Prevalence estimates of chronic hepatitis B virus infection

A comparative study of four sources and implications for burden assessment in sub-Saharan Africa

Nora Schmit, Shevanthi Nayagam, Mark Thursz, Tim Hallett
Imperial College London
Chronic hepatitis B virus (HBV) prevalence estimation

- Systematic review + modelling of empirical seroprevalence data
  → 4 recent sources of country-level, regional and global estimates of chronic HBV prevalence
4 sources of HBV prevalence estimates – different methods

Schweitzer et al. 1965-2013

IHME 2016 (Global Burden of Disease Study)

WHO 2015 (modelling by LSHTM)

CDA 2016
Background

4 sources of HBV prevalence estimates – different methods

- Schweitzer et al. (1965-2013)
- WHO 2015 (modelling by LSHTM)
- IHME 2016 (Global Burden of Disease Study)
- CDA 2016

Meta-analysis of all available data using different regression models

Single highest-quality prevalence estimate in a country used as input for dynamic transmission model
4 sources of HBV prevalence estimates – different methods

- **Schweitzer et al. 1965-2013**
- **WHO 2015** (modelling by LSHTM)
- **IHME 2016** (Global Burden of Disease Study)
- **CDA 2016**

WHO data is based on updated Schweitzer systematic review.
4 sources of HBV prevalence estimates – different methods

- Schweitzer et al. 1965-2013
- IHME 2016 (Global Burden of Disease Study)
- WHO 2015 (modelling by LSHTM)
- CDA 2016

Geospatial extrapolation, including to countries with no empirical seroprevalence data
Background

Published estimates of global HBV prevalence

- Nearly identical global estimates from WHO, CDA and Schweitzer
- Higher estimates from IHME
Background

Published estimates of global HBV prevalence

- Nearly identical global estimates from WHO, CDA and Schweitzer
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Compare the most recent country-level HBV prevalence estimates generated by 4 data sources:

- analyse the magnitude and direction of differences between estimates in the general population and in children under 5 years of age
- assess implications of differences for HBV burden estimation in sub-Saharan Africa

Are similarities in global estimates reflected on the country level in sub-Saharan Africa?
Are similarities in global estimates reflected on the country level in sub-Saharan Africa?

➢ Differences between prevalence estimates from any 2 sources in a country range from 0.03 to 16.9 percentage points.

WHO/CDA in The Gambia
WHO/Schweitzer in Swaziland

➢ Median difference between estimates from different sources:
  General population: 3.0% [IQR 1.7-4.7]
  Children under 5 years of age: 4.0% [IQR 2.1-7.2]
Where do estimates differ the most across sources?

Relative to the median prevalence, estimates are among the most variable across sources in:

- Countries with **no empirical seroprevalence data**
- Children <5 years compared to general population estimates ($p=0.001$)
Which sources have generated the most similar prevalence estimates?

- Higher estimates from IHME and Schweitzer: older seroprevalence data and no vaccination covariate
- Most similar estimates between WHO and CDA despite different methods
- CDA covers fewer countries than the other sources: 25 vs. 42-49
Comparing CDA and WHO general population estimates

- Absolute difference between estimates:
  - > 2.5 percentage points
  - < 25% of average prevalence

- Relative difference between estimates:
  - > 5 percentage points
  - < 50% of average prevalence
Comparing CDA and WHO general population estimates

- Nearly identical estimates in Tanzania, Mozambique, Senegal
Comparing CDA and WHO general population estimates

- Nearly identical estimates in Tanzania, Mozambique, Senegal
- WHO > CDA in 15/25 countries
- CDA > WHO in 10/25 countries

Absolute difference between estimates:
- > 2.5 percentage points
- > 5 percentage points

Relative difference between estimates:
- < 25% of average prevalence
- < 50% of average prevalence
Large differences in some countries despite overall similarity:

- Estimates in less than half of countries within 25% of each other, and 6/25 countries with relative differences >50%
- Largest absolute differences (>3.9 percentage points) in Nigeria, Chad, Burkina Faso and Gabon

Results

Comparing CDA and WHO general population estimates
Relative estimate discrepancy not correlated with relative uncertainty in the WHO estimate after excluding Chad ($p = 0.66$)

➢ suggests that larger differences between WHO and CDA point estimates do not reflect lack of seroprevalence studies in a country
Comparing CDA and WHO general population estimates

Relative estimate discrepancy not correlated with relative uncertainty in the WHO estimate after excluding Chad

- suggests that larger differences between WHO and CDA point estimates do not reflect lack of seroprevalence studies in a country

- Results

Absolute difference between estimates

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Case study: Nigeria – most data-rich country in sub-Saharan Africa

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**WHO**
Prevalence in 2015
5.47% (95% CI 4.39-6.95)
9.9 million infected people

78 primary studies included

**CDA**
Prevalence in 2016
11.20% (95% CI 10.10-12.80)
20.8 million infected people

1 primary study included
Case study: Nigeria – most data-rich country in sub-Saharan Africa

**WHO**

Prevalence in 2015

5.47% (95% CI 4.39-6.95)

9.9 million infected people

**CDA**

Prevalence in 2016

11.20% (95% CI 10.10-12.80)

20.8 million infected people

78 primary studies included

- Nearly all conducted on a sub-national level and many in special population groups (e.g. pregnant women in antenatal care)

Recent (2016) national serosurvey among the general population employing multistage household sampling and covering the six geopolitical zones of Nigeria

- Confirmed by national expert feedback
WHO and CDA take different perspectives on the available data

Countries with differences > 2.5 percentage points:

- CDA quality scoring prioritises generalisable (geographic scope, population, study design) and more recent studies with larger sample size (Nigeria, Burundi, Burkina Faso, Madagascar)

**BUT:** many countries do not have one particularly high-quality serosurvey (Chad, Malawi, Ivory Coast, Gabon, Mali)

- in 6/9 countries the included studies do not overlap between WHO and CDA → different identification process/inclusion criteria?
Comparing CDA and WHO estimates in children < 5 years of age

- Large relative differences overall (majority of estimates differ by over 50%)
- Countries with largest absolute differences largely the same as those with most discrepant general population estimates
- Trend towards a higher WHO estimate
Comparing CDA and WHO estimates in children < 5 years of age

Ratio of estimates in general population to children <5 years:
- lower and less variable in WHO estimates

➢ suggests a lack of primary data and a systematic difference in modelling strategy of age-specific prevalence patterns (statistical vs. dynamic model)
Conclusions & recommendations

- Large differences in country-level estimates in sub-Saharan Africa, particularly in children under 5 years of age:
  - IHME: consistently higher
  - WHO and CDA: lower and most similar estimates based on more recent data

- Differences between estimates arise from:
  - differences in the choice of primary data (currency and quality)
  - differences in modelling strategy (covariates, statistical vs. dynamic models)
Conclusions & recommendations

- Need for seroprevalence data in sub-Saharan African countries with and without previous serosurveys:
  - up-to-date
  - high quality (generalisable)
  - age-specific including young children

- Regular refinement of modelled estimates with new data

- Model comparison could improve understanding of how different assumptions and covariates affect the estimates
Acknowledgements

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  - CDA: Devin Razavi-Shearer
  - IHME: Nick Kassebaum & Kathryn Lau
  - Schweitzer: Jördis Ott & Johannes Horn
  - WHO: Yvan Hutin
Prevalence estimates and methods:


Other:
