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## Health insurance coverage and antenatal care utilization in Cambodia: Analysis of Cambodia Demographic and Health Survey 2021-22

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<b>Abstract:</b>	<p>Health insurance is essential in reducing or eliminating the financial constraint to accessing maternal health services caused by out-of-pocket payments. It has a beneficial effect in minimizing the number of maternal and child mortality. We examined the impact of health insurance coverage and antenatal care (ANC) utilization. We used data from the 2021-22 Cambodia Demographic and Health Surveys (CDHS). A total of 3,162 weighted women who gave birth within two years were included in the study. The association between health insurance coverage and pregnant women who attended at least four antenatal care visits during their pregnancy was evaluated using multiple logistic regression analysis. About 24.9% of women had health insurance coverage during 2021-22. Most (86.1%) of women attended at least 4 ANC visits. Almost 91.6% of women participating in four or more ANC visits were covered by health insurance. Having health insurance and attending four or more ANC visits were statistically significant adjusted odds ratio (AOR = 1.6; 95% CI: 1.1–2.4). Other factors significantly associated with attendance of four or more ANC visits include women with higher education (AOR = 3.1; 95% CI: 1.2–7.7), secondary education (AOR = 2.3; 95% CI: 1.5–3.5), richest households (AOR = 3.2; 95% CI: 1.5–6.8), and richer households (AOR = 1.9; 95% CI: 1.2–2.8). Pregnant women with health insurance were more likely to attend at least four ANC visits. Thus, providing health insurance may be essential to improving women's access to maternal health services in Cambodia.</p>
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# Health insurance coverage and antenatal care utilization in Cambodia: Analysis of Cambodia Demographic and Health Survey 2021-22

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## Abstract

Health insurance is essential in reducing or eliminating the financial constraint to accessing maternal health services caused by out-of-pocket payments. It has a beneficial effect in minimizing the number of maternal and child mortality. We examined the impact of health insurance coverage and antenatal care (ANC) utilization. We used data from the **2021-22 Cambodia Demographic and Health Surveys (CDHS)**. A total of 3,162 weighted women who gave birth within two years were included in the study. The association between health insurance coverage and pregnant women who attended at least four antenatal care visits during their pregnancy was evaluated using multiple logistic regression analysis. About 24.9% of women had health insurance coverage during 2021-22. Most (86.1%) of women attended at least 4 ANC visits. **Almost 91.6% of women participating in four or more ANC visits were covered by health insurance.** Having health insurance and attending four or more ANC visits were statistically significant adjusted odds ratio (AOR = 1.6; 95% CI: 1.1–2.4). Other factors significantly associated with attendance of four or more ANC visits include women with higher education (AOR = 3.1; 95% CI: 1.2–7.7), secondary education (AOR = 2.3; 95% CI: 1.5–3.5), richest households (AOR = 3.2; 95% CI: 1.5-6.8), and richer households (AOR = 1.9; 95% CI: 1.2-2.8). Pregnant women with health insurance were more likely to attend at least four ANC visits. Thus, providing health insurance may be essential to improving women's access to maternal health services in Cambodia.

**Key work:** Health insurance, Antenatal care utilization, Pregnant women, Cambodia

## Introduction

37

38 Cambodia's maternal mortality rate has significantly declined in the past decade. Data from the  
39 2021-22 Cambodia Demographic and Health Surveys (CDHS) show that maternal mortality had  
40 declined dramatically, from 488 to 154 per 100,000 live births between 2000 and 2021-22 [1,2].  
41 By 2030, the global maternal death ratio is expected to drop to less than 70 per 100,000 live births,  
42 according to Sustainable Development Goal (SDG) 3.1[3]. This achievement can be attributed to  
43 the country's concerted effort to increase women's access to maternal health services, particularly  
44 the initiative to increase institutional births [4]. Institutional births dramatically increased, from  
45 19.3% to 98%, while the proportion of pregnant women attending four or more antenatal care  
46 (ANC) appointments increased considerably, from 9% to 86.1%, between 2000 and 2021 [5]. In  
47 several studies, women who had health insurance had higher rates of using maternal health  
48 treatments, such as timely ANC and attending four or more ANC visits [6-9].

