HBV prevalence estimated by nationwide survey in Cambodia

The sero-epidemiological study on the prevalence of hepatitis B among children and mothers in the Kingdom of Cambodia

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Hà Nội Vietnam

Prevention and control of hepatitis B with combined vaccines and timely birth dose vaccination
Countermeasures for viral hepatitis in Japan:

- 2016: Periodic 3 dose HB vaccine to all infants
- 2015: 2nd generation: IFN free DAA
- 2014: 1st generation: IFN free DAA
- 2008: Medical-expenses support for anti viral therapy
- 2007: JRC: follow up system after post transfusion
- 2004: JRC: NAT screening
- 2002-2006: National screening of Hepatitis C&B virus in residents over 40 yo
- 1999: Screening: anti-HCV 2nd gen: JRC
- 1992: Cloning of HCV
- 1991: Screening : anti-HCV 1st gen: JRC
- 1990: Screening: HBsAg: JRC
- 1989: Screening : HCV
- 1986: Cloning of HCV
- 1985-1970: Australian antigen & HBV Dane
- 1972: Screening: HBsAg: JRC
- 1989: Screening : HCV
- 1990: Cloning of HCV
- 1992: Screening : anti-HCV 1st gen: JRC
- 1999: JRC: NAT screening
- 2004: JRC: follow up system after post transfusion
- 2007: Medical-expenses support for anti viral therapy
- 2008: 1st generation: IFN free DAA
- 2014: 2nd generation: IFN free DAA
- 2016: Periodic 3 dose HB vaccine to all infants
- 2018: Every prefecture has Regional core centers for the treatment of liver disease
Epidemiological Study in Cambodia so far

2009
Pilot sero-epidemiological study on hepatitis B and C infection among school children and adults in Siem Reap, Cambodia 2010-2014 1th - 8th

2010

2011

2012

2013

2014

2015

2016

2017

Hiroshima Univ. NGO Hiroshima Cooperated with MoH

Health and dental check-up in Sasar Sdam Elementary School, Siem Reap, Cambodia

Pilot study on school health check-ups system among school children in elementary school attached to Teacher training school

approved by
◆ Ethic committee for research science, Hiroshima University
◆ Cambodia National Ethics Committee for Health Research (NECHR)
Short Communication

Seroprevalence, genotypic distribution and potential risk factors of hepatitis B and C virus infections among adults in Siem Reap, Cambodia

Hiroko Yamada, Noboru Goto, M Keiko Katayama

Department of Epidemiology, Hiroshima University

PLOS ONE

Research Article

Hepatitis E Virus in Cambodia: Prevalence among the General Population and Complete Genome Sequence of Genotype 4

Hiroko Yamada, Sirany Hok, Keiko Katayama

1 Department Health Science General Hosp College, Phnom Penh School of Soc

Original Article

A seroepidemiological survey of the effect of hepatitis B vaccine and hepatitis B and C virus infections among elementary school students in Siem Reap province, Cambodia

Mayumi Fujimoto, Channarean Chuon, Shintaro Nagashima, Chikako Yamamoto, Ko Ko, Somana Svay, Sirany Hok, Olline Lim, Masayuki Ohisa, Tomoyuki Akita, Keiko Katayama, Junko Matsuo, Kazuaki Takahashi and Junko Tanaka

1 Department of Epidemiology Infectious Disease Control and Prevention, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, 2 Department of Medical Sciences, Toshiba General Hospital, Tokyo, Japan and 3 Ministry of Health, Phnom Penh, Cambodia
## Published References of HBV Prevalence in Cambodia

