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Screening for Hepatitis B Virus Infection in Pregnant Women: An Updated Systematic Review for the U.S. Preventive Services Task Force

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Structured Abstract

Objective: To update the 2009 U.S. Preventive Services Task Force (USPSTF) "A" recommendation on screening for hepatitis B virus (HBV) infection in pregnancy, we systematically reviewed evidence on the benefits (Key Question [KQ] 1) and harms (KQ 2) of universal screening programs for HBV infection in pregnant women, and the benefits (KQ 3) and harms (KQ 4) of case management programs to prevent perinatal transmission.

Data Sources: We conducted a literature search of MEDLINE, PubMed Publisher-Supplied Records, the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, the Cumulative Index for Nursing and Allied Health Literature, Embase, and PsycInfo from January 1, 1986 to May 3, 2018.

Study Selection: We screened 5,688 titles and abstracts and 499 full-text articles to identify eligible studies based on a priori inclusion and exclusion criteria.

Data Analysis: Two investigators independently appraised any article that met inclusion criteria using design-specific criteria. We abstracted and narratively synthesized included study data.

Results: No studies were identified for KQs 1 or 2 that addressed either the effects of screening programs on perinatal HBV transmission or the potential harms of screening. Two fair-quality observational studies that compared perinatal transmission rates over time were included for KQ 3. One study reported outcomes of case management for infants with data reported to the national Perinatal Hepatitis B Prevention Program (PHBPP), administered by the Centers for Disease Control and Prevention (CDC). In the PHBPP, 155,081 infants born to HBV-positive women were identified for case management from 1994 to 2008; perinatal transmission outcomes were available for infants born from 1999 to 2008 who received serologic testing (N=55,362). A statistically significant decline in the perinatal transmission rate was observed; perinatal transmission was reported for 1.9 percent of case-managed infants in 1999 and 0.8 percent in 2008 ($p<0.001$). Over the study period, the number of infants born to HBV-positive women increased in the United States, and an increasing proportion of infants born to HBV-positive women were enrolled in the PHBPP for case management ($p<0.001$). Serologic testing within 24 months of birth also increased across the time period ($p=0.001$). The second study reported outcomes of case management for infants born to HBV-positive women in a large regional health care organization in the United States. The health system case management program reported on 4,446 infants born to HBV-positive women from 1997 to 2010. Over this period, 85 percent of infants were tested for HBV, and a decreasing trend in perinatal transmission was reported (incident rate ratio, 0.90 [95% confidence interval, 0.82 to 1.00]). Overall rates of perinatal transmission were very low (25 of 3,353 of infants tested [0.75%]). More than 97 percent of case-managed infants received HBV vaccination and hepatitis B immune globulin within 12 hours of birth. No studies were identified for KQ 4 to assess potential harms of case management.

Limitations: Our review was narrowly focused on evidence of the effectiveness of screening or case management on prevention of perinatal transmission in contexts where prenatal screening and universal vaccination for HBV at birth are established practice. The included observational

studies' findings on declining perinatal transmission trends could be influenced by secular changes in other public health activities (e.g., universal HBV vaccination) or by improvements within case management program implementation and interventions (e.g., antiviral medication). Changes in data collection and reporting methods used in the studies could also introduce bias.

Conclusions: Perinatal transmission would be observed in more than one third of infants born to HBV-positive mothers in the absence of prophylaxis. Very low and declining rates of perinatal transmission have been documented for infants in case management programs that track and coordinate the delivery of preventive interventions. Screening for HBV infection in pregnancy is standard prenatal care practice in the United States and identifies women and infants eligible for effective case management for effective interventions to prevent perinatal transmission.

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Chapter 1. Introduction

Condition Background

Condition Definition

Hepatitis B is a viral infection of the liver caused by the hepatitis B virus (HBV). The presence of the hepatitis B surface antigen (HBsAg+) indicates an acute (i.e., <6 months) or chronic HBV infection. Hepatitis B e-antigen (HBeAg+) positivity is associated with active viral replication, high HBV DNA viral load, and higher infectivity. In the absence of HBsAg, the existence of HBV core antibodies may indicate that a person was previously infected with HBV. The presence of HBV surface antibodies indicates that the person has achieved immunity to HBV following an infection or from vaccination. HBV is transmitted through contact with the blood or bodily fluids of an infected person. In countries with high HBV prevalence, perinatal transmission of infection from mother to neonate at the time of delivery is common.[1] Consequently, adults living with HBV in the United States who were born in high-prevalence countries often contracted the infection in childhood.[2] New cases of HBV infection among adults in the United States are primarily transmitted through sexual intercourse and intravenous drug use. For children born in the United States, the primary source of infection is vertical transmission from an infected mother either in utero or peripartum, with the greatest risk occurring when the newborn is exposed to vaginal blood or secretions at delivery.[3]

Disease Prevalence and Burden of Disease

HBV remains an important global public health concern despite the existence of an effective vaccine and antiviral agents. Globally, in 2015, chronic HBV infection (measured by seroprevalence of HBsAg) was estimated to affect 3.5 percent of the population (approximately 257 million persons), including an estimated 65 million women of childbearing age. The highest prevalence rates reported by the World Health Organization (WHO) occur in the African (6.1%) and Western Pacific regions (6.2%), with recent modeling estimates finding higher prevalence for specific subregions.[4] Based on population, the largest number of persons living with chronic HBV infection are in the Western Pacific region and the smallest number are in the Americas.[4]

Data from the National Health and Nutrition Examination Survey (NHANES) from 2007 to 2012 estimate that 10.8 million persons in the United States had ever been infected with HBV.[5] It is estimated that 847,000 persons (0.3% of the population) were living with chronic infection in 2011 to 2012.[5] However, NHANES may underestimate the prevalence of chronic infections due to undersampling in key subgroups (i.e., persons born in high-prevalence countries, living in institutions, or who are incarcerated).[2, 6] Estimates attempting to account for this underestimation suggest there may be more than 2 million persons living with chronic HBV infection in the United States.[2, 6] The highest rates of chronic HBV infection were identified in non-Hispanic Asian (3.1%) and non-Hispanic black (0.6%) populations.[5] Foreign-born Americans have a 10-fold higher prevalence than persons born in the United States (1.1% vs. 0.1%). The prevalence in women is reported to be lower than in men (0.2% vs. 0.4%).[5]

Beginning in 1991, the United States implemented a public health strategy to control HBV including: screening all pregnant women for HBV infection, universal vaccination of all infants at birth, routine vaccination of previously unvaccinated children, and vaccination of adults at high risk for HBV infection.[7] Over time, immunity has increased in the United States from 21.7 percent in 1999 to 2006 to 25.1 percent in 2007 to 2012. Rates of immunity are highest among younger persons, with 44.4 percent immunity in persons ages 6 to 19 years compared with 8.7 percent immunity in those age 50 years or older, based on NHANES data from 2007 to 2012. However, while rates of immunity in older persons have increased over time, the rates of immunity in children ages 6 to 19 years have significantly decreased from the previously recorded rate of 56.8 percent in the years 1999 to 2006.[5]

According to data from the Nationwide Inpatient Sample from 1998 to 2011, the prevalence of maternal HBV infection was 85.8 cases per 100,000 deliveries (0.09% of liveborn singleton deliveries in the United States).[8] Rates of maternal HBV infection have shown an annual increase of 5.5 percent since 1998 and have increased among nearly every population subgroup, especially among women age 30 years and older. Older maternal age was significantly associated with a higher rate of HBV infection, with mothers age 30 years and older 2.3 times more likely than teenage mothers to be infected, likely due to the higher rates of vaccination among younger women of childbearing age. Non-Hispanic black and Asian women were estimated to have a 5- and 12-fold increased odds of HBV infection, respectively.[8] According to data from the National Health Interview Survey from 2013 to 2015, the greatest risk indicators for HBV infection among women ages 18 to 44 years were lower education, higher poverty levels, and lack of insurance coverage.[9] One factor contributing to the rise in rates is increasing immigration of foreign-born women from areas with a higher prevalence of HBV, particularly from Asian countries.[10] The majority of cases of HBV infection in the United States are among persons who emigrated from endemic regions, were born to immigrant parents, or were exposed through close household contact with these HBV-positive persons.[11-13] Some of the observed increase in HBV infection among pregnant women also may be attributed to increased case finding with the advent of screening for HBV infection in pregnant women.[8]