49

50 In 2019, the total population of Cambodia was 15.55 million, with 17.8% living below the national  
51 poverty line [10]. Since 2016, Cambodia has been classified as a lower-middle-income country,  
52 with gross domestic product (GDP) per capita from 302 US dollars in 2000 to 1,625 US dollars in  
53 2021 [11]. Also, current expenditures on health per capita significantly increased from 20 US  
54 dollars in 2000 to 116 US dollars in 2020 [12]. Globally, 50% of people cannot access essential  
55 health services, as the World Bank and World Health Organization (WHO) reported in 2017 [13].

56

57 Cambodian National Social Security Fund (NSSF) has provided health insurance coverage to  
58 formal sector workers [14]. And poor households are covered by the Health Equity Fund (HEF),  
59 the co-financing mechanism of the government and development partners [15]. By 2025, the  
60 government intends to expand the reach of the NSSF health insurance program to include the entire  
61 population [16]. Thus, nearly 70% of the population aged 15-49 reported not covered by health  
62 insurance [5]. Health insurance coverage is expected to provide financial risk protection and  
63 reduce disparities in access by facilitating greater uptake of maternal health services [13]. To our  
64 knowledge, limited published peer-reviewed studies assess the association between health  
65 insurance coverage and access to maternal health services among women of reproductive age in  
66 Cambodia using updated data. One prior study on health insurance coverage and its impact on  
67 maternal healthcare utilization in low- and middle-income countries utilized data from CDHS 2010

68 [8]. This study included all women and men aged 15-49 and pooled Demographic and Health  
69 Survey (DHS) data in 30 low-and middle-income countries (LMICs) [8]. An additional study  
70 aimed to assess levels of health insurance coverage in 30 LMICs and examines the impact of health  
71 insurance status on the use of maternal health care in eight countries spanning sub-Saharan Africa  
72 (Burundi et al., Namibia, and Rwanda), West Asia (Albania), and South and Southeast Asia  
73 (Cambodia and Indonesia) [8]. Given the lack of scholarship addressing this health concern among  
74 Cambodian women aged 15-49, we examined the effects of health insurance coverage and  
75 antenatal care (ANC) utilization among pregnant women in Cambodia. The findings will provide  
76 a broader perspective on levels of health insurance coverage and the impact of health insurance  
77 status on the use of maternal health care in Cambodia. Additionally, the study will enable  
78 policymakers to understand better health insurance coverage among the adult population in  
79 Cambodia and proffer suggestions for improving universal health coverage in Cambodia.

80

## 81 **Material and Methods**

82

### 83 **Ethical statement**

84

85 The CDHS 2021–22 is publicly available, with all personal identifiers of study participants  
86 removed. Permission to analyze the data was granted by registering with the DHS program website  
87 at (URL: <https://dhsprogram.com/data/available-datasets.cfm>). Written informed consent was  
88 obtained from the parent/guardian of each participant under 18 before data collection. The  
89 Cambodia National Ethics Committee for Human Health Research (NECHR) approved the data  
90 collection tools and procedures for CHDS 2022 for Health Research on 10 May 2021 (Ref # 83  
91 NECHR) and ICF's Institutional Review Board (IRB) in Rockville, Maryland, USA.

92

### 93 **Data source**

94

95

96 We used data from the most recent CDHS (2021–2022), a household survey conducted every five  
97 years nationally representative of the population [5]. The two-stage stratified cluster sampling  
98 method collected the samples from all provinces. At the first stage, clusters, or enumeration areas  
99 (EAs), that represent the entire country (urban and rural), are randomly selected from the sampling

100 frame using probability proportional (PPS) to cluster size. In the second stage, a complete listing  
101 of households was selected from each cluster using an equal probability systematic sampling, and  
102 then interviews were conducted with women aged 15–49 years who were born in the five years  
103 preceding the survey in the complete list selected households [5].

