Modelling jurisdictional disparities in the cascade of care for chronic hepatitis B in Australia: impact of treatment uptake on mortality

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Abstract

Objective: Investigate the cascade of care for chronic hepatitis B (CHB) and estimate impacts of increasing treatment uptake on attributable burden, according to jurisdiction.

Methods: A mathematical model of CHB in Australia was utilised, combined with notifiable disease and Medicare data. We estimated the proportion with CHB who were diagnosed, engaged in care and receiving treatment in each state/territory, and projected future mortality.

Results: The highest uptake of all measures was in New South Wales, however, the largest increase over time occurred in Northern Territory. No jurisdiction is due to meet 2022 targets of treatment uptake or mortality reduction. Previously declining mortality is predicted to plateau or increase in all jurisdictions except Northern Territory. The largest gap in the cascade of care was most commonly diagnosed individuals not engaged in care; however, in Victoria and Tasmania it was lack of diagnosis.

Conclusions: Measures of the cascade of care varied substantially between jurisdictions; while all require improvements to reduce mortality, the specific gaps vary, as do potential impacts.

Implications for public health: Improving the cascade of care for CHB will require jurisdictionally tailored approaches. If improvements are not made, more deaths will occur due to CHB in most states and territories.

Key words: Hepatitis B, modelling, public health, antiviral treatment, epidemiology

Chronic hepatitis B (CHB) is a significant public health burden and is the most prevalent blood-borne viral infection in Australia.[1] CHB is a leading cause of liver cancer, which is the sixth most common cause of cancer mortality in Australia.[2,3] Substantial improvements in access to appropriate care, monitoring and treatment are required to address hepatitis B related mortality nationally.[4]

Australia's National Hepatitis B Strategies have been fundamental to guiding the response to hepatitis B since 2010, with significant progress being achieved over this period. The 3rd National Hepatitis B Strategy 2018-2022[5] (National Strategy) sets goals to make progress towards eliminating hepatitis B as a public health threat, including reducing the burden of disease and eliminating the negative impact of stigma, discrimination, and legal and human rights issues on people's health. The National Strategy highlights priority areas and populations and outlines targets to measure progress throughout the span of the strategy. Key National Strategy aims include improving the cascade of care, by increasing the proportion of people living with CHB who have been diagnosed to 80%, increasing the proportion engaged in care to 50% and treatment uptake to 20%, with the goal of reducing CHB attributable mortality by 30%.[5]

Australia has also endorsed the World Health Organization (WHO) Global Health Sector Strategy (GHSS) on Viral Hepatitis 2016–2021,[6] which includes global targets for 2030 including 90% of people living with hepatitis B diagnosed, 80% of eligible persons with CHB treated and a 65% reduction in hepatitis B related deaths compared to 2015.

Antiviral treatment for CHB is associated with a substantial reduction in mortality from adverse outcomes, with studies showing a reduction

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in hepatocellular carcinoma (HCC) risk of at least 50% within five years.[7,8] Treatment is subsidised in Australia through the Pharmaceutical Benefits Scheme (PBS).

In Australia approximately 1% of the population is living with chronic hepatitis B (CHB),[4] with people born overseas and Aboriginal and Torres Strait Islander peoples representing three quarters of those affected.[1] Historically, through ongoing migration, the number of Australians living with CHB has continued to increase.[4] Differences in overseas migration patterns (including age distribution and country of birth) affect the epidemiology and future projections of hepatitis B prevalence across jurisdictions. For example, in jurisdictions such as New South Wales (NSW), Victoria (VIC) and the Australian Capital Territory (ACT), people born overseas make up approximately 70% of those affected, whereas in Northern Territory (NT) Aboriginal and Torres Strait Islander people represent approximately 70% of those affected.[1] These population differences have impacts in natural history and future projections, particularly in relation to variations in vaccine coverage and demographic distribution.[9]

The response to the National Strategy's call for action has differed among jurisdictions, however, there is not yet a nationally coordinated program to improve hepatitis B care engagement as a cancer prevention strategy. Jurisdictional estimates of key strategic indicators are important for assessing inequities in burden of disease, access to treatment and care, and associated health outcomes. We have previously shown the very wide disparities in burden of CHB, uptake of treatment and care and liver cancer incidence across Australia.[1,10] However, there is a need to assess by jurisdiction, the potential impacts on CHB attributable mortality under current levels of treatment and care access and under future projections of varying scenarios of uptake.

