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ORIGINAL ARTICLE

Evaluation of differences in maternal and newborn health coverage across urban and rural areas: A pooled analysis of 88 countries

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Abstract

Objective: This study aims to determine whether the variables that reveal countries' maternal and newborn health coverage differ between rural and urban areas.

Methods: The sample of the study consists of 88 countries. The data were obtained from the "Maternal and Newborn Health Coverage Database 2022" published by UNICEF and analyzed using IBM SPSS Statistics. The T-test, Mann–Whitney U test and factorial ANOVA were used to analyze the data.

Results: The percentage of women who attended at least four prenatal appointments was found to be higher among women living in urban areas (81.1%) than among women living in rural areas (72.3%) (p=0.008). More cesarean sections are performed in urban (14.6%) than in rural areas (7.6%) (p=0.001). Women living in urban areas (94.3%) give birth in a health institution more frequently than women living in rural areas (81.3%) (p=0.001). The percentage of births attended by skilled health personnel was found to be higher for women living in urban areas (81.1%) than for women living in rural areas (72.3%) (p=0.001). The percentage of mothers (80.6%) who received postnatal care within 2 days of giving birth was also higher in urban areas than in rural areas (70.2%) (p=0.001). There is an interaction effect of urban-rural area and income group on the antenatal care 1+visit variable (p=0.001), institutional deliveries variable (p=0.023), and skilled birth attendant variable (p=0.002).

Conclusion: This research reveals that women and newborns living in rural areas are disadvantaged compared with those in urban areas with regard to antenatal, delivery, and postnatal care. It is recommended that steps are taken to reduce socioeconomic inequalities in rural areas, subsidize maternity services in hospitals, and develop a referral system among health institutions in rural areas.

Keywords: Access to Health Care, Delivery, Disparities, Antenatal Care, Postnatal Care

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INTRODUCTION

In the United Nations Sustainable Development Objectives, the target of objective 3.2 is "By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality and under 5 mortality."[1] It is important to draw attention to the difficulties faced by patients and health facilities in rural areas and to reduce maternal diseases and deaths in rural areas. These challenges include both clinical factors (lack of labor and low patient volume) and social determinants of health (transportation, housing, poverty, food safety, racism, and violence).[2] Obstacles to the use of services in rural areas can be listed as geographical distance, cost, lack of service, and insufficient personnel.[3]

The literature supports the concept that hospital care positively affects the health outcomes of infants. Some studies have shown that survival rates have increased for infants born in hospitals with appropriate resources.[4] It has been argued that infant and newborn deaths are closely linked to newborn care after birth, pregnancy care, delivery, place of birth, and quality of care.[5] Differences in infant and newborn deaths continue to depend on socio-demographic characteristics, such as race and ethnic origin and geographical location.

One of the driving forces of these differences is the differing access to delivery by risk. Appropriate services, services for the mother, the birth of the baby in a health institution, and serving the baby immediately after delivery can be listed as services with appropriate technology and staff.[6]

Many studies have investigated whether living in urban and rural areas is important in terms of mothers' deaths or access to health services. It has been argued that there is a large gap in terms of people's income and health status between urban and rural areas and that this gap explains the regional differences in the health status and survival rates of children between urban and rural areas.[7] In a study conducted in 54 countries, it was found that the coverage of births attended by skilled health personnel was the most unfair variable among the countries. The most fair intervention was determined as the early start of breastfeeding.[8] A study examining geographical and rural–urban differences in maternal mortality in China found that the risk of dying is higher in less developed regions due to a higher preventive maternal mortality rate and pregnancy.[9] In a US study, if sociodemographic and clinical conditions were checked, it was found that the possibility of maternal disease and death was 9 percent higher in rural than in urban areas.[2] A study conducted in Brazil found that rural women, regardless of their socioeconomic and pregnancy conditions, have a higher risk of giving birth to babies with a very low birth weight and detectable disabilities at birth than women living in urban areas of the same region.[10]

Understanding the coverage of maternal and neonatal health services between rural and urban populations is important for assessing the health needs of populations and addressing health disparities. This research can help policymakers to understand and take steps to close the urban–rural difference and to develop strategies to improve access to such health care. The aim of this study is to establish whether the variables that reveal the maternal and newborn health coverage in countries differ between rural and urban

areas.