104 In total, 19,496 women aged 15-49 who had given birth in the last five years were interviewed  
105 face-to-face, using the survey standard questionnaire to collect information from women on several  
106 health indicators such as maternal health care service utilization, maternal and child health,  
107 nutrition, and reproductive health services [5]. Overall, 15,046 women who had not given birth in  
108 the past two years were excluded. Data restriction resulted in women who had a live birth in the  
109 past two years in a final analytic sample of 3,292 women (3,162 weighted women).

110

## 111 **Measurements**

112

### 113 **Outcome variable**

114

115 This study's outcome was the number of ANC visits during the last pregnancy among women aged  
116 15-59 years (coded as 0 = less than 4 ANC visits and 1 = four and more ANC visits) [17].

117

### 118 **Independent variable**

119

120 The primary independent variable is maternal health insurance coverage (yes vs. no), including  
121 public and private insurance. The confounding variables included maternal factors: Women's age  
122 in years (15-30 and 31-49), Marital status (married and not married), Birth order (1st, 2nd, 3rd, and  
123 4th or more), Education (no education, primary, and secondary or higher), Occupation (not  
124 working, professional, sales, services, agricultural, and manual labor), Individual Household  
125 factors include the Household wealth index (poorest, poorest, medium, richer, and richest),  
126 Geographical regions (Plains, Tonle Sap, Coastal/Sea, and Mountains), and Place of Residence  
127 (rural vs. urban).

128

### 129 **Statistical analysis**

130

131 Analyses were performed using STATA V17 (StataCorp LLC). We applied for the CDHS sampling  
132 weight variable (v005/1,000,000). Then, we used the survey-specific STATA command "svy" for

133 descriptive and analytical. Women's socio-economic and demographic characteristics were  
134 described using weighted frequency and percentage distributions.

135 Bivariate analysis using Chi-square tests assessed the association between the variables of interest  
136 (maternal and individual household characteristics) and ANC use. All independent variables  
137 associated with ANC use at  $p\text{-value} \leq 0.10$  were included in the multiple logistic regression  
138 analysis to determine the independent factors related to ANC use [26]. Multicollinearity between  
139 independent variables was checked, including women's age, number of children ever born,  
140 education, wealth index, occupation, marital status, coverage health insurance, and place of  
141 residence. Result of the evaluating variance inflation factor (VIF) scores after fitting an Ordinary  
142 Least Squares regression model. The mean value of VIF was 1.53, which is less than the cutoff  
143 point [27].

144



145 **Results**

146

147 **Characteristics of the study population**

148

149 **Table 1** describes the socio-economic and demographic characteristics of the 3,162 women aged 15–49  
150 born in the last two years preceding the survey. The mean age was 22.2 years old (SD = 4.2 years); the age  
151 group of 15–29 years old accounted for 94.3%. The majority (95%) were currently married. More than 33.4%  
152 of women were giving in the first birth order. Half of the women completed at least secondary education,  
153 while 10.6% had no formal education. Only 6.5% of workers are professionals, and 31.2% are unemployed.  
154 Of the sample, 20.7% of women were from the poorest households, and 19.7% were from poorer families.  
155 Sixty-two percent of the women lived in rural areas. Only 786 (24.9%) women aged 15–49 had health  
156 insurance coverage. 86.1% of women attended at least 4 ANC visits during pregnancy

157 **Table 1.** Socio-economic and demographic characteristics of women aged 15-49 years with a birth in the  
158 last two years preceding the survey (N = 3,162 weighted)

159

Variables	Freq.	%
<b>Mean age at the time of birth (SD)</b>	22.2(4.2)	
15-29	2,982	94.3
30-49	180	5.7
<b>Marital status</b>		
Married	3,004	95.0
Not married	158	5.0
<b>Birth order</b>		
1 <sup>st</sup> child	1055	33.4
2 <sup>nd</sup> child	1197	37.9
3 <sup>rd</sup> child or more	909	28.7
<b>Educational</b>		
No education	334	10.6
Primary	1253	39.6
Secondary	1361	43.0
Higher	214	6.8
<b>Occupation</b>		
None	986	31.2
Professional	205	6.5
Sales	579	18.3
Agricultural	445	14.1
Services	76	2.4
Manual labor	810	25.6
<b>Wealth index</b>		
Poorest	655	20.7
Poorer	623	19.7
Middle	626	19.8
Richer	683	21.6
Richest	574	18.2