Natural History

An estimated 70 percent of healthy adults with acute HBV infection are asymptomatic, and the remainder have symptoms of liver disease (e.g., abdominal pain, jaundice).[14] Fewer than 1.5% of acute HBV infections are fatal.[7] The progression to chronic HBV infection (infection beyond 6 months) varies dramatically depending on age at the time of initial infection. Chronic infections develop in 80 to 90 percent of infants (age <1 year) infected with HBV, in approximately 25 to 30 percent of acute infections before age 6 years, and in less than 1 to 12 percent of acutely infected older children or adults.[7, 11] The remaining individuals generally resolve their HBV infection without sequelae and develop immunity. Chronic HBV infection can result in serious long-term health complications such as chronic hepatitis, cirrhosis, and hepatocellular carcinoma. Up to 25 percent of persons who become chronically infected in childhood and 15 percent of persons infected in adulthood will die prematurely from cirrhosis or liver cancer.[7]

The primary well-established risk of harm associated with maternal HBV infection is perinatal transmission to the infant, occurring most commonly through the process of delivery (caesarean

or vaginal delivery). Higher levels of maternal HBV DNA occurring with active viral replication are strongly predictive of perinatal transmission; among HBeAg- mothers, the perinatal transmission risk is approximately 30 percent, but among HBeAg+ mothers, the risk rises to 85 percent.[7] However, viral replication is present in some HBeAg- women, and evidence suggests that viral load, rather than HBeAg marker status, may be most indicative of the risk of transmission.[15, 16]

Rationale for HBV Screening in Pregnancy and Interventions to Prevent Perinatal Transmission and Current Clinical Practice

Prevention of perinatal transmission of HBV infection hinges upon the timely administration of prophylaxis, particularly for infants whose mothers are HBV positive.[17] HBV screening has very high accuracy (sensitivity and specificity >98%), as established in studies by the CDC, U.S. Food and Drug Administration, and WHO in the 1980s and 1990s, when the tests were first developed.[18, 19] Routine HBV screening in prenatal care is intended to ensure preventive interventions, including those recommended for all newborns regardless of HBV status (i.e., HBV vaccination). In the United States, screening facilitates entry into a national case-management program tasked with ensuring and documenting the delivery of evidence-based prophylaxis for HBV-exposed infants.

Beginning in 1990, the PHBPP, funded by the CDC, was developed to identify HBV-positive pregnant women and ensure that their infants receive timely, evidence-based postexposure prophylaxis.[10] The Public Health Services Act, Section 317, mandates the Immunization Grants Program and the Prevention and Public Health Funds, which support the PHBPP in 64 jurisdictions: 50 states, six cities, five territories, and three freely-associated island nations.[20, 21] Grant recipients are required to submit yearly reports that include specific information on the number of infants born to HBV-positive women identified by the program, timing of prophylactic interventions, serologic testing, and loss to followup.[10] The CDC Advisory Committee on Immunization Practices (ACIP) recommends that all HBV-positive pregnant women be referred to their jurisdiction's PHBPP for case management to ensure their infants receive timely prophylaxis and followup.[7]

Since its licensure in 1981, the HBV vaccination remains the most effective measure to control and prevent HBV infection, perinatal transmission, and long-term sequelae.[22, 23] ACIP first recommended universal HBV vaccination for infants in 1991.[24] Systematic reviews and clinical trials have consistently demonstrated high seroprotection rates among infants and healthy adults age 40 years or younger who have received the complete vaccine series.[22, 25-27] Prior to the development of the HBV vaccination, HBIG administered within 12 hours of delivery was shown to be effective for reducing perinatal transmission by providing passive immunity and temporary protection (i.e., 3 to 6 months) from HBV infection.[3] The most recent recommendation (2018) is for all infants to receive their first dose of the HBV vaccination within 24 hours, and for infants born to HBV-positive mothers to receive infant vaccination and HBIG administration within 12 hours of birth.[7]

Since the introduction of standard guidelines for HBV postexposure prophylaxis in 1991, cases of chronic HBV infection in infants have declined by 75 percent; however, the CDC estimates that between 2000 and 2009 there were 800 to 1,000 infants (3.8% of babies born to HBV-positive mothers) infected each year in the United States.[10] Most of these cases occurred among infants of HBeAg+ women with high viral loads, with some infections theorized to occur in utero.[5]

Since 2015, the American Association for the Study of Liver Diseases has recommended the use of antiviral therapy to reduce perinatal HBV transmission in women with a high viral load (>200,000 IU/mL).[11, 28] This recommendation was incorporated into the CDC/ACIP guidance in 2018.[7]

While screening for HBV infection in pregnant women has been universally recommended for decades, it is not fully implemented in prenatal care services. As of December 2013, 26 states required all pregnant women to be screened for HBV infection, with 19 of these states mandating that screening occur at the first prenatal visit or shortly thereafter.[29] However, not all providers are aware of these legal requirements or the fact that HBV is a reportable infection.[30] Based on medical claims records from 2013 to 2014, 88 percent of commercially-insured women received HBV testing during pregnancy, with 60 percent tested during the first trimester; however, rates were lower for women enrolled in Medicaid, with 84 percent tested, but only 39 percent during the first trimester.[31] In addition, universal vaccination of all infants within the first 24 hours is recommended, but in 2016, only 71 percent of all infants born in the United States received their first HBV vaccination within 3 days of birth, likely owing to patient and health system variation in adherence to recommendations. Due to the incomplete vaccination coverage at birth, in 2016 ACIP removed previously permissive language that had allowed providers to consider delaying the birth dose, and in 2017, receipt of HBV vaccination at birth increased to 74%.[32] In 2017, 91 percent of U.S.-born children were fully immunized (i.e., received all three doses) by age 3 years.[32, 33]

Rationale and Supporting Evidence for Previous USPSTF Recommendations

No randomized trials of screening effectiveness for reducing HBV vertical transmission or health outcomes have been identified in prior USPSTF reviews. The original 1996 "A" recommendation to screen all pregnant women for HBV infection was based on reports showing that screening tests for HBV infection have high accuracy, and evidence from controlled trials and observational studies suggesting that neonatal vaccination and HBIG are effective for preventing perinatal transmission. The rationale for universal screening was based on evidence that identifiable risk factors (e.g., multiple sexual partners, exposure to human blood, contact with an infected person, travel to high-prevalence region) were present in only 35 to 65 percent of HBV-positive pregnant women.[34-39] In 2004 and again in 2009, the USPSTF reaffirmed its recommendation using brief evidence updates.[40, 41]

Since the original 1996 recommendation statement, updated reaffirmation reviews for the USPSTF have found little additional evidence on the effectiveness or harms of screening for and

treatment of HBV infection in pregnancy. No studies meeting inclusion criteria were identified, but limited observational evidence supporting the effectiveness of prophylaxis has been cited in reaffirmation reviews.[42-45] In 2009, no new trials of prenatal screening or newborn prophylaxis for HBV infection were identified, and a cited Cochrane review on HBV vaccination only included studies published prior to 1996.[46, 47] No previous reviews or new studies addressing the harms (e.g., consequences of a false-positive test result) were identified. No new evidence was found for the benefits or harms of HBV screening in pregnant women in either evidence update.[42, 46]

Recent reviews, including a network meta-analysis, support the preventive effectiveness of HBIG and HBV vaccination and, more recently, the prenatal use of antiviral medication.[25, 48-50] These reviews cite evidence limitations with regard to setting, sample size, and study protocols, and the need for further research. In particular, additional studies are needed on prenatal use of antiviral medication, which may further reduce perinatal transmission beyond the already low rates observed when HBV vaccination and HBIG are administered. A 2017 systematic review of comparative trials through August 2016 (n=599 pregnancies) demonstrated that tenofovir significantly reduced the risk of infant infection when combined with HBIG and HBV vaccination.[48] In the trials, tenofovir was administered in the second or third trimester among HBV-positive women with high viral loads (HBV DNA ≥200,000 IU/mL).[48] A 2016 systematic review of randomized and observational studies drew similar conclusions and reported no increased risk of adverse maternal or fetal outcomes (e.g., congenital malformation rate, prematurity rate, Apgar scores) associated with antiviral treatment.[49] Case management programs are guided by regular updates on evidence-based practices from ACIP and CDC for prevention of perinatal transmission. Accordingly, new guidelines in January 2018 recommended testing for viral load and treatment with antiviral therapy in addition to established HBV vaccination and HBIG practices.[7] Evidence in this area is still emerging. Most recently, a double-blind placebo-controlled trial (n=331) of tenofovir conducted in Thailand reported null findings for antiviral treatment coupled with HBIG and HBV vaccination, but the trial was underpowered given the low perinatal transmission rates (0 infections in the intervention group and 3 infections in the placebo group; p=0.12).[51] The trial also did not identify a statistical difference in the rate of adverse events for women or infants.