METHODS

This research adopts a cross-sectional study design, which is a type of observational study design. The researcher evaluates both outcomes and exposures in the population, searching for potential associations in cross-sectional studies.[11]

The sample of the study consists of 88 countries that do not have missing values in the maternal and newborn health coverage data examined within the scope of the research (Additional File 1). The research was conducted on secondary data. UNICEF is a United Nations agency working in more than 190 countries and territories to protect the rights of all children, helping them to survive, develop, and fulfill their potential from earl y childhood to adolescence.[12] The data for the study were obtained from the "Maternal and Newborn Health Coverage Database 2022" published by UNICEF.[13] The data sources were national health surveys and national statistics published by official institutions of each country. Explanations of the variables used in the study are presented in Table 1.

Table 1. Variables Used in the Research

Categories	Variables	Explanation
Antenatal	Antenatal care 1+ visits	The percentage of women attended at least once during pregnancy by any provider.
Antenatal	Antenatal care 4+ visits	The percentage of women attended at least four times during pregnancy by any provider.
Delivery	C-section rate	The percentage of deliveries by C-section
Delivery	Institutional deliveries	The percentage of deliveries in a health facility.
Delivery	Skilled birth attendant	The percentage of deliveries attended by skilled health personnel.
Postnatal Newborn	Postnatal care for newborns	The percentage of newborns who received postnatal care within 2 days after birth.
Postnatal Mother	Postnatal care for mothers	The percentage of women who received postnatal care within 2 days after birth.

Source: UNICEF Maternal and Newborn Health Coverage Database 2022

The dataset used contains the most up-to date data for the countries. Therefore, data that do not belong to the same year across countries were employed (Table 2).

Table 2. The Year of the Variables

Variable	Year
Antenatal care 1+ visits	2012-2021
Antenatal care 4+ visits	2012-2021
Postnatal care for newborns	2010-2021
Postnatal care for mothers	2012-2021
C-section rate	2010-2021
Institutional deliveries	2012-2021
Skilled birth attendant	2012-2021

2010: Burundi, Bhutan 2012: Belarus, Barbadus, Gabon, Mexico, Ukraine 2013: Namibia, Yemen 2014: Egypti Cambodia, Sudan, El Salvador, Eswatini, VietNam 2015: Burkina Faso, Congo, Guaetemala, Panama, Solomon Islands, Chad 2016: Angola, Armenia, Belize, Côte d'Ivoire, Myanmar, Paraguay, Timor-Leste 2017: Haiti, Indonesia, India, Lao People's Democratic Republic, Maldives, Niger, Philippines, Democratic People's Republic of Korea, Togo, Tajikistan, Tanzania 2018: Afghanistan, Albania, Congo, Costa Rica, Guinea, Iraq, Jordan, Krgyzstan, Lesotho, Madagascar, Mali, Montenegro, Mongolia, Nigeria, Tunisia, Türkiye, Uganda 2019: Bangladesh, Central African Republic, Cuba, Dominician Republic, Algeria, Ethiopia, Ghana, Guinea-Bissau, Honduras, Kiribati, North Macedonia, Nepal, Pakistan, Senegal, Sierra Leone, Somalia, Sao Tome and Principe, Turkmenistan, Tonga, Zambia, Zimbabwe 2020: Gambia, Guyana, Kenya, Liberia, Malawi, State of Palestine, Kosowo, Rwanda, Tuvalu, Samoa 2021: India, Niger

Within the scope of the study, 88 countries out of 186 countries, which were not missing data for the variables examined, were included. The data were analyzed with IBM SPSS Statistics (IBM SPSS Statistics for Windows, Version 26.0. Armonk, United States). The normal distribution assumption was tested with the Kolmogorov–Smirnov, skewness, and kurtosis values. In the analysis of the data, the significance test (t-test) of the difference between the two means and the Mann–Whitney U test were used. Factorial ANOVA was used to test the interaction effect of countries' income groups and countries' rural-urban data. The significance level was set as $p<0.05$. The research data are reported using the mean and median values, standard deviation, and interquartile range of prevalence measures.

For this research, the income group of 88 countries was obtained from the World Bank's website for 2022. The World Bank categorizes global economies into four income groups, namely low, lower-middle, upper-middle, and high income. The categorizations rely on the gross national income (GNI) per capita from the preceding year.[14]

The question to be answered by this research was determined as follows:

Do the variables of antenatal care, delivery, and postnatal care coverage differ between rural and urban regions?

