancet Reg Health West Pac. 2021 Jul 30;15:100230. doi: 10.1016/j.lanwpc.2021.100230. PMID: 34528011; PMCID: PMC8342952.

Response: We have compared the study above in Vietnam(4), where the effective coverage for sick childcare for diarrhea was similar with Cambodia (lines 302-304).

- Please provide some information on whether human resources (both quantity and quality) could be impacted by the healthcare service coverage and quality?

Response: In the revised discussion, we have cited two additional programs related to the workforce which may have influence service quality in Cambodia: the integrated MCH program funded by the Korea Foundation for International Healthcare and the Government Midwifery Incentive Scheme. Both efforts aimed to improve both the quantity and competency of health workers.(5,6) These programs could have impacted maternal and child health services coverage (the number of facility deliveries) and quality (the number of births attended by skilled health workers) in Cambodia (lines 267-274).

- COVID-19 has proposed critical barriers to accessing healthcare services. Please make a discussion on the situation in Cambodia and comparison with neighboring countries.

Response: Thank you for this suggestion. We have cited a report estimating service disruptions due to the Covid-19 pandemic in Cambodia.(7) In addition, we added empirical evidence on service disruptions reported in Laos due to the Covid-19 pandemic (lines 319-324).(8)

• Please provide some information on current national policy in Cambodia? Is there any national plan or health program? What is the lack of policies and what policy recommendation this paper could give?

Response: We have included the most current national policy – The National Strategic Plan 2017-2020.(9) Since our results indicate poor quality of sick childcare, which is often provided by the private sector, we recommend policies to regulate private sector providers to ensure that patients receive quality healthcare services (lines 278-280).

Reviewer: 2

Dr. Tiara Marthias, The University of Melbourne, Gadjah Mada University

Comments to the Author:

Effective coverage of maternal and child health services in Cambodia from 2005 to 2014

Comments to authors:

1. Abstract:

- In the results: “The poorest and less educated women experienced a greater improvement in effective coverage” □ in cases of such low baseline, it is not surprising if improvement is largest in the poorest or less educated women. This requires further critique, e.g. even if the improvement is largest, does the inequity still exist? And how large?

Response: We have completely revised the abstract.

- Please move the strength and limitation to the discussion section, unless BMJ Open’s guideline instructs it.

Response: BMJ Open guideline instructs to include short bullet points of strengths and limitations of the study along with the abstract.

2. Introduction:

- Can the authors please add more background info on the burden of maternal and child morbidity/mortality in Cambodia?

Response: We have added background information on the determinants of the maternal and child deaths in Cambodia (lines 81-84).(10,11)

- Line 19-20: Several studies: the effective coverage would be lower than crude coverage, given crude coverage is a subset of quality-adjusted coverage.

Response: We have edited the sentence to emphasize the gap between crude and effective coverage, signifying a low quality of care in several low- and middle-income countries (lines 73-75).

- Could the authors also consider recent publications by Amouzou et als?

Response: We have included a recent publication by Amouzou et al 2019 – “Advances in the measurement of coverage for RMNCH and nutrition: from contact to effective coverage” (line 72).(12)

3. Methods:

- Can the authors please clarify how N (need) was defined? Is it the number of women with live birth in the past 5 years preceding the survey?

Response: Yes, the N is the number of women who had at least one birth in the past five years preceding each survey wave for ANC and facility delivery. For three sick childcare visits, the N is the number of children under five years old living in residential households (lines 103-107).

- Page 6, line 6-8: “Quality-adjusted delivery care was defined as the proportion of women who delivered at a health facility and who reported that someone examined them or asked questions about their health before being discharged” □ would it be possible to include variables that are directly associated with quality of delivery care, e.g., whether the delivery was attended by SBA and at health facility, was monitored using partograph, as well as other components of quality delivery? Could also consider EC variables by Amouzou et al (2018)

Response: Thank you for this suggestion. Based on the paper by Amouzou et al,(12) we assessed whether women who delivered with a skilled attendant received a checkup before discharge.

Skilled birth attendants were defined as doctors, nurse, midwives, or auxiliary nurses/midwives. However, we found that almost all (>99%) of the facility deliveries were assisted by skilled birth attendants. Therefore, the results did not change and we opted to not include this in the revision.

Although it is limited, others, including Hategeka et al and the Lancet Global Health Commission on High Quality Health Systems, have used this measure to estimate effective coverage for delivery care. We have described the limitation of this quality measure in the discussion section.(13,14)

- Page 6, line 20: Was the wealth index calculated using PCA? Could also refer to DHS Methods report

Response: Yes, the PCA was used by the DHS to calculate the wealth index. We have included the DHS Wealth Index report summarizing the detail calculation of this indicator (lines 158-160).(15)

4. Results:

- Page 7, line 14: 27.1% fever cases seem very high. Any explanation for this?