In this article we present estimates of the 2020 cascade of care for CHB by jurisdiction in Australia and discuss key disparities and trends among jurisdictions since 2011. We compare the impact historical treatment uptake has had on reducing mortality attributable to CHB among jurisdictions and highlight potential future impacts of increasing treatment uptake. In addition, we present scenario-based modelling of future treatment uptake and quantify the impact this has on estimated future mortality in each jurisdiction. Due to the considerable population and health system impacts in Australia from the COVID-19 pandemic, which began in 2020, this analysis also provides preliminary assessment of the effects of this and variations by jurisdiction.

Methods

Mathematical model

The number of people living with CHB in Australia and in each state and territory was derived from an existing mathematical model for the natural history of hepatitis B in the Australian population from 1970-2050.[4] The model is a dynamic, age-structured deterministic mathematical model that incorporates births,[11] migration,[12] deaths[13] and ageing over time, with demographic data sourced from the Australian Bureau of Statistics (ABS). To appropriately represent the transmission, epidemiology and progression of hepatitis B, the model incorporates nine exclusive health states, representing the natural history of hepatitis B; susceptible, immune (through vaccination), acute infection, phases of chronic hepatitis B (immune tolerant, immune clearance, immune control, immune escape), decompensated cirrhosis (DC), HCC and resolved infection. Each health state is differentiated into no-cirrhosis and cirrhosis classifications and stratified by whether antiviral treatment is being received, resulting in 21 health states (Supplementary Figure S3). Each health state is divided into 18 age categories (five-year categories for those aged 0-84 years plus an 85+ group). A detailed description of the model has previously been published.[4]

Migration

Previous iterations of the model used estimates of migration exclusively from the ABS, however as these projections do not incorporate the impact of the COVID-19 pandemic we used modelled future population estimates from Wilson and colleagues[14] for 2021-2050. Wilson et al. derived three scenarios including: (i) *short impact,* where economic and demographic trends bounce back strongly over 2–3 years; (ii) *moderate impact,* where the effects are felt for about five years; and (iii) *longer impact,* with an extended economic depression of up to a decade.[14] For the modelled future projections presented here we used the *moderate impact* scenario. The proportion of future net overseas migration (NOM) entering each jurisdiction was drawn from ABS projections.[15]

Prevalence of CHB

Prevalence of CHB is derived by dividing the modelled estimated number of people living with CHB in each jurisdiction by the ABS estimated resident population (ERP).[16]

Proportion diagnosed

The proportion of people living with CHB who had been diagnosed was derived using the modeled number of people who have ever lived with CHB in Australia, including those who subsequently died, as the denominator and the cumulative number of notifications of unspecified (assumed chronic) hepatitis B from 1971 to 2020 as the numerator. Notification data were sourced from the National Notifiable Diseases Surveillance (NNDSS) system.[17] Further information on this method can be found in previously published work.[4]

Treatment

Treatment data for CHB represents the number of individuals prescribed any drug listed on the PBS[18] for the treatment of CHB (adefovir, entecavir, lamivudine, pegylated interferon alfa-2a, telbivudine and tenofovir) between 2000 and 2020. This was divided by the modelled number of people living with CHB each year to derive treatment uptake.

Monitoring and care

Monitoring was defined as receiving a viral load test in a given calendar year, as one viral load test per year is recommended for those not receiving treatment to monitor disease activity and assess the need for treatment .[19] This was obtained from Medicare Benefits Schedule (MBS) records of individuals who received a viral load test item in a given calendar year but were not prescribed treatment for CHB in the prior 12 months. This number was then combined with the number of individuals who were receiving treatment, to generate the number in care. This definition has been widely used in HBV cascade of care analyses and is the basis for national strategy indicators.[1]

Treatment and monitoring by jurisdiction is based on the postcode of residence at the time of the first hepatitis B treatment script of a given year.