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Study Design</th>
<th>Study Subject</th>
<th>Study Area</th>
<th>Sample Size</th>
<th>Positivity of HBsAg</th>
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<tbody>
<tr>
<td>Soeung et al.,</td>
<td>2009</td>
<td>Cross Sectional</td>
<td>5 years old</td>
<td>Most developed area</td>
<td>598</td>
<td>3.2</td>
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<td>Mao et al.,</td>
<td>2013</td>
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<td>4-5 years old</td>
<td>PP (Urban)</td>
<td>1196</td>
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<td></td>
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<td>Kratie (Rural)</td>
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<td>Steung Treng (Remote)</td>
<td>637</td>
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<td>Fujimoto et al.,</td>
<td>2017</td>
<td>Cross Sectional</td>
<td>Elementary School student 7-</td>
<td>Siem Reap</td>
<td>248</td>
<td>2.0</td>
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<tr>
<td>Ol et al.,</td>
<td>2009</td>
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<td>Voluntary Blood Donor</td>
<td>Battambang (Remote)</td>
<td>600</td>
<td>6.5</td>
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<td></td>
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<td></td>
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<td>Pailin (Urban)</td>
<td>600</td>
<td>8.8</td>
</tr>
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<td>Yamada et al.,</td>
<td>2015</td>
<td>Cross Sectional</td>
<td>18-89 years old</td>
<td>Siem Reap</td>
<td>483</td>
<td>4.6</td>
</tr>
<tr>
<td>Samati et al.,</td>
<td>2003</td>
<td>Cross Sectional</td>
<td>General population</td>
<td>Sdau Village, Kratie</td>
<td>164</td>
<td>9.1</td>
</tr>
</tbody>
</table>
Subject of the sero-prevalence study of HBV and HCV infection in Kingdom of Cambodia
Siem Reap province 2010-2014 N=868

Survey period ➢ 2010.2～2014.8 (8 times)

Subjects N=868
➢ The general population in Siem Reap province.
➢ Chrey village, Krabei Riel commune, Rohal village, Sasar Sdam commune

Subjects: 868 people (Male: 360, Female: 508)
Ages: 7-90 years old (as of 2014)
mean: 30.5±18.8, median: 29 years old

Prevalence of HBV and HCV among residents based on Serological study in Kingdom of Cambodia
Siem Reap province 2010-2014 N=868

Average HBsAg 4.7%
Pos=41 [GT: C(36), B(2), ND(3)]

Average anti-HCV 3.9%
Pos=11 [GT: 1b(4), 6e(2), 6q(1), 6r(3), 6s(1)]

Average HBCab 28.3%

Average HBsAb 24.8%

- Yamada H, Fujimoto M, Svay S, Lim O, ... Tanaka J. Seroprevalence, genotypic 
  distribution and potential risk factors of hepatitis B and C virus infections 
"Serological vaccinated rate" classified by birth year among 248 school children in Siem Reap

HB vaccination program (Partial area)

p<0.05: Cochran Armitage Trend Test

HB vaccination program (Nationwide)

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Vaccine Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-2000</td>
<td>15</td>
<td>6.1%</td>
</tr>
<tr>
<td>2001</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>31</td>
<td>22.6%</td>
</tr>
</tbody>
</table>

average 10.1%


*Analyzed by Hiroshima Univ.*
Prevention and control of hepatitis B with combined vaccines and timely birth dose vaccination

The sero-epidemiological study on the prevalence of hepatitis B among children and mothers in the Kingdom of Cambodia
“The sero-epidemiological study on the prevalence of hepatitis B among children and mothers in the Kingdom of Cambodia”

**Principle investigator:**
- Junko Tanaka, PhD, Professor, Department of Epidemiology Infectious Disease Control and Prevention, Institute of Biomedical and Health Sciences, Hiroshima University, Japan; Director, Project Research Center for epidemiology and prevention of viral hepatitis and hepatocellular carcinoma, Hiroshima University; and Assistant Director, the Research Center for Hepatitis and Immunology, National Center for Global Health and Medicine, Japan

