# Prevalence and Risk for Sexual Transmission of Hepatitis B Infection in 15 Million Rural Couples Aged 20-49 Years in China: a Cross-sectional Study

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## Background & Aim

- Prevention policy in China has primarily focused on reduction of chronic hepatitis B (CHB) virus (HBV) infection among infants and young age groups over the past decades[1]. The prevalence of chronic HBV infection among children aged <5 years has been reduced to 1.0% in 2006[2].
- Despite infections being controlled among young persons, the number of reported HBV infections in adults increased by 22%, from 740,000 in 2004 to 903,000 in 2014[3].
- Sexual exposure is the main source of new HBV infections in adults[4]. Data on estimates of infections by sexual exposure in adults in developing countries is lacking.
- To inform HBV prevention policy, it is critical to provide evidence of prevalence of HBV infection and quantify its risks of sexual transmission among adult population.
- We aimed to report the prevalence of chronic HBV infection and risks of sexual transmission in rural couples

## Methods

- A cross-sectional study was conducted in rural couples aged 20-49 years who planned to conceive within next six months between Jan 2010 and Dec 2014, using data from the National Free Pre-conception Check-up (NFPC) program.
- Data on demographics and clinical characteristics of participants were collected. Serologic markers including hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg), antibody of syphilis and alanine aminotransferase were measured.
- HBV status of couples was categorized based on their positivity of HBsAg: both positive (M+F+), only wife positive (M-F+), only husband positive (M+F-) and both negative (M-F-). Risks of sexual transmission were also assessed by examining individual HBV status and their partner's characteristics.
- Multivariate logistic regression models were used to evaluate risk factors of outcomes.

## Results

- **Characteristics of study population:** a total of 14,816,300 couples with complete HBV serologic tests and other data were included. Majority of wives were aged 20-24 years (41%), junior schooling (64%) and living in a HIV-low risk region (45%). 0.4% were syphilis positive. Among wives with CHB, 29% were HBeAg positive and 6.5% had ALT>38 U/L. Husbands had similar demographics.
- **Prevalence of CHB in Couples:** of 14,816,300 couples, 109,562 (0.74%) were both chronically infected with HBV; 925,489 (6.3%) had CHB in husbands only; 655,015 (4.4%) had CHB in wives only. An estimated 51% of observed rate of F+M+ occurred in the post-marriage period.
- **Prevalence of CHB Among Individuals:** prevalence of CHB in husbands was higher than in wives (7.0% vs 5.2%). Risk of having CHB among individuals was more than two-fold higher if partner was HBeAg(+)/HBsAg(+), HBeAg(-)/HBsAg(+) as compared to that for HBeAg(-)/HBsAg(-) partner (Figure 1).
- **Risk factors of CHB**: significant risk factors of couple's CHB included couple's positivity of syphilis and living in a HIV high-risk region. Partner's HBeAg (+)/HBsAg (+), HBeAg (-)/HBsAg (+), positivity of syphilis, living in a high-risk region were significantly associated with increased risk of having CHB among individuals.