RESULTS

The distribution of prenatal, postnatal care, and delivery coverage in urban and rural regions of the examined countries is presented in Table 3.

Table 3. Antenatal, Postnatal and Delivery Coverage Variables by Urban and Rural Areas

	Rural			Urban			p-value
	X̄±Sd	Med	IQR*	X̄±Sd	Med	IQR	
Antenatal							
Antenatal care 1+ visits	88.4±14	94.55	13.9	94.5±6.9	96.5	5.7	0.003[a]
Antenatal care 4+ visits	67.3±21.6	72.3	36	76.4±16	81.1	23	0.008[a]
Postnatal							
Postnatal care for newborns	66.21±30.6	66.2	30	74.9±26.3	74.9	24	0.015[b]
Postnatal care for mothers	70.25±24.7	70.2	28	80.6±17.3	80.6	21.9	0.001[b]
Delivery							
C-section rate	13.5±12.9	7.6	19.2	19.9±14.3	14.6	20.7	0.001[a]
Institutional deliveries	75.1±24.4	81.3	37.9	89.4±13.5	94.3	11.6	0.001[a]
Skilled birth attendant	77.7±22.9	86.4	36.7	92.11±9.9	96	9.6	0.001[a]

* IQR: Interquartile range

[a] p value was obtained by the Mann Whitney U test.

[b] p value was obtained using an independent two-sample t-test.

It was determined that there are significant differences between antenatal, delivery and postnatal coverage in urban and rural areas. Women and infants benefit from services at higher antenatal, delivery and postnatal in urban areas than in rural areas. In urban areas, women receive more services from health personnel before and after birth. Additionally, the average of women giving birth in health institutions is significantly higher in urban areas than in rural areas ($p=0.001$). C-section rates are also significantly higher in urban areas ($p=0.001$). These differences were determined to be statistically significant.

Table 4. Factorial ANOVA Test Results for Antenatal, Postnatal and Delivery Coverage Variables of Countries by Urban-Rural and Income Groups

	df	Mean Square	p	η2
Antenatal care 1+visit				
Urban-Rural	5	1043	0.001	0.086
Income groups	5	1043	0.001	0.140
Urban-Rural*Income groups	5	1043	0.001	0.036
Error	170	105.6		R^2=0.202
Antenatal care 4+visit				
Urban-Rural	1	3190	0.001	0.076
Income groups	2	11863	0.001	0.378
Urban-Rural*Income groups	2	279	0.298	0.014
Error	170	229		R^2=0.400
Postnatal care for mothers				
Urban-Rural	1	4588	0.001	0.071
Income groups	2	8834	0.001	0.226
Urban-Rural*Income groups	2	691	0.146	0.022
Error	170	355		R^2=0.262
Postnatal care for newborns				
Urban-Rural	1	3195	0.035	0.026
Income groups	2	10212	0.001	0.145
Urban-Rural*Income groups	2	447	0.534	0.007
Error	170	710		R^2=0.145
Institutional deliveries				
Urban-Rural	1	8542	0.001	0.146
Income groups	2	7670	0.001	0.234
Urban-Rural*Income groups	2	1132	0.023	0.043
Error	170	294		R^2=0.327
C-section rate				
Urban-Rural	1	1663	0.001	0.075
Income groups	2	5901	0.001	0.365
Urban-Rural*Income groups	2	12	0.905	0.001
Error	170	121		R^2=0.381
Skilled birth attendant				
Urban-Rural	1	8602	0.001	0.183
Income groups	2	6153	0.001	0.242
Urban-Rural*Income groups	2	1527	0.002	0.073
Error	168	229		R^2=0.368

[a] p value was obtained by the Factorial ANOVA.

Countries' antenatal, delivery and postnatal coverage variables differ according to income groups. There is an interaction effect of urban-rural area and income group on the antenatal care 1+visit variable (p=0.001), institutional deliveries variable (p=0.023), and skilled birth attendant variable (p=0.002). The effect size of income groups in antenatal care visit and C-section rate variables is larger than other variables. It was determined that the income group variable had a

large effect size on the antenatal care 4+visit (η2= 0.378) and C-section (η2= 0.365).