**Co-Principle Investigators**
- Joseph Woodring, DO, MPH, MTM&H, Technical Officer, Expanded Programme on Immunization Unit, Division of Communicable Diseases, World Health Organization Regional Office for the Western Pacific, Philippines
- Annemarie Wasley, ScD, Technical Officer, U.S. Centers for Diseases Control and Prevention, Atlanta, Georgia
- Mao Bunsoth, MD, University of Health Sciences, Phnom Penh, Cambodia
  - Ork Vichit, Manager, National Immunization Program (NIP), Ministry of Health, Cambodia
  - Hok Sirany, MD, Focal Point for Viral Hepatitis, Department of Preventive Medicine, Ministry of Health, Cambodia

**WHO, CDC, MoH in Cambodia, and Hiroshima Univ.**

**CAMBODIA HEPATITIS B SEROSURVEY, 2017**

**training text book**
Sampling Method

**Multistage stratified random sampling**
- **Seventy communes** were randomly selected among three strata: Phnom Penh; urban non Phnom Penh; and rural.
- **Four villages** were selected among each commune. (Totally 70*4 villages)
- **Nine children and their mothers** were selected in each village (Totally 70*4*9 = 2,520 pairs of child and his/her mother)

**Sample size: 2,520 children & their mother (Totally 5,040)**

\[ n = \left( Z_{1-\alpha/2} \right)^2 \times \left[ p(1-p)/d^2 \right] \times \text{Deff} \times (1/R) \]

With
- \( p \): assumed prevalence of HBsAg = 1.41%
- \( d \): absolute precision = 0.5%
- confidence level = 95%, \( Z_{1-\alpha/2} = 1.96 \)
- Deff: design effect =1.15
- \( R \): response rate = 97.5%

**Phnom Penh**
- **Urban area (non PP)**
- **rural area**
- 1,621 communes

**Random sampling by each strata**

- **4 villages** were selected by each commune
- **280 villages**

**PP**
- **Urban area (non PP)**
- **rural area**

9 pairs of child and his/her mother were selected by each village

**PP**
- **Urban area (non PP)**
- **rural area**

2,520 pairs of child & his/her mother

*Analyzed by Hiroshima Univ.*
Method

【Study design】 Nation-wide
A cross-sectional sampling strategy with random selection

【Subject】
1) **children aged 5 - 7 years of age** who were born since implementation of widespread infant immunization
2) **children's mothers**, most of whom were born before introduction of hepatitis B vaccine starting in 2001.

【Investigations】
1) Questionnaire: 40 questions
2) Rapid test and DBS
3) (A subset of subjects) **Venipuncture**

【ethical considerations】
The survey will be conducted in accordance with the WHO and Cambodia’s ethical guidelines on research involving human subjects. The study was submitted to the ethics committee for epidemiological research at Hiroshima University which is in compliance to the Ethical Guidelines for Medical and Health Research Involving Human Subjects published by the Ministry of Health and Welfare in Japan and the Cambodian National Ethics Committee for Health Research (NECHR) for approval.
Nationwide Survey  2017.3.6～4.6
Laboratory testing

**Definitions of study subjects HBV status**
- Chronic HBV infection: participants with a positive HBsAg test
- Not currently infected with HBV: participants with a negative HBsAg test

**Laboratory testing**
The following point-of-care HBV marker will be tested in the field:
- **Rapid HBsAg testing** will be tested with Abbott Determine test strip using 50 microliters of blood (1 drop); Dainabot Co. Ltd, Tokyo, Japan

The following HBV and HCV markers will be tested in Hiroshima University, Japan for all samples using DBS and venipuncture-derived serum samples:
- **HBsAg** will be tested by CLEIA with Lumipulse II; Fujirebio, Tokyo Japan.
- **Anti-HBs** will be tested by CLEIA with Lumipulse II; Fujirebio, Tokyo Japan.
- **Anti-HBc** will be tested by CLEIA with Lumipulse II; Fujirebio, Tokyo Japan.
- **Anti-HCV** will be tested by CLEIA with Lumipulse II Ortho HCV; Ortho Clinical Diagnostics, Tokyo, Japan.
  - In HBsAg or anti-HCV positive cases, **HBV DNA** or **HCV RNA** will be also tested by real-time PCR, respectively.
1. HBsAg positivity of Children and their mothers
   tested by Rapid HBsAg testing, Dainabot Co. Ltd, Tokyo, Japan