Chapter 2. Methods

Scope and Purpose

Screening for HBV infection in pregnancy has been a standard of care for more than 30 years, with an "A" recommendation from the USPSTF from its 1996 inception.[40, 41, 52] In the United States, the aim of screening for HBV infection in pregnancy is to identify women at risk of transmitting the infection to their infants to ensure the delivery of effective prophylactic interventions. In the United States, a federal CDC program, the PHBPP, funds, coordinates, and documents the delivery of effective interventions to prevent perinatal transmission through case management programs. Case management is also practiced in some private health care systems, where the care of women who screen positive for HBV is organized through patient tracking and evidence-based care protocols.[53] The scope of this review was designed to focus on overarching effectiveness and potential harms of screening and the effectiveness and harms of case management to prevent perinatal transmission.

The USPSTF has based previous recommendations for this topic on the following factors, and previous evidence updates have not identified new or contrary evidence: 1) screening for HBV infection in pregnant women is feasible in primary care and has high test accuracy, and 2) there are effective interventions to prevent vertical transmission of HBV infection that are rarely harmful.

Given the lack of formal trials evaluating the effectiveness of screening for HBV infection in pregnancy, the included Key Questions (KQs) were scoped to allow for observed population changes in HBV outcomes within geographic and historical comparisons of screening practices.

Given the recognized effectiveness of individual interventions (i.e., HBV vaccination, HBIG administration) and the available guidance on protocols for prophylaxis from CDC and ACIP, the KQs related to treatment guiding this review were focused on the effectiveness of case management programs. The focus on case management is motivated by the fact that it is the recommended intervention in the United States for all HBV-positive pregnant women. Thus, the KQs were intended to identify evidence on the effects of screening and case management on perinatal transmission of HBV infection and any associated harms.

Analytic Framework and KQs

In consultation with members of the USPSTF, we developed an analytic framework (**Figure 1**) and four KQs to guide the literature search, data abstraction, and data synthesis.

KQs

1. What are the observed population benefits of universal HBV screening programs during pregnancy?

2. What harms have been observed in programs of universal HBV screening during pregnancy?
3. What is the effectiveness of case management programs to prevent perinatal transmission among HBV-positive pregnant women?
4. What harms have been observed in case management programs to prevent perinatal transmission among HBV-positive pregnant women?

Data Sources and Searches

We conducted a literature search of MEDLINE, PubMed Publisher-Supplied Records, the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, the Cumulative Index for Nursing and Allied Health Literature, Embase, and PsycInfo from January 1, 1986 to May 3, 2018. The search start date was selected to coincide with the availability of the recombinant vaccine for HBV in the United States. We worked with a research librarian to develop our search strategy, which was peer reviewed by a second research librarian (**Appendix A**). We supplemented these searches by reviewing reference lists of recent reviews and primary studies. The searches were limited to articles published in English. We managed literature search results using Endnote® version X7 (Thomson Reuters, New York, NY).

Study Selection

We developed specific inclusion criteria to guide study selection (**Appendix A Table 1**). Two reviewers independently reviewed the titles and abstracts of all identified articles using DistillerSR (Evidence Partners, Ottawa, Canada). Two reviewers then independently evaluated the full text of all potentially relevant articles. We resolved differences in the abstract or full-text review by discussion. For all KQs, we included studies conducted in countries categorized as "high" or "very high" on the Human Development Index. Studies conducted in settings without universal birth HBV vaccination programs were excluded, since findings would not be applicable to the U.S. setting. For all KQs, we included randomized and nonrandomized controlled trials and large observational cohort studies, including ecologic studies and those with historical or geographical comparator controls. We excluded editorials, narrative reviews, and case studies.

For KQs 1 and 3, studies reporting on the perinatal transmission rates for screening and case management programs were considered for inclusion. For KQs 2 and 4, evidence on the potential harms of screening and case management programs, including potential psychological, psychosocial, or other negative consequences for pregnant women or their children, were considered for inclusion.

Quality Assessment and Data Abstraction and Synthesis

Two reviewers independently assessed the methodological quality of each included study using predefined criteria based on the Newcastle-Ottawa scale and the National Heart, Lung, and

Blood Institute's Quality Assessment Tool for Before-After (Pre-Post) Studies With No Control Group (**Appendix A Table 2**);[54, 55] disagreements were resolved by discussion. We extracted important study design, setting, and participant characteristics (e.g., demographic characteristics, health conditions) and outcomes and synthesized the evidence from included studies in a narrative format.

Expert Review and Public Comment

A draft Research Plan for this review was available for public comment from July 13, 2017 to August 9, 2017. Comments received during this period were reviewed, considered, and addressed as appropriate. The full draft report was shared with invited expert reviewers and federal partners. We compiled the comments received from these invited experts and addressed them in the report when appropriate. The draft version of this report was posted for public comment on the USPSTF Web site from January 8, 2019 to February 4, 2019. Comments received during this period were reviewed and considered, and minor changes were made to the contextual information in the report. No changes were made to the evidence or to our conclusions.

USPSTF Involvement

This evidence update was funded by AHRQ under a contract to support the USPSTF. We consulted with USPSTF members during development of the Research Plan (i.e., KQs, analytic framework, and inclusion criteria). An AHRQ Medical Officer provided project oversight, reviewed the draft and final versions of the evidence update, and assisted with public comment on the Research Plan and draft report. The USPSTF and AHRQ had no role in the study selection, quality assessment, or writing of the evidence update.

Chapter 3. Results

Literature Search

Our literature search yielded 5,688 unique citations. From these citations, we accepted 499 articles for review based on titles and abstracts (**Appendix A Figure 1**). After reviewing the full-text articles and conducting critical appraisal, we included two fair-quality studies for KQ 3. **Appendix B** contains a list of all full-text articles and their reasons for exclusion. No studies were excluded based on study quality.

No eligible studies were identified that directly investigated the population benefits of universal HBV screening in pregnancy. Broad criteria were used to identify potentially relevant studies based on title and abstract screening; however, no studies that examined the rates of HBV transmission before and after the implementation of a perinatal screening program were found. Many of the studies reviewed that were excluded focused on the rates of decline in HBV infection due to the implementation of targeted or universal vaccination programs or, particularly in the older literature, examined the comparative effectiveness of individual strategies for the prevention of HBV transmission (e.g., HBIG administration vs. placebo, various HBV vaccination doses) and did not address a KQ. Among studies evaluating case management programs, many reported outcomes at a single time point without a historical or geographical comparator necessary to establish program effectiveness. Harms outcomes were not reported in any of the studies reviewed for inclusion.

Results of Included Studies

KQ 1. What Are the Observed Population Benefits of Universal HBV Screening Programs During Pregnancy?

No eligible studies were identified that directly examined the population benefits of universal HBV screening in pregnancy. We did not find any studies comparing screened with unscreened populations that met the eligibility criteria. The primary reasons for exclusion of these studies were the lack of a comparator (i.e., data across time or locations) and lack of perinatal HBV transmission outcomes.

KQ 2. What Harms Have Been Observed in Programs of Universal HBV Screening During Pregnancy?

No eligible studies were identified that directly examined the harms of universal HBV screening programs in pregnancy.

KQ 3. What Is the Effectiveness of Case Management Programs to Prevent Perinatal Transmission Among HBV-Positive Pregnant Women?

We identified two studies that met the inclusion criteria for KQ 3—a fair-quality observational study reporting a historical trend in infant outcomes with infant case management provided through the PHBPP, which is administered by the CDC,[56] and a fair-quality observational study reporting the trend in perinatal transmission associated with infant case management provided in a coordinated care health system (Kaiser Permanente Northern California).[53]

In addition to rates of perinatal transmission (key outcome), the studies reported time trend data on the estimated proportion of HBV-positive women identified for case management and the time trends in the proportion of their infants who received HBV vaccination at birth, vaccination series completion by 12 months, and postvaccination testing for HBV immunity or infection.