DISCUSSION

This research reports regional disparities between urban and rural areas in maternal and neonatal health coverage using maternal and neonatal health coverage data from 88 countries. In this study, it was found that the percentage of women who were attended at least once during pregnancy by skilled health personnel was higher in urban than in rural areas. The percentage of women who attended at least four antenatal services was found to be higher in urban areas than in rural areas. In addition, it was observed that the interaction effect of urban-rural area and income group on the skilled birth attendant variable. Partridge et al. (2012) stated that the risk of prematurity, stillbirth, early and late neonatal death, and infant death increases as antenatal care decreases.[15] A study conducted in China found that there is a disparity between rural and urban areas in terms of antenatal care, health facilities for birth, and health professional services at birth. It reported that mothers from high wealth index households were more likely to live in urban areas, use maternal health services, and have higher education and greater media exposure than mothers living in rural areas.[9] Margaret et al. (2013) suggested that health care workers in urban areas demonstrated better knowledge and practice than their rural counterparts. According to research, urban areas generally have better equipment, materials, and training than rural areas. The availability of specialized and higher-tenured personnel is greater in urban areas.[16] A study performed in Northern Ghana found the main factors explaining the relatively high skilled birth coverage in urban areas to be higher frequency of attendance at antenatal care (ANC), proximity to a health facility (physical access), and a larger proportion of women achieving higher levels of education.[17]

A study conducted in Iran suggested that low cost, lack of health insurance, and socio-cultural and familial reasons cause mothers to hesitate to give birth at home and seek professional emergency care for birth complications.[18] In this study, the percentage of newborns and mothers who had postnatal contact with a health provider within 2 days of delivery was found to be statistically significantly higher in urban areas than in rural areas. It has been noted that babies who die within the first 28 days after birth suffer from a lack of quality service at birth or a lack of quality service and treatment immediately after birth and in the first days of life.[19] The density of human resources for health was found to affect indicators such as the maternal mortality rate, infant mortality rate, and under-five mortality rate.[20] It has been stated that there are policies that encourage health workers from poor countries to migrate to developed countries.[21] Besides, it has been argued that geographic accessibility to health facilities is an obstacle to the use of maternal and neonatal health (MNH) services.[22] In a study conducted in Malawi, pregnancy complications, women's lower education levels, difficulties accessing the available health facilities, and low exposure to media were significantly associated with a delay in women's use of postpartum care services within 24 hours of birth in rural Malawi.[23]

In this study, it was determined that women living in urban areas gave birth in a health institution more frequently than women living in rural areas. There are interaction effects between urban and rural areas and income groups on important variables such as prenatal care, institutional birth, and skilled birth attendant. It has been stated that, due to the poor socioeconomic status of rural women, most of them cannot afford to travel to places where they can obtain help from health professionals while giving birth. Although births are mostly free in rural health institutions, the facts that these health facilities are not within easy reach of rural women and that most women cannot afford the transportation cost may cause them to choose to give birth at home.[24] Understanding the

barriers to rural women's access to maternity services will be an important step.

In this study, it was found that the c-section rate is higher among urban women than among rural women. In different studies on access to cesarean sections, being able to receive cesarean section services has been particularly associated with income. Ushie et al. (2019) found that belonging to the poorest quintile and not receiving formal education were associated with a lower probability of having a cesarean delivery.[25] Leone et al. (2008) analyzed the institutional, socioeconomic, and societal factors affecting cesarean sections in six countries and concluded that women from higher socioeconomic backgrounds with better access to antenatal services were more likely to have a cesarean section.[26] The lowest cesarean rates were found in the more distant part of the hospital service area in Rwanda.[27] A study conducted in Indonesia found that the rate of cesarean sections in urban areas was almost double that in rural areas in 2017. This ratio was almost three times higher in the richest quintile than in the poorest quintile.[28] The probability of having a cesarean section was found to be higher in urban areas of Mozambique and Pakistan.[29–30] Achieving equity in healthcare will require the service to be available to those who need it rather than just those who can pay.