<b>Residence</b>		
Urban	1202	38.0
Rural	1960	62.0
<b>Region</b>		
Plain	1532	48.5
Tonle Sap	996	31.5
Coastal	201	6.4
Plateau/Mountain	432	13.7
<b>Covered by health insurance</b>		
No	2376	75.1
Yes	786	24.9
<b>Number of ANC visits</b>		
< 4 ANC	440	13.9
≥ 4 ANC	2722	<b>86.1</b>

**Notes:** Survey weights are applied to obtain weighted percentages. \***Plains:** Phnom Penh, Kampong Cham, Tbong Khmum, Kandal, Prey Veng, Svay Rieng, and Takeo; **Tonle Sap:** Banteay Meanchey, Kampong Chhnang, Kampong Thom, Pursat, Siem Reap, Battambang, Pailin, and Otdar Meanchey; **Coastal/sea:** Kampot, Kep, Preah Sihanouk, and Koh Kong; **Mountains:** Kampong Speu, Kratie, Preah Vihear, Stung Treng, Mondul Kiri, and Ratanak Kiri.

## Maternal health insurance characteristics

The highest proportion of women having health insurance was among those aged 15-30 years (25.3.4%,  $p = 0.094$ ); higher education (48.1%,  $p < 0.001$ ); worked in professional jobs (59.0%), manual labor (52.5%) with  $p < 0.001$ ; and women from the richer households (30.2%), richest households (32.2%) with  $p < 0.001$ ; and women in urban areas (35.9%,  $p < 0.001$ ); (see **Table 2**).

**Table 2.** Socio-economic and demographic characteristics by the health insurance coverage of women aged 15-49 years with a birth in the last two years preceding the survey (**N = 3,162**)

Variables	Covered by health insurance				p-value
	No (N=2,367)		Yes (N=786)		
	Freq.	%	Freq.	%	
<b>Age at time of birth</b>					
15-30	2,229	74.7	753	25.3	0.094
31-49	147	81.7	33	18.3	
<b>Marital status</b>					
Married	2,260	75.2	744	24.8	0.757
Not married	116	73.4	42	26.6	
<b>Birth order</b>					
1 <sup>st</sup> child	778	73.7	277	26.3	0.035
2 <sup>nd</sup> or 3 <sup>rd</sup> child	876	73.2	321	26.8	
4 <sup>th</sup> child or more	722	79.4	188	20.7	
<b>Educational</b>					
No education	269	80.5	65	19.5	<0.001
Primary	950	75.8	304	24.3	
Secondary	1,046	76.9	315	23.1	

Higher	111	51.9	103	48.1	
<b>Occupation</b>					
None	892	90.5	93	9.4	<0.001
Professional	84	41.0	121	59.0	
Sales	514	88.8	65	11.2	
Agricultural	387	87.0	58	13.0	
Services	64	84.2	12	15.8	
Manual labor	385	47.5	425	52.5	
<b>Wealth index</b>					
Poorest	537	82.0	118	18.0	<0.001
Poorer	493	79.1	131	21.0	
Middle	479	76.5	147	23.5	
Richer	477	69.8	206	30.2	
Richest	389	67.8	185	32.2	
<b>Residence</b>					
Urban	770	64.1	432	35.9	<0.001
Rural	1,606	81.9	354	18.1	
<b>Region</b>					
Plain	1,119	73.0	413	27.0	0.019
Tonle Sap	781	78.4	216	21.7	
Coastal	167	83.1	34	16.9	
Plateau/Mountain	309.0	71.5	123.0	28.5	