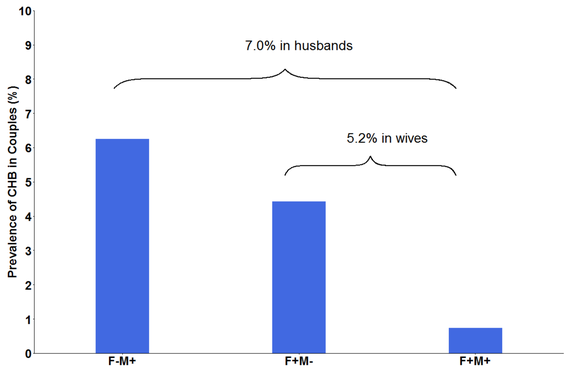


Figure 1. Prevalence of CHB in Couples

| | AOR for F+M+ | AOR for F-M+ | AOR for F+M- |
|---|---|---|---|
| Wife's age | | | |
| 20-24 years | Ref | Ref | Ref |
| 25-29 years | 1.01 (1.00,1.03) | 0.98 (0.98,0.99) | 1.02 (1.02,1.03) |
| 30-49 years | 0.93 (0.92,0.95) | 0.95 (0.94,0.95) | 1.05 (1.04,1.05) |
| Wife's education | | | |
| ≥college | Ref | Ref | Ref |
| senior school | 1.05 (1.02,1.07) | 0.93 (0.92,0.94) | 1.00 (0.99,1.01) |
| junior school | 0.96 (0.94,0.98) | 0.83 (0.82,0.83) | 0.95 (0.94,0.96) |
| ≤primary school | 1.03 (1.00,1.06) | 0.85 (0.84,0.86) | 0.99 (0.98,1.00) |
| Couple's syphilis | **2.69** (2.57,2.82) | **1.73** (1.69,1.76) | **1.54** (1.50,1.58) |
| HIV low-risk region | Ref | Ref | Ref |
| HIV medium-risk region | 1.03 (1.02,1.05) | 1.11 (1.10,1.11) | 1.03 (1.03,1.04) |
| HIV high-risk region | **1.53** (1.51,1.56) | **1.50** (1.49,1.51) | **1.34** (1.33,1.35) |

Table 1. Multivariate Logistic Regression for CHB in Couples

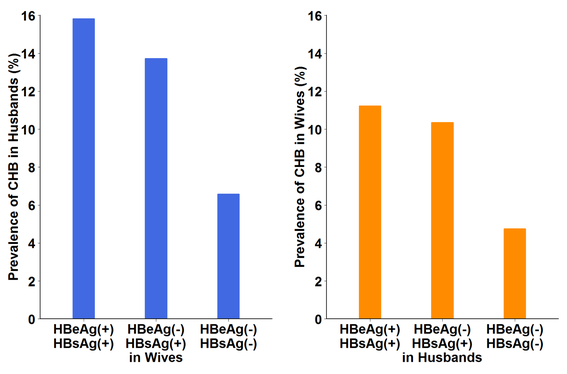


Figure 2. Prevalence of Individual CHB by Partner's HBV Serostatus

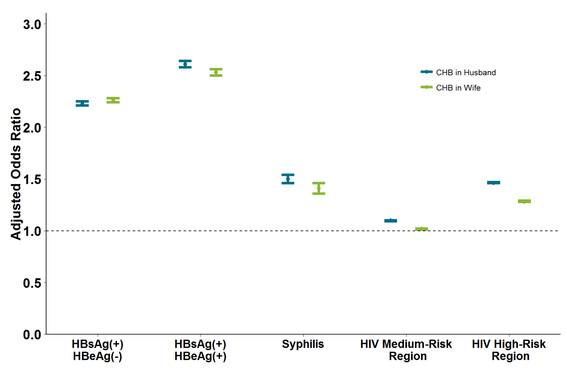


Figure 3. Multivariate Logistic Regression for Individual CHB

## Conclusions

- Our study demonstrates that 11.4% of rural couples who planned to conceive in China were affected by CHB and most of these infections were discordant.
- Despite a small proportion of couples (0.74%) who both had CHB, a half of them were attributed to transmission in their post-marriage life.
- The positive associations between partner's positivity of HBeAg and HBsAg, positivity of syphilis, living in a HIV high-risk region and increased risk of individual CHB further support that a fraction of CHB in couples were obtained sexually.
- Partner's HBeAg(+)/HBsAg(+) is the most important risk factor for sexual transmission of CHB.
- We predict that with the successful implementation of HBV immunization among children, new HBV infections in China will mostly come from sexual transmission in adults, especially in discordant couples. A comprehensive strategy that emphasizes vaccination of adults at risk for HBV infections and education on risk factors of HBV transmission should be scaled up immediately.

## References

1. Ministry of Health China. 2006–2010 National Guidelines for Hepatitis B Prevention and Treatment. [cited 2016 June 27]; Available from: http://www.moh.gov.cn/mohbgt/pw10603/200804/27587.shtml
2. Liang X, Bi S, Yang W, Wang L, Cui G, Cui F, et al. Epidemiological serosurvey of hepatitis B in China--declining HBV prevalence due to hepatitis B vaccination. Vaccine 2009;27:6550-6557.
3. Chinese Center for Disease Control and Prevention. Distribution of hepatitis by age groups. [cited 2016 June 30]; Available from: http://www.phsciencedata.cn/Share/ky_sjml.jsp?id=8defcfc2-b9a4-4225-b92c-ebb002321cea
4. Alter MJ, Ahtone J, Weisfuse I, Starko K, Vacalis TD, Maynard JE. Hepatitis B virus transmission between heterosexuals. Jama 1986;256:1307-1310.

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