National PHBPP Study Results

Data from the PHBPP for a cohort of infants born from 1994 to 2008 were reported, with perinatal transmission outcomes reported for infants born from 1999 to 2008.[56] The annual number of births to HBV-positive women were estimated in the study using national data (NHANES) on seroprevalence rates among women of childbearing age. These data indicate that foreign-born women identified as Asian or Pacific Islander had the highest seroprevalence rates (9%), followed by non-Hispanic black women (0.5%).[56] Outcomes were reported by the PHBPP 2 years after the birth year and perinatal transmission rates could be estimated only among those infants for whom HBV serologic testing was complete.

There was a statistically significant increasing trend over time (1994 to 2008) in the estimated number of births to HBV-positive women in the United States (from 19,208 to 25,600; $p<0.001$) (**Table 1**). The proportion of infants born to HBV-positive women who were identified by the PHBPP for case management also increased over time, starting at 42.1 percent in 1994 and increasing to 47.9 percent in 2008 ($p=0.002$). Of the identified infants, 98 percent were case managed, and the number of case-managed infants increased over time, from 7,415 in 1994 to 12,033 in 2008 ($p<0.001$).

Serologic testing for HBV is an indicator of completed case management because it is conducted after the completion of the three-dose vaccination series (based on CDC recommendations, testing was done by ages 9 to 18 months over the study period) and determines whether prophylaxis was successful. Of the case-managed infants in PHBPP, rates of serologic testing within 24 months of birth increased over the study period, more than doubling from 25.1 percent in 1994 to 55.7 percent in 2008 ($p<0.001$). A statistically significant downward trend in the perinatal transmission rate from 1999 to 2008 was also reported. In 1999, of the 3,826 infants tested, 71 were infected with HBV (1.9%), and in 2008, of the 6,697 infants tested, 56 were infected (0.8%), a statistically significant decreasing trend ($p=0.001$).

An increasing number of the estimated cases of HBV infection among pregnant women in the United States were case managed through the PHBPP over the study period. Rates of HBIG

administration and HBV vaccination at birth (>90%) and completion of the three-dose vaccination series by ages 6 to 8 months (>70%) among those infants who were case managed held steady, with statistically nonsignificant tests for trend (p=0.126 and p=0.734, respectively). There was, however, a decline in the proportion of case-managed infants who received the full HBV vaccination series by age 12 months (p<0.001), with rates dropping below 80 percent in 2001 from a high of 86 percent in 1994.

This observational study contributes evidence that the infant case management program, as implemented from 1994 to 2008, achieved improvements in identifying women with HBV infection and enrolling their infants, and maintained high levels of preventive interventions.

Reporting on the proportion of PHBPP case-managed infants lost to followup was required starting in 2004. From 2004 to 2008, there was not a statistically significant trend over time in loss to followup (range, 13% to 26%; p=0.126), but the lowest rate was reported in 2008. Reported reasons for loss to followup did not differ, with one exception: "family refused" increased as a stated reason for noncompletion of case management. Overall, the most common reasons reported were "moved out of country" (24%) or "could not locate" (33%).

The reductions in perinatal HBV transmission reported in this observational study could have been influenced by secular changes outside of the PHBPP (e.g., universal HBV vaccination practices). Within PHBPP, rates of HBIG administration and HBV vaccination at birth remained steady and high across the time period, ranging from 90 to 97 percent from 1999 to 2008, and completion of all three HBV vaccination doses by age 12 months, ranging from 78 to 80 percent for the same time period. Postvaccination serologic testing increased over this period, allowing calculation of perinatal transmission rates for a greater proportion of infants in PHBPP. The reported perinatal transmission rate could also have been affected by changes in recordkeeping and tracking of infants in PHBPP, with the cases at greater risk potentially least likely to have completed the program. Observed improvements in serologic testing and reduced loss to followup, however, suggest that data may be more complete in recent years.

The loss to followup in the PHBPP study was nearly one quarter of women in 2004 and just slightly more than 1 in 10 women in the most recent year reported. The loss to followup in the PHBPP program highlights the challenges of studying and tracking the population at greatest risk of perinatal HBV transmission, since populations most at risk, such as immigrants, lower-income populations, and women with substance abuse disorders, are also more likely to face instability in housing, employment, and health care access. The available data suggest that followup in PHBPP improved over time, possibly increasing the presence of higher-risk infants in the study data over time, so the observed trend is more likely an underestimate of the benefit of case management. Overall, completion of PHBPP case management is associated with low and declining rates of perinatal transmission.

Health System Study Results

An observational study using data on births (n=4,446) to HBV-positive women who received clinical care in a coordinated, managed care health setting reported on the trend over time from 1997 to 2010 in perinatal transmission of HBV (**Table 2**).[53] The health system commenced the

Regional Perinatal Screening Hepatitis B program in 1988. Women in the health system are screened during prenatal care and, if found to be HBV positive, are entered into the health system's case management system ("tracking program") to support on-time delivery of immunoprophylactic interventions and followup testing. Of the 4,446 infants born to HBV-positive pregnant women identified from 1997 to 2010, most received HBIG administration and HBV vaccination within the recommended time frames (i.e., >97% received HBIG administration and HBV vaccination within 12 hours of birth). Eighty-five percent of infants (n=3,353) were tested for HBV infection, with the highest rates of testing reported in recent years (93% for 2006 to 2010, before age 12 months). The overall rate of perinatal transmission over the time period was very low at 0.75 cases per 100 tested infants (25/3,353). A decreasing trend was observed in perinatal infection from 1997 to 2010 (incident rate ratio, 0.90 [95% confidence interval, 0.82 to 1.00]). This trend could be attributed to changes in case management (e.g., viral load testing in later years), to differences in case ascertainment (i.e., retroactive serologic testing in earlier years, more infants tested in later years), or a combination of these factors, as well as other unmeasured factors. Overall, the study demonstrates high effectiveness of modern prophylactic interventions for insured pregnant women and infants case managed in a coordinated health system.

KQ 4. What Harms Have Been Observed in Case Management Programs to Prevent Perinatal Transmission Among HBV-Positive Pregnant Women?

No eligible studies were identified that reported on harms of case management programs for pregnant women living with HBV infection.

Chapter 4. Discussion

Summary of Evidence

Two fair-quality observational studies provide evidence on the effectiveness of case management for delivering prophylaxis to prevent perinatal transmission of HBV, and evidence that over time, reductions in perinatal transmission have been observed for woman and infants enrolled in case management. These improvements may be owing to a combination of factors, such as improvements in the evidence-based protocols that are implemented in the programs, and refinements in the case management process whereby tracking of infants and delivery of interventions have improved. Changes in recordkeeping, loss to followup, and population demographics could also influence the reported findings, given that these are observational data. National data from the PHBPP in the United States provided evidence that case management for prevention of perinatal transmission is associated with low infection rates that have declined over time. At the same time, higher rates of maternal HBV case identification and infant program completion (serologic testing 2 years after birth) were reported. More complete data from a regional health system that employs a coordinated case management program is consistent with the national data trend, with rising rates of testing for HBV infection for case-managed infants, and the lowest rates of perinatal transmission observed in the most recent years (2006 to 2010).

Prior to the development of HBV prophylaxis, it was estimated that up to 40 percent of infants born to HBV-positive mothers would become infected.[57] An established body of evidence has demonstrated the effectiveness of prophylactic interventions, as recommended by CDC and ACIP, for reducing the risk of perinatal transmission. Foundational evidence from an earlier era and observational data from case management programs in the modern era together support the value of prenatal screening to identify infants for prophylactic interventions. Screening identifies women whose infants would benefit from case management, through timely delivery of recommended prophylaxis. Infants born to HBV-positive women in case management programs exhibit very low and declining rates of perinatal transmission over time.