177 **Notes:** Survey weights are applied to obtain weighted percentages. \***Plains:** Phnom Penh, Kampong Cham, Tbong Khmum, Kandal,  
178 Prey Veng, Svay Rieng, and Takeo; **Tonle Sap:** Banteay Meanchey, Kampong Chhnang, Kampong Thom, Pursat, Siem Reap,  
179 Battambang, Pailin, and Otdar Meanchey; **Coastal/sea:** Kampot, Kep, Preah Sihanouk, and Koh Kong; **Mountains:** Kampong Speu,  
180 Kratie, Preah Vihear, Stung Treng, Mondul Kiri, and Ratanak Kiri.

181

182

**183 Factors Associated with Four or more ANC visits in Chi-Square analysis**

184  
 185  
 186 In bivariate analysis (**Table 3**), a higher proportion of women with health insurance coverage had a  
 187 significant association with four or more ANC visits (91.6% vs. 84.2%,  $p < 0.001$ ). Women aged 31–49  
 188 reported being more likely to attend four or more ANC visits (88.0% vs. 86.0%,  $p < 0.001$ ). Also, married  
 189 women reported four or more ANC visits than nonmarried women (86.6% vs. 76.2%,  $p = 0.007$ ). Women  
 190 with no education were less likely to attend four or more ANC visits than those with higher education (71.0%  
 191 vs. 95.6%,  $p < 0.001$ ). Four or more ANC visits were higher among women working in professional (95.3%)  
 192 and service (96.4%), respectively, compared to unemployed women (84.3), with  $p < 0.001$ ). Additionally,  
 193 four or more ANC visits were higher among women from the richer and richest on the wealth index (94.8  
 194 and 89.4%, respectively), compared to the poorer and poorest (73.9 and 86.9%, respectively, with  $p < 0.001$ ).  
 195 Lastly, women living in urban areas reported higher four or more ANC visits than in rural areas (91.5 vs.  
 196 82.7%,  $p < 0.001$ ).

197  
 198 **Table 3.** Maternal and household characteristics by women attending at least four antenatal care and delivery in  
 199 a health facility (N = 3,162)  
 200

Variables	Number of ANC visits		p-value
	Four or more n=2,722	Less than four n=440	
	%	%	
<b>Covered by health insurance</b>			
No	84.2	15.8	<0.001
Yes	91.6	8.4	
<b>Age at time of birth</b>			
15-30	86.0	14.0	<0.001
31-49	88.0	12.0	
<b>Marital status</b>			
Married	86.6	13.4	0.007
Not married	76.2	23.8	
<b>Birth order</b>			
1 <sup>st</sup> child	88.4	11.6	<0.001
2 <sup>nd</sup> or 3 <sup>rd</sup> child	88.6	11.4	
4 <sup>th</sup> child or more	80.1	19.9	
<b>Educational</b>			
No education	71.0	29.0	<0.001
Primary	84.1	15.9	
Secondary	90.1	9.9	
Higher	95.6	4.4	
<b>Occupation</b>			
None	84.3	15.7	<0.001

Professional	95.3	4.7	
Sales	84.4	15.6	
Agricultural	79.0	21.0	
Services	96.4	3.6	
Manual labor	89.9	10.1	
<b>Wealth index</b>			
Poorest	73.9	26.1	<0.001
Poorer	86.9	13.1	
Middle	86.3	13.7	
Richer	89.4	10.6	
Richest	94.8	5.2	
<b>Residence</b>			
Urban	91.5	8.5	<0.001
Rural	82.7	17.3	
<b>Region</b>			
Plain	89.3	10.7	<0.001
Tonle Sap	86.6	13.4	
Coastal	89.0	11.0	
Plateau/Mountain	72.2	27.8	