These data do not include services that were provided outside the Medicare system, such as those paid privately by individual patients, or subsidised by state government services. However, previous analyses and comparison with other source data demonstrate that the vast majority of CHB testing and treatment services are provided through Medicare.[10]

Mortality and impact of treatment on future deaths

The estimated number of deaths attributable to CHB is a model derived output. For further methodological details see McCulloch et al.[4] Estimates of CHB attributable mortality per 100,000 population were derived using the estimated resident population for each jurisdiction.[16]

Two treatment uptake scenarios were modelled for each jurisdiction to consider the impact of future treatment uptake on future mortality: (i) Current trends scenario: Assumes the number receiving treatment in 2021 and 2022 remain the same as 2020, due to the impact of COVID-19. From 2023 onwards the average annual increase follows 2016–2019 trends for that jurisdiction; and (ii) WHO 2030 scenario: Assumes the number receiving treatment in 2021 and 2022 remain the same as in 2020, but from 2023 onwards treatment uptake was modelled at the level of increase required to meet the WHO GHSS 2030 treatment target (80% of eligible people receiving treatment; estimated to be 25% based on national modelling of treatment eligibility.[4,20] Here the proportion of people eligible for treatment is estimated for each jurisdiction separately, incorporating variation in the phases of CHB and the proportion of people living with cirrhosis.

Plausible ranges of modelled estimates

The plausible ranges reported were derived by allowing the force of infection, migrant CHB and cirrhosis prevalence, CHB mortality, and other disease transition estimates to vary within plausible distributions (for further details see McCulloch et al.[4]). In addition, for modelled future projection estimates, the total number of migrants entering the Australian population varied was according to the short, moderate and long impact scenarios.[14] This was achieved using Latin-hypercube sampling (LHS), as described by Marino et al.[21] The mathematical model for each jurisdiction was run using 100 different combinations of these varied parameters, and plausible ranges were determined by the 10th and 90th percentiles of simulations.

Results

Prevalence

The proportion of the total population living with CHB in 2020 varied substantially across Australian jurisdictions, with the highest prevalence in NT (1.8%) and the lowest in Tasmania (TAS) (0.28%), while the national average was 0.87%. Among other jurisdictions, VIC (1.0%) and NSW (1.0%) had estimated prevalence above the national average, Western Australia (WA) (0.89%) was equivalent, and ACT (0.74%), Queensland (QLD) (0.65%) and South Australia (SA) (0.65%) were below (Supplementary Table S1, **Figure 1**). The prevalence of CHB in Australia increased stably between 2011 and 2019, from 0.83% to 0.88%, before reducing to 0.87% in 2020. This increase during 2011-2019 also occurred in all jurisdictions but was more pronounced in SA (0.56% to 0.65%) and WA (0.81% to 0.89%). Figure 1A presents CHB prevalence trends according to state and territory from 2011-2020. The estimated number of people living with CHB declined for the first time in 2020, which was most noticeable in the larger jurisdictions (NSW and VIC, Figure 1A). This was also reflected in a decline in the prevalence in all jurisdictions except SA and TAS between 2019 and 2020.

Diagnosis

Since 2011 modest increases in the estimated proportion of people living with CHB who have been diagnosed have been observed in all jurisdictions (Figure 1B). The estimated proportion diagnosed in 2020 varied greatly between jurisdictions, with NSW (79.2%, [62,982/79,522]) and QLD (73.4%, [24,947/33,987]) having the highest. Estimates for all other states and territories were below the national average of 73.0% (162,469/222,559), with higher proportions in NT (70.0%, [3,177/4,538]), ACT (69.3%, [2,226/3,211]), and SA (67.2%, [7,733/11,507]), compared to VIC (63.0%, [40,719/64,632]), WA (57.3%, [13,551/23,649]) and TAS (53.1%, [804/1,513]). The overall proportion diagnosed increased from 65.4% to 73.0% in Australia since 2011, however this trend varied by jurisdiction. The greatest increase was seen in NT (57.0% to 70.0%) while the smallest increase occurred in QLD (70.3% to 73.4%), which had a higher than average baseline, and in SA (62.6% to 67.2%). The remaining jurisdictions had a proportional change similar to the national average (Figure 1B).