As in previous reviews on this topic, no comparative studies were identified on the benefits or harms of screening. Screening pregnant women for HBV infection is standard care, but recommended universal HBV vaccination of all infants at birth also serves as a safeguard to prevent infection among infants whose mothers' infections are not identified through prenatal screening. A downward trend in perinatal HBV transmission in the United States as case management completion increased highlights the value of screening women to determine HBV status during pregnancy in the setting of universal birth vaccination. Even if universal birth vaccination recommendations were fully implemented, screening and case management may confer additional benefit for coordinating the delivery of additional interventions recommended for infants born to HBV-positive women. The additional benefit of HBIG administration at birth for vaccinated infants born to HBV-positive women was supported in a recent network meta-analysis, although most included studies in this review were among women who were HBeAg+ or had a high viral load and several studies were evaluated to have high risk of bias. Further research is needed to strengthen the evidence base with regard to protocols for HBIG administration at birth and potentially in the prenatal period.[25, 58, 59] Limited evidence suggests

potential preventive benefits of antiviral treatment before birth for women with high HBV viral loads.[48, 49]

Screening for HBV infection during pregnancy facilitates entry into case management in the United States. The rate of women entering the PHBPP based on screening during pregnancy (i.e., women not already known to have an HBV infection) has not been reported; however, data from a large urban hospital in Boston spanning the years 1995 to 2014 indicated that more than one third (37%) of pregnant women with chronic HBV infection were initially diagnosed at the first prenatal visit.[60]

Women with poor access to health care are at greater risk of not being screened until delivery or not at all, reducing the time available to plan the best prophylactic intervention. Efforts are needed to improve outreach and screening for HBV infection and other preconception health risks to vulnerable populations.[61] In particular, higher rates of chronic HBV infection are found among foreign-born women from countries where HBV prevalence is higher and infection is common in childhood. Thus, the highest seroprevalence among women of childbearing age occurs among foreign-born Asian and Pacific Islander women.[56] Prenatal care that can address language and health care access barriers for this population may further reduce rates of perinatal transmission in the United States.

Public health policy and health institution practices play an important role in improving prevention of perinatal HBV transmission. Earlier evidence suggests that state and hospital policies requiring HBV screening increased the likelihood of women's HBV-positive status being recorded in medical charts. Further, enhanced case management by health care delivery systems, including routine reminders, flags in patient charts, and standing orders for birth HBV vaccination, were shown to improve the receipt of timely HBV vaccination and HBIG administration.[62] Demonstrations of improved intervention rates in clinical settings serving subpopulations with higher chronic HBV infection rates are particularly encouraging.[63] Rates of HBV screening in pregnancy are high in the United States; research to ensure that case management care reaches women who screen positive may require a focus on health system quality improvement interventions.

Review Limitations and Future Research Needs

For this review, we sought overarching evidence on populationwide screening programs for reducing perinatal transmission of HBV. Only two studies were identified that met the inclusion criteria for a KQ. The included studies, however, are highly relevant for evaluating recommended interventions for preventing perinatal transmission of HBV in the United States. It was not possible to identify studies that could disentangle the effects of prenatal screening from effects of universal birth HBV vaccination, as these practices emerged around the same time, and their contributions to prevention of perinatal transmission of HBV are confounded.

This review supports the broad conclusion that screening can facilitate the receipt of prophylactic interventions and referral to effective case management programs. There is foundational evidence on individual intervention effectiveness (HBV vaccination, HBIG administration) and

data from case management programs demonstrating very low rates of perinatal transmission of HBV. There were no serious harms of screening or case management identified in the included studies, but theoretical harms, such as false-positive results and inappropriate entry into case management, would likely be corrected with additional testing in the PBHPP throughout the course of pregnancy.

The availability of effective interventions and their adoption by national case management programs will continue to be guided by emerging evidence and established practice. Recent reviews and recommendations continue to support the notion that active and passive prophylaxis likely provide the greatest degree of protection from HBV infection.[3, 25] Systematic reviews focused on the use of antiviral medications during pregnancy for women with an acute HBV infection and a high viral load have also identified the need for further research to prevent perinatal transmission in these highest-risk cases. Efforts to further increase the proportion of infants identified for and completing case management, accompanied by implementation of recommended interventions, may further reduce rates of perinatal transmission of HBV. More recent data from the PBHPP would be informative for understanding current program performance and research needs. Finally, research and targeted resources are needed to ensure that case management is effectively implemented and reaches vulnerable populations most at risk for perinatal transmission of HBV. Improving access to prenatal care, screening, and integration of public health and clinical health services to facilitate case management are among the strategies outlined to help eliminate perinatal HBV infection in the United States,[64] a goal of the 2017–2020 National Viral Hepatitis Action Plan.[65]

Conclusions

This evidence update includes two observational studies of case management interventions conducted in the United States, bolstered by a larger body of evidence establishing the effectiveness of interventions to prevent perinatal HBV transmission. The comprehensive strategy for the elimination of perinatal HBV transmission in the United States includes the use of routine screening of all women for HBV infection in pregnancy, along with universal HBV vaccination of all infants and additional prophylactic measures to those born to HBV-positive mothers. Within the U.S. public health system, case management programs can ensure implementation of recommended protocols for prevention of perinatal transmission of HBV. Although direct evidence of the effects of screening on perinatal transmission is not available, screening in pregnancy is an important step toward appropriate delivery of prophylactic interventions. Screening in pregnancy identifies women eligible for case management, which is associated with a very low risk of perinatal transmission. Until the public health goal of eliminating HBV infections in the United States is achieved, screening in pregnancy to identify opportunities to prevent perinatal transmission will remain important.

References

1. World Health Organization. Global Hepatitis Report 2017: World Health Organization; 2017.
2. Kowdley KV, Wang CC, Welch S, et al. Prevalence of chronic hepatitis B among foreign-born persons living in the United States by country of origin. Hepatology (Baltimore, Md). 2012;56(2):422-33. PMID: 22105832. https://dx.doi.org/10.1002/hep.24804
3. Dionne-Odom J, Tita AT, Silverman NS. #38: Hepatitis B in pregnancy screening, treatment, and prevention of vertical transmission. American journal of obstetrics and gynecology. 2016;214(1):6-14. PMID: 26454123. https://dx.doi.org/10.1016/j.ajog.2015.09.100
4. Polaris Observatory C. Global prevalence, treatment, and prevention of hepatitis B virus infection in 2016: a modelling study. Lancet Gastroenterol Hepatol. 2018;26:26. PMID: 29599078. https://dx.doi.org/10.1016/S2468-1253(18)30056-6
5. Roberts H, Kruszon-Moran D, Ly KN, et al. Prevalence of chronic hepatitis B virus (HBV) infection in U.S. households: National Health and Nutrition Examination Survey (NHANES), 1988-2012. Hepatology (Baltimore, Md). 2016;63(2):388-97. PMID: 26251317. https://dx.doi.org/10.1002/hep.28109
6. Gish RG, Sollano JD, Jr., Lapasaran A, et al. Chronic hepatitis B virus in the Philippines. J Gastroenterol Hepatol. 2016;31(5):945-52. PMID: 26643262. https://dx.doi.org/10.1111/jgh.13258
7. Schillie S, Vellozzi C, Reingold A, et al. Prevention of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices. MMWR 2018;67(RR-1):1-31. https://dx.doi.org/10.15585/mmwr.rr6701a1
8. Salemi JL, Spooner KK, Mejia de Grubb MC, et al. National trends of hepatitis B and C during pregnancy across sociodemographic, behavioral, and clinical factors, United States, 1998-2011. Journal of medical virology. 2017;89(6):1025-32. PMID: 27805270. https://dx.doi.org/10.1002/jmv.24725
9. Miller GK, Barker L, Taylor A, et al. Hepatitis B vaccination among U.S. women of reproductive age. Journal of Women's Health. 2017;26(4):A29. PMID: None. https://dx.doi.org/10.1089/jwh.2017.29011.abstracts
10. Ko SC, Fan L, Smith EA, et al. Estimated Annual Perinatal Hepatitis B Virus Infections in the United States, 2000-2009. Journal of the Pediatric Infectious Diseases Society. 2016;5(2):114-21. PMID: 26407247. https://dx.doi.org/10.1093/jpids/piu115
11. Terrault NA, Lok ASF, McMahon BJ, et al. Update on prevention, diagnosis, and treatment of chronic hepatitis B: AASLD 2018 hepatitis B guidance. Hepatology (Baltimore, Md). 2018;67(4):1560-99. PMID: 29405329. https://dx.doi.org/10.1002/hep.29800
12. Schwarz KB, Cloonan YK, Ling SC, et al. Children with Chronic Hepatitis B in the United States and Canada. J Pediatr. 2015;167(6):1287-94 e2. PMID: 26364985. https://dx.doi.org/10.1016/j.jpeds.2015.08.021