201 **Notes:** Survey weights are applied to obtain weighted percentages. \***Plains:** Phnom Penh, Kampong Cham, Tbong Khmum, Kandal,  
202 Prey Veng, Svay Rieng, and Takeo; **Tonle Sap:** Banteay Meanchey, Kampong Chhnang, Kampong Thom, Pursat, Siem Reap,  
203 Battambang, Pailin, and Otdar Meanchey; **Coastal/sea:** Kampot, Kep, Preah Sihanouk, and Koh Kong; **Mountains:** Kampong Speu,  
204 Kratie, Preah Vihear, Stung Treng, Mondul Kiri, and Ratanak Kiri.  
205

206  
207  
208

209 **Association between health insurance and maternal Healthcare Services Utilization**  
 210

211 **Table 4** shows the results of the multiple logistic regression analysis of the association between  
 212 health insurance coverage and maternal healthcare services utilization after controlling for the  
 213 socio-demographic factors. Compared to women without health insurance, those with health  
 214 insurance coverage were more likely to attend four or more ANC visits (AOR = 1.6, 95% CI: 1.1–  
 215 2.4). Women with higher education (AOR = 3.1, 95% CI: 1.2–7.7), secondary education (AOR =  
 216 2.3, 95% CI: 1.5–3.5), and primary education (AOR = 1.7, 95% CI: 1.2–2.7) were more likely to  
 217 have four or more ANC visits than women without any formal education. The odds of having four  
 218 or more ANC visits were more significant for women from the wealthiest households than for  
 219 those from the poorest households: richest households (AOR = 3.2; 95% CI: 1.5-6.8), richer  
 220 households (AOR = 1.9; 95% CI: 1.2-2.8), and middle households (AOR = 1.5; 95% CI: 1.1-2.2).  
 221 However, the odds of having four or more ANC visits were lower in unmarried women than in  
 222 married women (AOR = 0.5; 95% CI: 0.3-0.8).  
 223

224 **Table 4.** Association between health insurance and four or more ANC visits in simple and multiple logistic  
 225 regression model (N = 3,162)

Variables	Four or more ANC visits			
	Unadjusted		Adjusted	
	OR	95% CI	AOR	95% CI
<b>Covered by health insurance</b>				
No	1.0		1.0	
Yes	2.0***	(1.4-2.9)	<b>1.6*</b>	<b>(1.1-2.4)</b>
<b>Age at time of birth</b>				
15-30	1.0		1.0	
31-49	1.2	(0.7-2.1)	1.1	(0.6-2.0)
<b>Marital status</b>				
Married	1.0		1.0	
Not married	0.5**	(0.3-0.8)	<b>0.5**</b>	<b>(0.3-0.8)</b>
<b>Birth order</b>				
1 <sup>st</sup> child	1.0		1.0	
2 <sup>nd</sup> or 3 <sup>rd</sup> child	1.0	(0.8-1.4)	1.1	(0.8-1.5)
4 <sup>th</sup> child or more	0.5***	(0.4-0.7)	0.7*	(0.5-1.0)
<b>Educational</b>				
No education	1.0		1.0	
Primary	2.2***	(1.5-3.1)	<b>1.8**</b>	<b>(1.2-2.7)</b>
Secondary	3.7***	(2.6-5.3)	<b>2.3***</b>	<b>(1.5-3.5)</b>
Higher	8.9***	(4.3-18.3)	<b>3.1*</b>	<b>(1.2-7.7)</b>
<b>Occupation</b>				
None	1.0		1.0	
Professional	3.8***	(2.0-7.0)	1.4	(0.7-2.8)

Sales	1.0	(0.7-1.4)	0.7	(0.5-1.0)
Agricultural	0.7*	(0.5-1.0)	1.0	(0.7-1.4)
Services	4.9**	(1.8-13.5)	2.6	(0.9-7.2)
Manual labor	1.7**	(1.2-2.3)	1.3	(0.9-1.9)
<b>Wealth index</b>				
Poorest	1.0		1.0	
Poorer	2.4***	(1.7-3.2)	<b>1.7**</b>	<b>(1.2-2.3)</b>
Middle	2.2***	(1.6-3.1)	<b>1.5*</b>	<b>(1.1-2.2)</b>
Richer	3.0***	(2.1-4.2)	<b>1.9**</b>	<b>(1.2-2.8)</b>
Richest	6.4***	(3.4-12.0)	<b>3.2**</b>	<b>(1.5-6.8)</b>
<b>Residence</b>				
Urban	1.0		1.0	
Rural	0.4***	(0.3-0.6)	0.8	(0.5-1.1)
<b>Region</b>				
Plain	1.0		1.0	
Tonle Sap	0.8	(0.6-1.1)	1.2	(0.9-1.7)
Coastal	1.0	(0.6-1.5)	1.3	(0.8-2.1)
Plateau/Mountain	0.3***	(0.2-0.4)	0.5***	(0.3-0.6)