Engagement in care

The proportion of people living with CHB who were engaged in care also varied between state and territories (Figure 1C), and in 2020 NSW (27.0%, [21,471/79,522]), ACT (25.7%, [826/3,211]), NT (24.8%, [1,126/4,538]) and VIC (24.4%, [15,771/64,632]) had the highest uptake (Figure 1C). Despite some fluctuations, the proportion of people living with CHB who are engaged into care has been increasing in most states and territories since 2011. The increase was more pronounced in NT (22% since 2011) and ACT (16%) compared to 6-12% in all other jurisdictions. These changes brought NT and ACT from well below the national average for care uptake in 2011 to levels similar or above the national average in 2020. However, SA, TAS and NT have seen a reduction in the number of individuals who have received a monitoring test since 2016, 2017 and 2018 respectively. In addition, NSW and VIC saw a decrease in 2020 compared to 2019 (Figure 1C), which drove a decrease at the national level (from 23.2% to 22.6%).

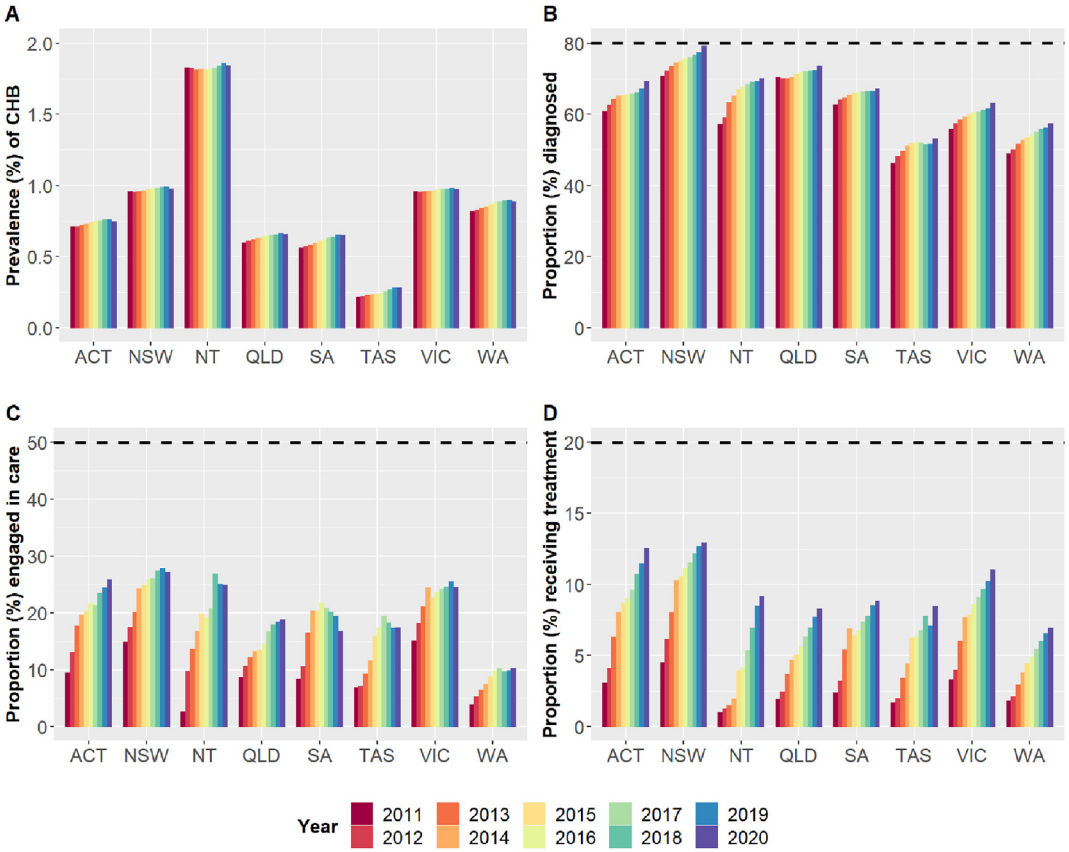
Treatment

Treatment uptake was highest in NSW (12.9%, [10,269/79,522]), ACT (12.5%, [402/3,211]) and VIC (11.0%, [7,112/64,632]) in 2020 (Figure 1D), while all other states and territories were below the national average of 10.7% (23,787/222,559) (NT (9.1%, [414/4,538]), SA (8.8%, [1,013/11,507]), TAS (8.5%[128/1,513]), QLD (8.3%, [2,804/33,987]) and WA (6.9%, [1,631/23,649])). Treatment uptake increased the most substantially of all