13. Ghany MG, Perrillo R, Li R, et al. Characteristics of adults in the hepatitis B research network in North America reflect their country of origin and hepatitis B virus genotype. Clin Gastroenterol Hepatol. 2015;13(1):183-92. PMID: 25010003. https://dx.doi.org/10.1016/j.cgh.2014.06.028
14. National Academies of Sciences Engineering and Medicine. Eliminating the Public Health Problem of Hepatitis B and C in the United States: Phase One Report. Buckley GJ, Strom BL, editors. Washington (DC): National Academies Press (US); 2016.
15. del Canho R, Grosheide PM, Mazel JA, et al. Ten-year neonatal hepatitis B vaccination program, The Netherlands, 1982-1992: protective efficacy and long-term immunogenicity. Vaccine. 1997;15(15):1624-30. PMID: 9364693.
16. Chen HL, Zha ML, Cai JY, et al. Maternal viral load and hepatitis B virus mother-to-child transmission risk: a systematic review and meta-analysis. Hepatology Research. 2018;23:23. PMID: 29473269. https://dx.doi.org/10.1111/hepr.13072
17. Haber P, Moro PL, Ng C, et al. Safety of currently licensed hepatitis B surface antigen vaccines in the United States, Vaccine Adverse Event Reporting System (VAERS), 2005-2015. Vaccine. 2018;36(4):559-64. PMID: 29241647. https://dx.doi.org/10.1016/j.vaccine.2017.11.079
18. Centers for Disease Control and Prevention. Sensitivity of the test for antibody to hepatitis B surface antigen--United States. MMWR Morbidity and mortality weekly report. 1993;42(36):707-10. PMID: 8361466.
19. World Health Organization. Hepatits B Surface Antigen Assays: Operational Characteristics (Phase I). http://www.who.int/diagnostics_laboratory/evaluations/en/hep_B_rep1.pdf: World Health Organization; 2001.
20. Schillie S, Walker T, Veselsky S, et al. Outcomes of infants born to women infected with hepatitis B. Pediatrics. 2015;135(5):e1141-e7. PMID: 25896839. http://dx.doi.org/10.1542/peds.2014-3213
21. Centers for Disease Control and Prevention. Perinatal Hepatitis B Prevention Program. https://www.cdc.gov/vaccines/programs/perinatal-hepb/index.html. Accessed: 05/03/2018.
22. Abara WE, Qaseem A, Schillie S, et al. Hepatitis B Vaccination, Screening, and Linkage to Care: Best Practice Advice From the American College of Physicians and the Centers for Disease Control and Prevention. Annals of internal medicine. 2017;167(11):794-804. PMID: 29159414 https://dx.doi.org/10.7326/M17-1106
23. Bruce MG, Bruden D, Hurlburt D, et al. Antibody levels and protection after hepatitis B vaccine: results of a 30-year follow-up study and response to a booster dose. The Journal of infectious diseases. 2016;214(1):16-22. PMID: 26802139. 10.1093/infdis/jiv748
24. Centers for Disease Control and Prevention. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination. Recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR Recommendations and reports : Morbidity and mortality weekly report Recommendations and reports. 1991;40(Rr-13):1-25. PMID: 1835756.

25. Chen ZX, Zhuang X, Zhu XH, et al. Comparative Effectiveness of Prophylactic Strategies for Perinatal Transmission of Hepatitis B Virus: A Network Meta-analysis of Randomized Controlled Trials. Open Forum Infect Dis. 2017;4(4):ofx225. PMID: 29181424. https://dx.doi.org/10.1093/ofid/ofx225
26. Venters C, Graham W, Cassidy W. Recombivax-HB: perspectives past, present and future. Expert Rev Vaccines. 2004;3(2):119-29.
27. Assad S, Francis A. Over a decade of experience with a yeast recombinant hepatitis B vaccine. Vaccine. 1999;18(1-2):57-67. PMID: 10501235. https://dx.doi.org/10.1016/S0264-410X(99)00179-6
28. Terrault NA, Bzowej NH, Chang KM, et al. AASLD guidelines for treatment of chronic hepatitis B. Hepatology (Baltimore, Md). 2016;63(1):261-83. PMID: 26566064. https://dx.doi.org/10.1002/hep.28156
29. Culp LA, Caucci L, Fenlon NE, et al. Assessment of State Perinatal Hepatitis B Prevention Laws. American journal of preventive medicine. 2016;51(6):e179-e85. PMID: 27866601. https://dx.doi.org/10.1016/j.amepre.2016.09.005
30. Kwong AJ, Chang MS, Tuomala RE, et al. Peripartum Care for Mothers Diagnosed with Hepatitis B During Pregnancy: A Survey of Provider Practices. Matern Child Health J. 2018. PMID: 29512054. https://dx.doi.org/10.1007/s10995-018-2515-0
31. Kolasa MS, Tsai Y, Xu J, et al. Hepatitis B Surface Antigen Testing Among Pregnant Women, United States 2014. Pediatric Infectious Disease Journal. 2017;36(7):e175-e80. PMID: 28030527. https://dx.doi.org/10.1097/INF.0000000000001516
32. Hill HA, Elam-Evans LD, Yankey D, et al. Vaccination coverage among children aged 19–35 months—United States, 2017. 2018;67(40):1123.
33. Hill HA, Elam-Evans LD, Yankey D, et al. Vaccination Coverage Among Children Aged 19-35 Months - United States, 2016. MMWR Morbidity and mortality weekly report. 2017;66(43):1171-7. PMID: 29095807. https://dx.doi.org/10.15585/mmwr.mm6643a3
34. Delage G, Montplaisir S, Remy-Prince S, et al. Prevalence of hepatitis B virus infection in pregnant women in the Montreal area. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 1986;134(8):897-901. PMID: 3955483.
35. Jonas MM, Schiff ER, O'Sullivan MJ, et al. Failure of Centers for Disease Control criteria to identify hepatitis B infection in a large municipal obstetrical population. Ann Intern Med. 1987;107(3):335-7. PMID: 3039886.
36. Kumar ML, Dawson NV, McCullough AJ, et al. Should all pregnant women be screened for hepatitis B? Ann Intern Med. 1987;107(3):273-7. PMID: 3619218.
37. Summers PR, Biswas MK, Pastorek JG, 2nd, et al. The pregnant hepatitis B carrier: evidence favoring comprehensive antepartum screening. Obstetrics and gynecology. 1987;69(5):701-4. PMID: 3574797.
38. Wetzel AM, Kirz DS. Routine hepatitis screening in adolescent pregnancies: is it cost effective? American journal of obstetrics and gynecology. 1987;156(1):166-9. PMID: 3099577.
39. McQuillan GM, Townsend TR, Johannes CB, et al. Prevention of perinatal transmission of hepatitis B virus: the sensitivity, specificity, and predictive value of the recommended screening questions to detect high-risk women in an obstetric population. Am J Epidemiol. 1987;126(3):484-91. PMID: 3618580.