Response: The prevalence of fever (27.1%) among children under five years old in the last 2 weeks is consistent with the Cambodia Demographic Health Survey in 2014.(16) This prevalence significantly varied across provinces ranged from a low of 11% in Kampot/Kep to a high of 40% in Battambang/Pailin. A high burden of malaria has been found along the national borders which includes western provinces of Battambang and Pailin (lines 193-195).(17)

- Figure 3: Interesting to see that for childhood fever, the crude coverage decreased, but EC increased between 2010 and 2014. Any explanation for this? Could also re-check the variable definition or any differences between DHS waves.

Response: We have hypothesized this observation due to a dramatic reduction in malaria cases from 61% in 2015 to 27% in 2018. Moreover, no malaria related deaths were reported for the first time in the Cambodia’s history in 2018 (lines 285-291).(18)

References

1. Jimenez-Soto E, Durham J, Hodge A. Entrenched Geographical and Socioeconomic Disparities in Child Mortality: Trends in Absolute and Relative Inequalities in Cambodia. PLOS ONE. 2014 Oct 8;9(10):e109044.

2. Hong R, Them R. Inequality in Access to Health Care in Cambodia: Socioeconomically Disadvantaged Women Giving Birth at Home Assisted by Unskilled Birth Attendants. Asia Pac J Public Health. 2015 Mar 1;27(2):NP1039–49.

3. Statistics/Cambodia NI of, Health/Cambodia DG for, Macro ICF. Cambodia Demographic and Health Survey 2010. 2011 Sep 1 [cited 2021 Nov 8]; Available from: https://dhsprogram.com/publications/publication-fr249-dhs-final-reports.cfm

4. Nguyen PT, Rahman MS, Le PM, Nguyen HV, Vu KD, Nguyen HL, et al. Trends in, projections of, and inequalities in reproductive, maternal, newborn and child health service coverage in Vietnam 2000-2030: A Bayesian analysis at national and sub-national levels. Lancet Reg Health West Pac. 2021 Oct;15:100230.

5. Lee HY, Heo J, Koh H. Effect of a comprehensive program on maternal and child healthcare service in Battambang, Cambodia: A multivariate difference-in-difference analysis. J Glob Health Sci [Internet]. 2019 May 27 [cited 2021 Dec 16];1(1). Available from: https://doi.org/10.35500/jghs.2019.1.e2

6. Ir P, Korachais C, Chheng K, Horemans D, Van Damme W, Meessen B. Boosting facility deliveries with results-based financing: a mixed-methods evaluation of the government midwifery incentive scheme in Cambodia. BMC Pregnancy Childbirth. 2015 Aug 15;15(1):170.

7. Global Financing Facility. Preserve Essential Health Services During the Covid-19 Pandemic Cambodia [Internet]. Available from: https://www.globalfinancingfacility.org/sites/gff_new/files/documents/Cambodia-Covid-Brief_GFF.pdf

8. Arsenault C, Gage A, Kim MK, Kapoor NR, Akweongo P, Amponsah F, et al. COVID-19 and resilience of healthcare systems in ten countries. Nat Med. 2022 Mar 14;1–11.

9. Department of Planning & Health Information. The Third Health Strategic Plan 2016-2020 (HSP3) [Internet]. 2016 May. Available from: http://hismohcambodia.org/public/fileupload/carousel/HSP3-(2016-2020).pdf

10. Pierce H. Increasing health facility deliveries in Cambodia and its influence on child health. Int J Equity Health. 2019 May 14;18(1):67.

11. Liljestrand J, Sambath MR. Socio-economic improvements and health system strengthening of maternity care are contributing to maternal mortality reduction in Cambodia. Reprod Health Matters. 2012 Jan 1;20(39):62–72.

12. Amouzou A, Leslie HH, Ram M, Fox M, Jiwani SS, Requejo J, et al. Advances in the measurement of coverage for RMNCH and nutrition: from contact to effective coverage. BMJ Glob Health. 2019 May 1;4(Suppl 4):e001297.

13. Hategeka C, Arsenault C, Kruk ME. Temporal trends in coverage, quality and equity of maternal and child health services in Rwanda, 2000–2015. BMJ Glob Health. 2020 Nov 1;5(11):e002768.

14. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Health. 2018 Nov 1;6(11):e1196–252.