indicators, more than tripling between 2011 (3.3%) and 2020 (10.7%). This trend was seen in all jurisdictions but was most pronounced in those with the lowest baseline treatment uptake, NT (from 1.2% to 9.1%) and TAS (1.6% to 8.5%).

Mortality

Reflecting the higher prevalence of CHB, NT was estimated to have the highest rate of mortality attributable to CHB, at 4.06 per 100,000 population in 2020, which is more than double the national average

Figure 1: Historical trends in the cascade of care for chronic hepatitis B among Australian jurisdictions. A – Estimated prevalence of CHB by jurisdiction 2011 to 2020. B – Estimated proportion of people living with CHB who have been diagnosed by jurisdiction 2011 to 2020. C – Estimated proportion of people living with CHB who were engaged in care by jurisdiction 2011 to 2020. D – Estimated proportion of people living with CHB who were receiving antiviral treatment by jurisdiction 2011 to 2020. Dashed lines indicate the 2022 National Strategy Targets. Data used to generate Figures 1A – 1D are provided in supporting information Tables S3 – S6.



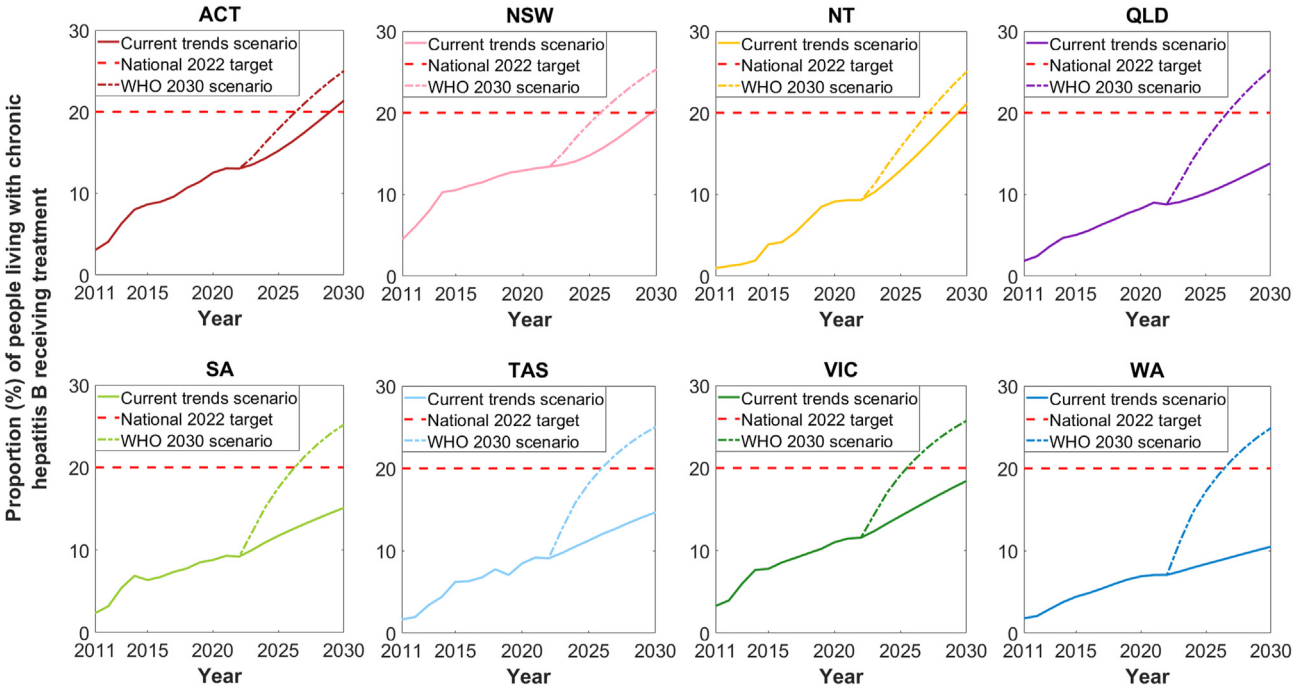
of 1.42 per 100,000 population (Table 1). In the remaining jurisdictions, attributable mortality rate ranged between 1.76 per 100,000 in WA and 0.55 per 100,000 in TAS. Since 2011, all jurisdictions have had a reduction in estimated mortality, with the highest reduction seen in ACT, VIC and NSW with reductions of 51.3%, 43.7% and 42.6% respectively (Table 1).