226 **Ref** = reference value

227 \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

228 **Notes:** Survey weights are applied to obtain weighted percentages. \***Plains:** Phnom Penh, Kampong Cham, Tbong Khmum, Kandal,  
229 Prey Veng, Svay Rieng, and Takeo; **Tonle Sap:** Banteay Meanchey, Kampong Chhnang, Kampong Thom, Pursat, Siem Reap,  
230 Battambang, Pailin, and Otdar Meanchey; **Coastal/sea:** Kampot, Kep, Preah Sihanouk, and Koh Kong; **Mountains:** Kampong Speu,  
231 Kratie, Preah Vihear, Stung Treng, Mondul Kiri, and Ratanak Kiri.

## 236 Discussion

237  
238 We analyzed the most recent 2021–22 CDHS data to examine the relationship between health  
239 insurance coverage and receiving four or more ANC visits during pregnancy. Overall, 24.9% of  
240 women reported having health insurance coverage among women of reproductive age who gave  
241 birth within two years of the survey. This finding is similar to lower-middle-income countries,  
242 where 27.3% of women had health insurance coverage [18]. This is higher than in low-income  
243 countries, where 7.9% of women have health insurance coverage [18]. However, lower than in  
244 upper-middle-income countries, 52.5% of women had health insurance coverage [18]. Since the  
245 formal launch of the Cambodia National Social Security Fund (NSSF) with the Health Insurance  
246 Scheme in 2008, the proportion of women with health insurance coverage has increased from 16%  
247 in 2014 to 22% in 2021–22 [5]. This proportion exponentially increased due to the Royal  
248 Government of Cambodia’s implementation of the NSSF for all workers in the formal and informal  
249 sectors of the economy [10]. Moreover, it has plans to extend the healthcare benefits under the  
250 NSSF to the family members of the employees as well [16].

251 The proportion of women with health insurance coverage was found to be highest among women  
252 with higher levels of education and those from better households. This is in line with a meta-  
253 analysis of 48 studies conducted in 17 countries, which revealed a higher likelihood of health  
254 insurance participation in the wealthiest and most educated households [19]. Additionally, women  
255 with higher educational levels and wealth status consistently predicted health insurance ownership  
256 among women at reproductive age across five Sub-Saharan African countries [20]. Furthermore,  
257 we found women with health insurance coverage, a lower proportion among women living in rural  
258 areas. Consistent with studies in Nigeria [9]. This suggests that the more vulnerable populations,  
259 such as the poor, rural areas, and least educated, should be reached with government interventions  
260 such as having health insurance coverage.

261 The proportion of pregnant women attending four or more antenatal care appointments has  
262 increased considerably from 9% to 86.1% between 2000 and 2021. This study found that women  
263 with health insurance coverage were 1.6 times more likely to attend four or more ANC visits during  
264 pregnancy. Previous studies documented the positive relationship between health insurance and  
265 the number of ANC visits among women of reproductive age [8,9,18]. Health insurance eliminates  
266 the financial barrier to accessing maternal health services caused by out-of-pocket payments. It  
267 has a beneficial effect in reducing the number of low-birth-weight babies born and child mortality  
268 [21,22]. The result is more equitable access to care, potentially improving maternal health  
269 outcomes [9,18]. The MoH has since raised the minimum standard for ANC visits during  
270 pregnancy to at least four trips [17,23]. The dramatically significant increase in the highest  
271 prevalence of four or more ANC visits was an effort by the Royal Government of Cambodia, which  
272 has strengthened health facilities across the country, particularly in rural areas, improved  
273 infrastructure, provided essential medical equipment and supplies, increased the number of  
274 midwives, expanded antenatal care, and provided more skilled medical practitioners at childbirth  
275 to ensure safe delivery practices. Furthermore, to encourage early and routine ANC visits, the  
276 government is offering pregnant women a monetary incentive of US\$20 for each visit during a  
277 maximum of four ANC visits at any health facility with a contract with the National Social Security  
278 Fund (NSSF) [14,24].