15. Rutstein SO, Johnson K. The DHS wealth index. 2004 Aug 1 [cited 2022 Apr 22]; Available from: https://dhsprogram.com/publications/publication-cr6-comparative-reports.cfm

16. Statistics/Cambodia NI of, Health/Cambodia DG for, International ICF. Cambodia Demographic and Health Survey 2014. 2015 Sep 1 [cited 2021 Nov 5]; Available from: https://dhsprogram.com/publications/publication-fr312-dhs-final-reports.cfm

17. Chhim S, Piola P, Housen T, Herbreteau V, Tol B. Malaria in Cambodia: A Retrospective Analysis of a Changing Epidemiology 2006–2019. Int J Environ Res Public Health. 2021 Feb;18(4):1960.

18. World Health Organization. World malaria report. Geneva; 2019.

VERSION 2 – REVIEW

REVIEWER	Nguyen, Phuong St Luke's International University, Graduate School of Public Health
REVIEW RETURNED	25-May-2022

GENERAL COMMENTS	The manuscript has been revised and improved. I think it could be improved further with some additional suggestions below. 1. The authors have calculated Relative Risk by using an approximate estimation method from logistic models. Please provide the used formula with appropriate references for it. Please make some discussions on the use of this method in literature and comparison with other available methods of relative risk calculation (for example, using the log-linear model). 2. The results of logistic regression and relative risk are the main findings, thus, should be presented in the manuscript, instead of Supplementary. Please reconstruct the Results section by presenting Supp Table S2 and other important findings in the main text.

REVIEWER	Marthias, Tiara The University of Melbourne, Nossal Institute for Global Health
REVIEW RETURNED	01-Jun-2022

GENERAL COMMENTS	I believe the authors have addressed the major inputs from the first round of review. I have only a couple more inputs as follow: Comments to revised version: Methods: • Page 5, line 379-380: “However, due to the age of the data, we excluded the 2000 data from the main analysis” □ I am unclear on this statement, what’s with the age of the data? Are there variables not available in the earlier version of DHS, which prevent comparable trend analyses? And should also state for which variables that 2000 data were excluded. Could the authors please clarify this? Ethical approval: I do have a question about ethical review; I understand this is a population (administrative) data source but there was no mention as to whether the study underwent ethical review, nor any information about consent for participants. This needs to be addressed (this information may be included in the cited paper)

	and it is important to include a statement of ethic compliance in every report.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

Dr. Phuong Nguyen, St Luke's International University

Comments to the Author:

The manuscript has been revised and improved. I think it could be improved further with some additional suggestions below.

1. The authors have calculated Relative Risk by using an approximate estimation method from logistic models. Please provide the used formula with appropriate references for it. Please make some discussions on the use of this method in literature and comparison with other available methods of relative risk calculation (for example, using the log-linear model).

Response: Thank you for this comment. Because the outcome of interest (effective coverage) is binary (e.g., whether each child received antibiotics for suspected pneumonia when seeking care), we used logistic regression models to estimate relative risks between the top and bottom categories of each measure of socioeconomic position. The method for estimating risk ratios using the margins command in STATA is described in: Cummings, P., 2011. Estimating adjusted risk ratios for matched and unmatched data: an update. The Stata Journal, 11(2), pp.290-298.(1)

We clarified this in the statistical analysis section (lines 169-177) and added the above reference in the paper.

We also provided the statistical code for these regressions in STATA for improved transparency and reproducibility: https://github.com/mkkim1/RiskRatio_Cambodia.git

2. The results of logistic regression and relative risk are the main findings, thus, should be presented in the manuscript, instead of Supplementary. Please reconstruct the Results section by presenting Supp Table S2 and other important findings in the main text.

Response: Thank you for this suggestion. We have added this table in the main text. Relative risks are now presented in Table 2.

Reviewer: 2

Dr. Tiara Marthias, The University of Melbourne, Gadjah Mada University

Comments to the Author:

I believe the authors have addressed the major inputs from the first round of review. I have only a couple more inputs as follow:

Comments to revised version:

Methods:

• Page 5, line 379-380: “However, due to the age of the data, we excluded the 2000 data from the main analysis” □ I am unclear on this statement, what’s with the age of the data? Are there variables not available in the earlier version of DHS, which prevent comparable trend analyses? And should also state for which variables that 2000 data were excluded. Could the authors please clarify this?

Response: Since the 2000 data were collected over two decades ago, we excluded them from the main analysis. In addition, indicators to estimate effective coverage for facility delivery and sick childcare for fever were not available in 2000. We clarified this in the methods section (lines 178-180) and as a footnote to supplemental table 2.

Ethical approval:

I do have a question about ethical review; I understand this is a population (administrative) data source but there was no mention as to whether the study underwent ethical review, nor any information about consent for participants. This needs to be addressed (this information may be included in the cited paper) and it is important to include a statement of ethic compliance in every report.

Response: Please see the editor’s comment above.

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Reference

1. Cummings P. Estimating Adjusted Risk Ratios for Matched and Unmatched Data: An Update. Stata Journal. 2011 Jul 1;11:290–8.