Under the current trends treatment scenario, no jurisdiction is projected to reach the 2022 National Strategy treatment target of 20% uptake. ACT, NT and NSW are projected to reach the 20% target by 2030, with the proportion of people living with CHB receiving treatment in 2030 estimated at 21.4%, 21.2% and 20.5% respectively (**Figure 2**).

Table 1: Historical and future modelled estimates of the proportion of people living with CHB receiving antiviral treatment and the estimated total mortality attributable to CHB per 100,000 population. The 2030 estimates correspond to two future treatment uptake scenarios (see also Figure 2).

State/ Territory	2011		2020		2030 (Current trends)		2030 (WHO 2030)	
	Proportion receiving treatment	Mortality per 100k population	Proportion receiving treatment	Mortality per 100k population	Proportion receiving treatment	Mortality per 100k population	Proportion receiving treatment	Mortality per 100k population
ACT	3.1%	1.90	12.5%	0.93	21.4%	0.83	25.0%	0.83
NSW	4.5%	2.54	12.9%	1.46	20.5%	1.27	25.3%	1.09
NT	1.0%	6.05	9.1%	4.06	21.2%	2.20	25.1%	1.83
QLD	1.9%	1.63	8.3%	1.08	13.8%	0.96	25.3%	0.67
SA	2.4%	1.71	8.8%	1.13	15.1%	0.95	25.2%	0.73
TAS	1.6%	0.78	8.5%	0.55	14.7%	0.19	25.0%	0.19
VIC	3.3%	2.80	11.0%	1.58	18.4%	1.24	25.7%	1.00
WA	1.8%	2.29	6.9%	1.76	10.5%	1.65	24.9%	0.97
National Av.	3.3%	2.32	10.7%	1.42	17.3%	1.20	25.4%	0.93

Figure 2: Estimated proportion of people living with chronic hepatitis B in Australia receiving treatment by jurisdiction 2011 - 2030, Current trends vs WHO 2030 future uptake scenarios.



Even under the more optimistic WHO 2030 treatment scenario, which projects that treatment increases to reach 25% of people living with CHB receiving treatment in 2030, the 20% target would not be met nationally until 2026, and in some jurisdictions not until 2027 (ACT, QLD, SA, WA) or 2028 (NT). Meeting this target would require between a 1.5-fold (NSW) and three-fold (WA) increase in treatment access from the end of 2022 onwards (Figure 2).

Future treatment impact on CHB mortality

It is estimated that the number deaths due to CHB decreased during 2011-2020 in all jurisdictions (Supplementary Figure S2), although due to the low absolute numbers of people living with CHB, the number of estimated deaths (<15) in NT, TAS and ACT should be interpreted with caution. A decline of 29.9% is estimated to have occurred at the national level, and the proportional decline was greatest in NSW (42.9%) and smallest in WA (13.0%). The estimated overall rate of CHB deaths was highest in NT (4.06 per 100,000), more than double the next highest jurisdiction (WA, 1.76 per 100,000).

It is projected that under the current treatment trend scenario there will be a plateau or increase in the number of deaths attributable to CHB between 2021 and 2024 in all jurisdictions except NT (Figure 2). Under this scenario the national projected change in crude mortality between 2020 and 2030 would be a 7.7% decline.