According to the research findings, women living in urban areas give birth in a health institution more frequently than women living in rural areas. Hernández-Vásquez et al. (2021), in their meta-analysis, found that the women in the richest quintile had the lowest percentage of home births, while the poorest had the highest percentage of home births. They reported that it was more common for uneducated women to give birth at home in general and that, in almost all countries, rural women generally had a higher home birth rate than those in urban areas.[31] In addition, most neonatal deaths occur at home.[24]

Limitations

This research is limited to 88 countries with urban- and rural-specific data in the UNICEF Maternal and Newborn Health Coverage Database 2022. Although the most up-to date data were used, not all of the analyzed data belong to the same year. Different results might be obtained for countries that were not included in the analysis. For this reason, the income characteristics of the countries that were not included in the analysis were evaluated (countries with complete data: low income=24; lower-middle income=38; upper-middle and high income=26; countries with incomplete data: low income=6; lower-middle income=18; upper-middle income=31; high income=46). When the countries with extracted data were excluded from the analysis, a more balanced distribution was achieved by combining the upper-middle and high-income groups.

Strengths

The strength of this research is that it analyzes the coverage of maternal and child health in rural and urban areas as well as taking into account the income group to which the countries belong.

CONCLUSION

This research reveals that women and newborns living in rural areas are disadvantaged compared with those living in urban areas with regard to antenatal, delivery, and postnatal care. There is a significant difference between rural and urban areas in terms of deliveries and receiving care from health professionals. It appears that more efforts are needed to make these services accessible. Interaction effect of urban-rural area and income group was found on the variable of antenatal care, delivery and skilled birth attendant. This means that the high-income group in an urban area tend to benefit more from prenatal care services, while this may differ for the low-income group in a

rural area. This suggests that, in addition to inequality in urban and rural areas, being socioeconomically disadvantaged increases this inequality.

These differences in urban and rural areas conflict with the sustainable development goals that seek to reduce health inequalities. Although there is not much difference between women living in rural and urban areas in terms of receiving care from skilled health personnel at least once during pregnancy, the difference widens as the frequency of receiving care increases. Unfortunately, in both rural and urban areas, it is possible that skilled health personnel do not attend births. It may be beneficial to make interventions for health workforce retention in rural areas.

This study recommends raising awareness through campaigns on maternal health, especially for women of childbearing age who live in rural areas, to determine self-awareness of the complications of pregnancy, to develop health information-seeking behaviors and skills, and to achieve these through accessible channels. Steps can be taken to reduce the socioeconomic inequalities between rural and urban areas. It can be beneficial to increase the skills of health professionals during birth, to set minimum targets for access to antenatal and postnatal care, to subsidize maternity services in hospitals, and to develop a referral system among health institutions in rural areas.

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Additional File 1. Countries Included in the Research

Nu.	Countries	Nu.	Countries
1	Afghanistan	45	Mexico
2	Angola	46	North Macedonia
3	Albania	47	Mali
4	Armenia	48	Myanmar
5	Burundi	49	Montenegro
6	Benin	50	Mongolia
7	Burkina Faso	51	Malawi
8	Bangladesh	52	Namibia
9	Belarus	53	Niger
10	Belize	54	Nigeria
11	Barbados	55	Nepal
12	Bhutan	56	Pakistan
13	Central African Republic	57	Panama
14	Côte d'Ivoire	58	Philippines
15	Democratic Republic of the Congo	59	Democratic People's Republic of Korea
16	Congo	60	Paraguay
17	Costa Rica	61	State of Palestine
18	Cuba	62	Kosovo
19	Dominican Republic	63	Rwanda
20	Algeria	64	Sudan
21	Egypt	65	Senegal
22	Ethiopia	66	Solomon Islands
23	Gabon	67	Sierra Leone
24	Ghana	68	El Salvador
25	Guinea	69	Somalia
26	Gambia	70	Sao Tome and Principe
27	Guinea-Bissau	71	Eswatini
28	Guatemala	72	Chad
29	Guyana	73	Togo
30	Honduras	74	Tajikistan
31	Haiti	75	Turkmenistan
32	Indonesia	76	Timor-Leste
33	India	77	Tonga
34	Iraq	78	Tunisia
35	Jordan	79	Türkiye
36	Kenya	80	Tuvalu
37	Kyrgyzstan	81	United Republic of Tanzania
38	Cambodia	82	Uganda
39	Kiribati	83	Ukraine
40	Lao People's Democratic Republic	84	Viet Nam
41	Liberia	85	Samoa
42	Lesotho	86	Yemen
43	Madagascar	87	Zambia
44	Maldives	88	Zimbabwe