279 This study found that increased education and household wealth index increased the likelihood of  
280 four or more ANC visits. Women's education and higher wealth index are more likely to attend  
281 four or more ANC visits. This aligns with previous evidence around socio-economic inequalities



282 in maternal health service utilization in Cambodia and South Asia [25,26]. This may be because  
283 the more educated the woman is, the more aware she is of the importance of ANC for her health  
284 and baby [27]. Additionally, education gives women the power to decide whether to seek medical  
285 attention and enables them to recognize warning signs of pregnancy complications. On the other  
286 hand, women from higher-income households were more likely to be able to cover the costs of  
287 care-seeking, including any related expenses and transportation [25,26]. Thus, in this study,  
288 women with higher education levels and household wealth indexes had the highest proportion of  
289 health insurance coverage.

290  
291 This study has several strengths. First, it used the most recent women's data from the 2021–22  
292 CDHS, an extensive representative national population-based household survey with a high  
293 response rate of 97%. Second, the recall bias has been minimized by limited analysis of women's  
294 most recent deliveries within the last two years preceding the survey [5]. Data were collected using  
295 validated survey methods and highly trained data collectors, contributing to improved data quality  
296 [28]. Third, the complex survey design and sampling weights in the analysis accounted for both  
297 descriptive and analytics methods that enabled us to generalize our findings to the population of  
298 WRA in Cambodia. Lastly, to our knowledge, this is the first study to report the association  
299 between health insurance coverage and ANC visits in Cambodia. After controlling  
300 sociodemographic factors, we found significant associations between health insurance coverage  
301 and several forums or more ANC visits. A key finding compares the association with other studies  
302 in Southeast Asia and globally.

303

304 Despite this, there are several limitations. First, this study was a household-based survey, so it did  
305 not address health institution factors of antenatal care utilization and service availability; hence,  
306 this study could not explore the quality of ANC services, though the quality of healthcare services  
307 plays a vital role in patient satisfaction and use. Second, the study's cross-sectional nature could  
308 not assist in the temporal relationship of variables. Therefore, further study should be conducted  
309 to identify factors related to health institutions. In addition, antenatal care utilization should be  
310 performed based on the new WHO guidelines at the national level [23].

311 Moreover, longitudinal studies that address comprehensive variables should be studied. Third, we  
312 excluded other factors, such as maternal complications and women's empowerment indicators, that  
313 could affect the use of maternal care. Lastly, CDHS did not assess a direct measure of maternal  
314 health literacy.

315

## 316 **Conclusion**

317

318 This is the first study to report the association between health insurance coverage and ANC visits  
319 in the healthcare setting in Cambodia. Cambodian pregnant women attend four or more antenatal  
320 care visits, which is slightly high. However, it still needs to be satisfactory. Health among coverage  
321 women of reproductive age in Cambodia is relatively low. Moreover, we found that women with  
322 health insurance, women with education, and being rich in the wealth quintile were strong  
323 predictors of women attending four or more ANC visits. There is a need to pay close attention to  
324 improving the uptake of health insurance among women of reproductive age, especially targeting  
325 women with no education, from low-income families, and women who reside in rural areas.  
326 Policymakers may need to prioritize women of reproductive age in designing and implementing  
327 health insurance programs to increase their uptake. This would provide financial risk protection,  
328 facilitate access to maternal health services, and possible attainment of Cambodia's SDG 3 targets.

329

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332

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