Alternatively, under the WHO 2030 target treatment scenario estimated mortality would continue to decline nationally from 2021 onwards, as well as in most jurisdictions (Supplementary Figure S2). Under this scenario, mortality would reduce by 36.0% Australia-wide between 2020 and 2030, with the largest proportional decreases occurring in SA (43.5%) and WA (42.0%). However, this scenario requires substantial increases in treatment uptake from 2020 onwards (Figure 2).

Discussion

This analysis shows that there are substantial differences between jurisdictions in baseline estimates, subsequent trends and projected progress in uptake of CHB treatment and care and impacts on mortality according to state and territory. In order to support the public health response to hepatitis B in Australia, it is important to highlight jurisdictions which have made substantial improvements and progress, as well as those in need of the most intervention to meet strategic goals. No jurisdiction has yet reached the 2022 National Strategy target of 80% of people living with CHB diagnosed, however NSW was very close by 2020, while jurisdictions such as TAS and WA remain below 60%. Temporal trends in diagnosis since 2011 have also varied, with some jurisdictions such as QLD and SA showing minimal increases (<5%), while others such as NT have seen an increase of approximately 13%.

CHB treatment uptake has increased over time in all states and territories, however, the rate of increase has been disparate. Care uptake in jurisdictions such as ACT and NT has shifted from being below, to above the national average between 2011 and 2020. The highest uptake of care and treatment is seen in NSW and VIC, resulting in a greater projected decline in CHB mortality. However, as these are the most populous states, they are also home to the greatest absolute numbers of individuals with CHB not receiving guideline-based care.

NSW and VIC also experienced higher incidence of COVID-19 during 2020[22] and declines in viral hepatitis testing, diagnosis, monitoring and treatment have occurred.[23] Assessment of ongoing trends, particularly mortality, beyond 2020 will be crucial to identify the impact of these shifts and assess if the problem of deferred care for CHB has been addressed.

Given the inclusion of treatment in the composite care indicator, these results are correlated, however, the jurisdictional patterns do vary. The plateau in treatment uptake from 2014 to 2015, following a relatively rapid increase observed in most jurisdictions, differs significantly in NT, which has instead seen substantial increases in treatment in recent years. NT has been the focus of comprehensive efforts and funding aimed at improving care engagement, particularly for Aboriginal and Torres Strait Islander people, including initiatives such as improving health record management, linkage to care, and generation and distribution of culturally appropriate resources for Indigenous communities.[24-26] These efforts appear to have resulted in substantial increases in treatment and care uptake, demonstrating the importance of comprehensive programmatic responses, which are designed and delivered in partnership with the communities in focus. It is critical that lessons are learned from initiatives within those jurisdictions that have seen improvements in the last decade and consider their adaptation and adoption in other settings.

The greatest disparity in the cascade of care between jurisdictions was in treatment uptake, in which the highest uptake jurisdiction (NSW) had treatment uptake nearly double that of the lowest uptake jurisdiction (WA). However in all jurisdictions, the largest gap in the cascade of care in terms of numbers affected occurred between diagnosis and engagement in guideline-based care. People who had been diagnosed but were not engaged in care represent between 35% and 55% of the total population with CHB, depending on the jurisdiction. However in some jurisdictions, such as WA and TAS, the proportion undiagnosed was similar to the proportion diagnosed but not in care; this contrasted to NSW and QLD, where the proportion diagnosed but not in care was more than double the proportion undiagnosed. These variations highlight the need for tailored strategies to meet nationally agreed treatment and care targets in each jurisdiction, depending on where along the cascade of care most Australians living with CHB are being failed in our current response.

The findings here reflect those observed globally and across regions, where the majority of people living with hepatitis B are not engaged in care or treatment.[27] Country-specific population-level data are often lacking regarding uptake of hepatitis B diagnosis and treatment, with the majority of 21 respondents to a European Union survey indicating data were not available for these indicators.[28] A population-based analysis available from Canada found similar proportions as in this study (18.4% of people estimated to be living with CHB had been engaged in care).[29] The issue of lack of engagement in hepatitis B diagnosis, care and treatment is an issue well beyond Australia, and reflects diverse and complex barriers at many levels.