2. HB vaccination coverage by questionnaire

3. HBsAg positivity of Children by HB vaccination coverage

4. “serologically vaccinated rate” by DBS

5. The risk analysis of HBsAg positivity of Children
1. HBsAg positivity of Children and their mothers tested by Rapid HBsAg testing, Dainabot Co. Ltd, Tokyo, Japan (rapid test)

### Children (N=2,520)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Positives</th>
<th>HBsAg positivity (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2520</td>
<td>14</td>
<td>0.56% (0.27%-0.85%)</td>
</tr>
<tr>
<td>Male</td>
<td>1275</td>
<td>7</td>
<td>0.55% (0.14%-0.95%)</td>
</tr>
<tr>
<td>Female</td>
<td>1245</td>
<td>7</td>
<td>0.56% (0.15%-0.98%)</td>
</tr>
<tr>
<td>5 years old</td>
<td>1237</td>
<td>10</td>
<td>0.81% (0.31%-1.31%)</td>
</tr>
<tr>
<td>6 years old</td>
<td>1200</td>
<td>4</td>
<td>0.33% (0.01%-0.66%)</td>
</tr>
<tr>
<td>7 years old</td>
<td>83</td>
<td>0</td>
<td>0.00% (0.00%-4.44%)</td>
</tr>
</tbody>
</table>

### Mothers (N=2,026)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Positive</th>
<th>HBsAg positivity (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2026</td>
<td>89</td>
<td>4.39% (3.50%-5.29%)</td>
</tr>
<tr>
<td>under 29</td>
<td>698</td>
<td>29</td>
<td>4.15% (2.67%-5.64%)</td>
</tr>
<tr>
<td>30-39</td>
<td>1063</td>
<td>49</td>
<td>4.61% (3.35%-5.87%)</td>
</tr>
<tr>
<td>over 40</td>
<td>265</td>
<td>11</td>
<td>4.15% (1.75%-6.55%)</td>
</tr>
</tbody>
</table>

Analyzed by Hiroshima Univ.
## 2. HB vaccination coverage

either birth dose or 3-dose pentavalent vaccine by questionnaire Q12,13,14

### Birth dose coverage

78%

<table>
<thead>
<tr>
<th>Place where child was Born</th>
<th>Birth dose ≤7days</th>
<th>Birth dose ≤24h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dosed</td>
<td>N</td>
</tr>
<tr>
<td>Public hospital</td>
<td>420</td>
<td>512</td>
</tr>
<tr>
<td>Health center</td>
<td>1065</td>
<td>1271</td>
</tr>
<tr>
<td>At home</td>
<td>208</td>
<td>486</td>
</tr>
<tr>
<td>Other</td>
<td>189</td>
<td>248</td>
</tr>
<tr>
<td>Don't know</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The place of receiving most vaccines for child</th>
<th>Birth dose ≤7days</th>
<th>Birth dose ≤24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public hospital</td>
<td>65</td>
<td>73</td>
</tr>
<tr>
<td>Health center</td>
<td>1518</td>
<td>1864</td>
</tr>
<tr>
<td>Private clinic</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Other place</td>
<td>286</td>
<td>520</td>
</tr>
<tr>
<td>Don't know</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Never received vac.</td>
<td>3</td>
<td>35</td>
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</table>

<table>
<thead>
<tr>
<th>Age of mother</th>
<th>Birth dose ≤7days</th>
<th>Birth dose ≤24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 29 yrs</td>
<td>534</td>
<td>699</td>
</tr>
<tr>
<td>30-39 yrs</td>
<td>802</td>
<td>1063</td>
</tr>
<tr>
<td>over 40 yrs</td>
<td>187</td>
<td>266</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother's Educational background</th>
<th>Birth dose ≤7days</th>
<th>Birth dose ≤24h</th>
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</thead>
<tbody>
<tr>
<td>No/Primary</td>
<td>1045</td>
<td>1468</td>
</tr>
<tr>
<td>JHS</td>
<td>367</td>
<td>438</td>
</tr>
<tr>
<td>HS/College/Univ</td>
<td>111</td>
<td>122</td>
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</table>