40. U. S. Preventive Services Task Force. Screening for hepatitis B virus infection: recommendation statement 2004. http://www.ahrq.gov/clinic/uspstf/uspshepb.htm. Accessed: 06/01/2017.
41. U. S. Preventive Services Task Force. Screening for hepatitis B virus infection in pregnancy: U.S. Preventive Services Task Force reaffirmation recommendation statement. Ann Intern Med. 2009;150(12):869-73, W154. PMID: 19528565. 10.7326/0003-4819-150-12-200906160-00011
42. Krishnaraj R. Screening for hepatitis B virus infection: a brief evidence update for the U.S. Preventive Services Task Force. http://www.ahrq.gov/clinic/3rduspstf/hepbscr/hepbup.htm. Accessed: 06/01/2017.
43. Mele A, Tancredi F, Romano L, et al. Effectiveness of hepatitis B vaccination in babies born to hepatitis B surface antigen-positive mothers in Italy. J Infect Dis. 2001;184(7):905-8. PMID: 11509998. https://dx.doi.org/10.1086/323396
44. Ni YH, Chang MH, Huang LM, et al. Hepatitis B virus infection in children and adolescents in a hyperendemic area: 15 years after mass hepatitis B vaccination. Ann Intern Med. 2001;135(9):796-800. PMID: 11694104.
45. Chang MH, Chen CJ, Lai MS, et al. Universal hepatitis B vaccination in Taiwan and the incidence of hepatocellular carcinoma in children. Taiwan Childhood Hepatoma Study Group. N Engl J Med. 1997;336(26):1855-9. PMID: 9197213. https://dx.doi.org/10.1056/NEJM199706263362602
46. Lin K, Vickery J. Screening for hepatitis B virus infection in pregnant women: evidence for the U.S. Preventive Services Task Force reaffirmation recommendation statement. Ann Intern Med. 2009;150(12):874-6. PMID: 19528566.
47. Lee C, Gong Y, Brok J, et al. Effect of hepatitis B immunisation in newborn infants of mothers positive for hepatitis B surface antigen: systematic review and meta-analysis. BMJ. 2006;332(7537):328-36. PMID: 16443611.
48. Hyun MH, Lee YS, Kim JH, et al. Systematic review with meta-analysis: the efficacy and safety of tenofovir to prevent mother-to-child transmission of hepatitis B virus. Aliment Pharmacol Ther. 2017;45(12):1493-505. PMID: 28436552. https://dx.doi.org/10.1111/apt.14068
49. Brown RS, Jr., McMahon BJ, Lok AS, et al. Antiviral therapy in chronic hepatitis B viral infection during pregnancy: A systematic review and meta-analysis. Hepatology (Baltimore, Md). 2016;63(1):319-33. PMID: 26565396. https://dx.doi.org/10.1002/hep.28302
50. Tavakolpour S, Darvishi M, Mirsafaei HS, et al. Nucleoside/nucleotide analogues in the treatment of chronic hepatitis B infection during pregnancy: a systematic review. Infect Dis (Lond). 2018;50(2):95-106. PMID: 29020844. https://dx.doi.org/10.1080/23744235.2017.1384957
51. Jourdain G, Ngo-Giang-Huong N, Harrison L, et al. Tenofovir versus Placebo to Prevent Perinatal Transmission of Hepatitis B. N Engl J Med. 2018;378(10):911-23. PMID: 29514030. https://dx.doi.org/10.1056/NEJMoa1708131
52. US Preventive Services Task Force. Guide to Clinical Preventive Services: Report of the U.S. Preventive Services Task Force. Baltimore (MD): Williams & Wilkins; 1996 [cited Workplan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK15435/.

53. Kubo A, Shlager L, Marks AR, et al. Prevention of vertical transmission of hepatitis B: an observational study. Annals of internal medicine. 2014;160(12):828-35. PMID: 24862434. https://dx.doi.org/10.7326/M13-2529
54. National Heart Lung and Blood Institute. Quality Assessment Tool for Before-After (Pre-Post) Studies with No Control Group. https://www.nhlbi.nih.gov/health-pro/guidelines/in-develop/cardiovascular-risk-reduction/tools/before-after. Accessed: 9/12/2017.
55. Wells G, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. http://www.ohri.ca/programs/clinical_epidemiology/oxford.htm. Accessed: 9/12/2017.
56. Smith EA, Jacques-Carroll L, Walker TY, et al. The national Perinatal Hepatitis B Prevention Program, 1994-2008. Pediatrics. 2012;129(4):609-16. PMID: 22451702. https://dx.doi.org/10.1542/peds.2011-2866
57. Stevens CE, Beasley RP, Tsui J, et al. Vertical transmission of hepatitis B antigen in Taiwan. N Engl J Med. 1975;292(15):771-4. PMID: 1113797. https://dx.doi.org/10.1056/NEJM197504102921503
58. Machaira M, Papaevangelou V, Vouloumanou EK, et al. Hepatitis B vaccine alone or with hepatitis B immunoglobulin in neonates of HBsAg+/HBeAg- mothers: a systematic review and meta-analysis. The Journal of antimicrobial chemotherapy. 2015;70(2):396-404. PMID: 25362571. https://dx.doi.org/10.1093/jac/dku404
59. Eke AC, Eleje GU, Eke UA, et al. Hepatitis B immunoglobulin during pregnancy for prevention of mother-to-child transmission of hepatitis B virus. Cochrane Database of Systematic Reviews. 2017;2:CD008545. PMID: 28188612. https://dx.doi.org/10.1002/14651858.CD008545.pub2
60. Rajbhandari R, Barton K, Juncadella AC, et al. Discontinuity of care for mothers with chronic hepatitis B diagnosed during pregnancy. Journal of Viral Hepatitis. 2016;23(7):561-8. PMID: 26940754. https://dx.doi.org/10.1111/jvh.12524
61. Pierce RL, Smith S, Rowe-West B, et al. Hepatitis B maternal screening, infant vaccination, and infant prophylaxis practices in North Carolina. Archives of Pediatrics & Adolescent Medicine. 1999;153(6):619-23. PMID: 10357304.
62. Centers for Disease Control and Prevention. Prevention of perinatal hepatitis B through enhanced case management--Connecticut, 1994-95, and the United States, 1994. MMWR - Morbidity & Mortality Weekly Report. 1996;45(27):584-7. PMID: 9132578.
63. Weerasinghe I, Bannister N, Huang V, et al. The Role of the Patient-Centered Medical Home in Addressing Hepatitis B Perinatal Transmission: Charles B. Wang Community Health Center's Hep B Moms Program. AAPI Nexus: Policy, Practice and Community. 2014;12(1-2):140-60. PMID: None.
64. National Academies of Sciences Engineering and Medicine. A National Strategy for the Elimination of Hepatitis B and C: Phase Two Report. Strom BL, Buckley GJ, editors. Washington (DC): National Academies Press (US); 2017.
65. U.S. Department of Health and Human Services. National Viral Hepatitis Action Plan 2017-2020. www.hhs.gov/hepatitis/: 2017.

Figure 1. Analytic Framework

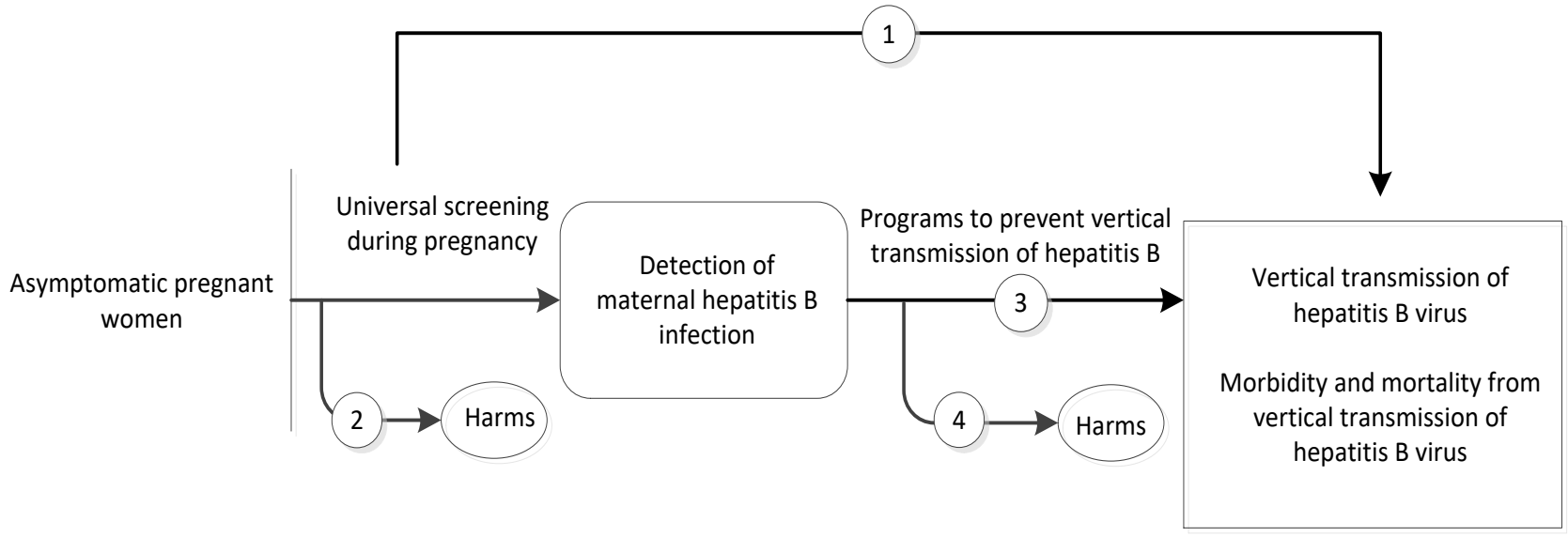

Table 1. Results From the PHBPP on Infants Born to HBV-Positive Women in the United States[56]

Outcome	Calculation	Time	Range
PHBPP coverage	Percentage of infants born to HBV-positive women in the United States* identified for PHBPP case management	1994–2008	Increase from 42.1% in 1994 to 47.9% in 2008 (p=0.002). As estimated number of births continued to rise, stable coverage of ~50%. Number of case-managed infants increased from 7,415 to 12,033.
Postvaccination serologic testing completed†	N with serologic testing/ N case managed	1994–2008	Increase from 25.1% in 1994 to 55.7% in 2008 (p<0.001). Number of case-managed infants receiving serologic testing increased from 1,860 to 6,697.
HBV positivity among infants completing case management	N HBV infected/ N serologically tested	1999–2008	Decrease from 1.9% in 1999 to 0.8% in 2008 (p<0.001)

* The study authors used deidentified U.S. natality and HBV prevalence data to calculate trends in the estimated number of births to HBV-positive women. Data were reported for women of childbearing age by race/ethnicity, primarily obtained through the National Health and Examination Survey. The number of women identified through the PHBPP for case management was then divided by this estimated number of births to HBV-positive women and reported by year.
† Within 24 months of birth.