Demonstrated reasons for lack of engagement in CHB testing, care and treatment include time pressures, workflow issues and awareness in general practice; lack of clarity regarding testing indications; stigma and discrimination in health care settings; and knowledge and health literacy among commonly affected communities.[30-32] These factors are likely to vary according to jurisdiction; for example, those regions where the average level of awareness among health care providers of testing indications is higher may result in greater proportion diagnosed, while care engagement still lags due to systemic issues. One proposed intervention which could be applied systematically to enhance engagement in care is the systematic follow-up of notified cases to reduce the gap in engagement in care, as has been explored for hepatitis C in Australia.[33]

Under current treatment trends, it is estimated that despite previous decreases, most jurisdictions are projected to experience an increase in the number of deaths attributable to CHB. This is because increases in treatment uptake are slowing, partly due to the COVID-19 pandemic, combined with an ageing population with CHB. Improvements in CHB treatment uptake during 2022 could significantly mitigate the projected increases in preventable deaths. Differing trends in mortality across jurisdictions reflect varying treatment uptake and demonstrate the gains that could be realised by addressing inequalities in access to effective care for CHB. If treatment uptake could be increased to the level of the WHO 2030 targets, mortality reductions of even greater magnitude would be achieved across Australia.

This study represents a comprehensive assessment of jurisdictional variation in indicators relating to CHB across Australia, and has incorporated migration trends, cultural diversity, immunisation coverage, age distribution, and other factors. However, the uncertainty imposed by COVID-19 on many of these variables is an unavoidable limitation to the future projections presented. Most people living with CHB in Australia were born overseas and acquired hepatitis B in childhood prior to migration, and therefore changes in Australia's migrant population will substantially affect projections. Given the recent instability in migration patterns due to the COVID-19 pandemic,[34] future estimates of the number of people living with CHB are necessarily uncertain.

Some data sources have unavoidable limitations, such as the notifications used to generate diagnosis estimates. Although cases can be de-duplicated within jurisdictions, these processes vary and aggregate reporting at the national level is de-identified, preventing the removal of duplicated cases notified in multiple jurisdictions. Previous analysis of hepatitis C notifications identified substantial duplicate cases[35]; studies underway to link hepatitis B notifications across Australia will reduce the total number and proportion diagnosed, with the impact likely to vary between jurisdictions.

Medicare data are the most complete source of numerator data regarding treatment and monitoring, however, necessarily exclude those not eligible for coverage, such as temporary residents not covered by reciprocal health care systems and, for the MBS, those resident in correctional facilities. It has been previously estimated that up to 10% of people living with CHB in Australia may be ineligible for Medicare.[36] As these individuals are disproportionately younger and less likely to require treatment, it is unlikely to have a substantial impact on estimates of treatment uptake among those for whom it is indicated.

The decreasing trends in the number of individuals receiving monitoring tests in SA, TAS and NT may relate to these limitations, as anomalies in the expected number of viral load tests performed in SA and WA have been observed previously, hypothesized to be due to hepatitis B viral load tests being performed in state-supported services without seeking rebates under the MBS.[1] These limitations highlight the importance of assessments of progress in CHB that focus on varying cascade indicators drawn from a diversity of data sources, as represented by our analysis.

The National Hepatitis B Strategy[5] provides a framework to guide the response to hepatitis B in all Australian jurisdictions, including specific goals and indicators. Efficiently and rapidly improving the cascade of care will require different approaches to address locally identified

gaps and priorities and it is unlikely that a 'one size fits all' approach will be sufficient. Comprehensive programmatic responses developed in partnership with affected communities such as those deployed in the NT have been shown to improve the cascade of care, even in a setting with a range of other health priorities and with geographic challenges to service delivery.[1] Elimination of viral hepatitis as a public health threat by 2030 will not be achieved in Australia unless we learn the lessons of what has worked and invest in making the benefits of these interventions available to all Australians living with CHB, no matter where they live.

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Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anzjph.2022.100011.