<table>
<thead>
<tr>
<th>Mother's HBsAg</th>
<th>Birth dose ≤7days</th>
<th>Birth dose ≤24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>1468</td>
<td>1937</td>
</tr>
<tr>
<td>Positive</td>
<td>54</td>
<td>89</td>
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</tbody>
</table>
3. HBsAg positivity of Children categorized by their vaccination status

<table>
<thead>
<tr>
<th>Total</th>
<th>N</th>
<th>Positivity of Child's HBsAg (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2520</td>
<td>14 0.6% (0.3%-0.8%)</td>
</tr>
</tbody>
</table>

**Child has received pentavalent vaccine P=0.010**

<table>
<thead>
<tr>
<th>Dose</th>
<th>N</th>
<th>Positivity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 dose</td>
<td>114</td>
<td>3 2.6% (0.0%-5.6%)</td>
</tr>
<tr>
<td>1 dose</td>
<td>64</td>
<td>1 1.6% (0.0%-4.6%)</td>
</tr>
<tr>
<td>2 doses</td>
<td>107</td>
<td>1 0.9% (0.0%-2.8%)</td>
</tr>
<tr>
<td>3+ doses</td>
<td>2235</td>
<td>9 0.4% (0.1%-0.7%)</td>
</tr>
</tbody>
</table>

**Child has received birth dose within 7 days**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Positivity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1882</td>
<td>5 0.3% (0.0%-0.5%)</td>
</tr>
<tr>
<td>No</td>
<td>638</td>
<td>9 1.4% (0.5%-2.3%)</td>
</tr>
</tbody>
</table>

**Child has received birth dose within 24h**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Positivity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1145</td>
<td>2 0.2% (0.0%-0.5%)</td>
</tr>
<tr>
<td>No</td>
<td>1375</td>
<td>12 0.9% (0.4%-1.4%)</td>
</tr>
</tbody>
</table>

**Child has received birth dose within 24 hours & 3 doses of pentavalent vaccine NS**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Positivity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>1066</td>
<td>2 0.2% (0.0%-0.5%)</td>
</tr>
<tr>
<td>Not Received</td>
<td>1454</td>
<td>12 0.8% (0.4%-1.3%)</td>
</tr>
</tbody>
</table>

*Significant difference of mother's positivity among questionnaire categories* 

(Mother's HBsAg positivity)

(4.39%)

89/2026

3 dose Coverage 88.7%

(5.88%)

4/68

(7.69%)

4/52

(6.74%)

6/89

(4.13%)

75/1817

Coverage 74.7%

(3.55%)*

54/1522

(6.94%)*

35/504

Coverage 45.4%

(3.50%)

32/915

(5.13%)

57/1111

Coverage 42.3%

(3.65%)

31/849

(4.93%)

58/1177

*Significant difference of mother's positivity among questionnaire categories*
HBsAg positivity of 2520 children classified by HB vaccine status

2520: All Children
HBsAg: 0.56% (14)
(95% CI: 0.27-0.85)

78%

1976: Birth dosed
HBsAg: 0.30% (6)
(0.06-0.55%)

58%

1145: Birth dosed within 24 hours
HBsAg: 0.17% (2)
(0.00-0.42%)

99%

759: Pentavalent vaccine 3 times dosed
HBsAg: 0.39% (3)
(0.00-0.86%)

479: Pentavalent vaccine dosed
HBsAg: 1.04% (5)
(0.13-1.95%)

86%

410: Pentavalent vaccine 3 times dosed
HBsAg: 0.98% (4)
(0.02-1.93%)

14%

69: Pentavalent vaccine 1 or 2 times dosed, unk
HBsAg: 1.45% (1)
(0.00-4.27%)

22%

544: Not Birth dosed or UNK
HBsAg: 1.47% (8)
(0.46-2.48%)

42%

831: Birth dosed after 24 hours or UNK
HBsAg: 0.48% (4)
(0.01-0.95%)

1%
4. Multivariate risk analysis of HBsAg positivity of Children tested by Rapid test

<table>
<thead>
<tr>
<th>Factor</th>
<th>AOR</th>
<th>(95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place where child was born</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public hospital</td>
<td>0.5</td>
<td>0.0-4.2</td>
<td>0.5474</td>
</tr>
<tr>
<td>Health center</td>
<td>1.5</td>
<td>0.3-9.2</td>
<td>0.6427</td>
</tr>
<tr>
<td>Home</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.8</td>
<td>0.0-8.6</td>
<td>0.8497</td>
</tr>
<tr>
<td>Age of mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under 29 yrs</td>
<td>1.2</td>
<td>0.2-11.1</td>
<td>0.8302</td>
</tr>
<tr>
<td>30 - 39 yrs</td>
<td>0.5</td>
<td>0.1-4.3</td>
<td>0.4948</td>
</tr>
<tr>
<td>over 40 yrs</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of children in household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under 2</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>over 3</td>
<td>2.5</td>
<td>0.5-12.5</td>
<td>0.2508</td>
</tr>
<tr>
<td>Mother's HBsAg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>91.2</td>
<td>21.3-588.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Negative</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother has her child's immunization card</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes/Seen at HC</td>
<td>1.2</td>
<td>0.2-8.8</td>
<td>0.8254</td>
</tr>
<tr>
<td>No/unknown</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HB vaccine status of child</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth dose&lt;24h</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth dose&gt;24h &amp; Penta. 3 times</td>
<td>1.7</td>
<td>0.2-16.0</td>
<td>0.631</td>
</tr>
<tr>
<td>Birth dose&gt;24h &amp; Penta. 0-2 times</td>
<td>11.6</td>
<td>0.3-218.9</td>
<td>0.1139</td>
</tr>
<tr>
<td>Birth dose none &amp; Penta. 1-3 times</td>
<td>3.2</td>
<td>0.4-29.9</td>
<td>0.2648</td>
</tr>
<tr>
<td>Birth dose none &amp; Penta. none</td>
<td>46.5</td>
<td>2.7-104.9</td>
<td>0.0116</td>
</tr>
<tr>
<td>House roof</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tile</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal/Aluminium</td>
<td>0.9</td>
<td>0.2-4.6</td>
<td>0.866</td>
</tr>
<tr>
<td>Cement/Bricks</td>
<td>13.5</td>
<td>0.5-198.8</td>
<td>0.067</td>
</tr>
<tr>
<td>Other</td>
<td>0.0</td>
<td>0.0-2.1</td>
<td>0.987</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.43, p < 0.0001, N = 2,000 \]
"Serological vaccinated rate" among 248 school children in Siem Reap


Nationwide Cambodia 2017

29.8%

2010-2012 birth year

SiemReap

average 10.1%

Whole Cambodia

average 29.8%

from the result of DBS sample

Analyzed by Hiroshima Univ.
Summary

1. HBsAg Positivity of 2520 Children is 0.56% (95%CI: 0.27-0.85%)
2. That of their mothers is 4.39% (3.50-5.29%)
3. Coverage of birth dose HB vaccine is 78% and HBsAg positivity among them is 0.3%.
4. 22% of children did not receive any birth dose HB vaccine and their positivity is 1.47%.
5. Coverage of birth dose HB vaccine within 24 hours is 45.5% and HBsAg positivity among them is 0.17%.
6. Controversially, HBsAg positivity among children who never received any type of HB vaccine is 4.62%

7. The HB vaccine program is well practiced. However, it is desirable to further raise BD <24 hours vaccine coverage or to recommend to give birth dose vaccine at a hospital.

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Continue to next step.........

- **Screening of pregnant** to prevent vertical infection
- **Coverage of vaccine** to prevent horizontal
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