Abbreviations: HBV = hepatitis B virus; N = number of persons; PHBPP = Perinatal Hepatitis B Prevention Program.

Table 2. Perinatal Transmission Among Infants Born to HBV-Positive Women Enrolled in KPNC Case Management, 1997–2010[53]

Outcome	Total 1997–2010	1997–2000	2001–2005	2006–2010	Trend
Infants born to HBV-positive women at KPNC, N (range per year)	4,446 (261 to 381)	1,152	1,616	1,678	NR
Postvaccination serologic testing for infection completed, N (%)	3,353 (85)	715 (70)	1,235 (86)	1,403 (93)	NR
Rate of HBV positivity among infants tested for HBV infection (HBsAg+)*	0.75 (0.48 to 1.10)	1.12 (0.42 to 2.21)	0.81 (0.39 to 1.49)	0.50 (0.20 to 1.03)	Poisson IRR, 0.90 (95% CI, 0.82 to 1.00)

* Rate per 100 children tested; Poisson distribution-based 95% CI.

Abbreviations: CI = confidence interval; HBsAg = hepatitis B surface antigen; HBV = hepatitis B virus; IRR = incident rate ratio; N = number of persons; KPNC = Kaiser Permanente Northern California.

Table 3. Snapshot of the Evidence

	Rationale and foundational evidence for previous USPSTF recommendations[40, 41, 52]	New evidence findings	Limitations of new evidence	Consistency of new evidence with foundational evidence and current understanding
Benefits	**Screening:** Screening is highly accurate and identifies infants at risk of perinatal transmission. Universal screening is important because known risk factors only present in 35% to 65% of HBV-positive pregnant women. **Treatment:** There are effective preventive measures (i.e., HBV vaccination within 12 hours of birth, HBIG administration) for preventing perinatal transmission and sequelae.	**Screening:** No new evidence. **Treatment (case management):** Two observational studies of the effectiveness of case management programs for infants at risk for perinatal HBV transmission in the United States; one study of the national public health system program and one study in an integrated health system. Case management in the integrated health system attained very high rates of on-time prophylaxis completion. Very low perinatal transmission rates reported in most recent years (0.5% to 0.8%) that had been trending downward over time.	Observational studies that cannot control for the effects of trends over time in historical, population, or recordkeeping factors that could also influence estimates. Program data are not complete and based on unverified reports by physicians, hospitals, and laboratories; loss to followup, missing data, and differences in data collection procedures may have had a greater effect on data estimates from earlier years.	The included observational studies suggest improving trends for perinatal transmission prevention among infants who have completed case management programs. A high proportion of case-managed infants are documented as having HBIG administration and HBV vaccination at birth and three vaccine doses by 12 months. Screening for HBV infection in pregnancy can identify infants at risk of perinatal transmission to identify them for case management.
Harms	**Screening:** Highly accurate test, low false-positive rate, no serious harms reported. **Treatment:** None identified, universal vaccination of all infants recommended regardless of maternal HBV status; HBIG harms not reported.	**Screening:** No new studies of screening were identified. **Treatment:** No harms of screening or case management were reported in the included study.	Program data do not capture potential harms of screening, other than reasons for loss to case management program followup.	No harms of screening or case management reported in foundational or included evidence.

Abbreviations: HBV = hepatitis B virus; N = number of persons; PHBPP = Perinatal Hepatitis B Prevention Program; HBIG = hepatitis B immune globulin; U.S. Preventive Services Task Force.

Appendix A. Literature Search Strategies for Primary Literature

Screening for Hepatitis B Virus Infection in Pregnant Women | Search strategies
Smyth Lai, 09/26/2017

Sources searched:
Cumulative Index for Nursing and Allied Health Literature (CINAHL), via EBSCO
Cochrane Central Register of Controlled Clinical Trials, via Wiley
Cochrane Database of Systematic Reviews, via Wiley
EMBASE
MEDLINE, via Ovid
PsycInfo, via Ovid
PubMed, publisher-supplied

Key:
* = truncation
$ = truncation
ab = word in abstract
de = index term
exp = explode
id = keyword
kw = keyword
la = language
lim = limit
py = publication year
ti = word in title

CINAHL
Published Date: 1986 01/01-2017 12/31; English Language; Exclude MEDLINE records

S12	S3 AND S11
S11	S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10
S10	TI (((vertical* or maternal* or mother or fetomaternal* or foetomaternal* or maternofetal* or maternofoetal*) N3 (transmission or transmit* or transfer*)) OR AB (((vertical* or maternal* or mother or fetomaternal* or foetomaternal* or maternofetal* or maternofoetal*) N3 (transmission or transmit* or transfer*))
S9	TI ((pregnan* or prenatal or "pre natal" or perinatal or "peri natal" or peripartum or "peri partum" or obstetric*)) OR AB ((pregnan* or prenatal or "pre natal" or perinatal or "peri natal" or peripartum or "peri partum" or obstetric*))
S8	(MH "Disease Transmission, Vertical")
S7	(MH "Pregnancy Outcomes")
S6	(MH "Prenatal Care") OR (MH "Maternal-Child Care") OR (MH "Obstetric Care") OR (MH "Perinatal Care")
S5	(MH "Pregnancy+") OR (MH "Pregnancy Trimesters+")
S4	(MH "Expectant Mothers")
S3	(S1 OR S2)
S2	TI (("hepatitis b" or hbv)) OR AB (("hepatitis b" or hbv))
S1	(MH "Hepatitis B") OR (MH "Hepatitis B, Chronic")

Appendix A. Literature Search Strategies for Primary Literature

Cochrane Central Register of Controlled Trials : Issue 8 of 12, August 2017

#1	("hepatitis b" or hbv):ti,ab,kw
#2	pregnan*:ti,ab,kw
#3	(prenatal or "pre natal"):ti,ab,kw
#4	(perinatal or "peri natal"):ti,ab,kw
#5	(antenatal or "anti natal"):ti,ab,kw
#6	(antepartum or "ante partum"):ti,ab,kw
#7	(peripartum or "peri partum"):ti,ab,kw
#8	obstetric*:ti,ab,kw
#9	(vertical* or maternal* or mother or fetomaternal* or foetomaternal* or maternofetal* or maternofoetal*):ti,ab,kw near/3 (transmission or transmit* or transfer*):ti,ab,kw
#10	41-#9-#9 41439
#11	#1 and #10 Publication Year from 1986 to 2017

EMBASE

#17
#16 AND **'english'**:la AND [1986-2017]/py

#16
#4 AND #15

#15
#5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #14

#14
#12 AND #13

#13
'transmission':ti OR **'transmit*'**:ti OR **'transfer*'**:ti

#12
'vertical*':ti OR **'maternal*'**:ti OR **'mother'**:ti OR **'fetomaternal*'**:ti OR **'foetomaternal*'**:ti OR **'maternofetal*'**:ti OR **'maternofoetal*'**:ti

#11
'pregnan*':ti OR **'prenatal'**:ti OR **'pre natal'**:ti OR **'perinatal'**:ti OR **'peri natal'**:ti OR **'peripartum'**:ti OR **'peri partum'**:ti OR **'obstetric*'**:ti

#10
'vertical transmission'/de

#9
'obstetric procedure'/de

#8
'perinatal care'/de OR **'perinatal period'**/de OR **'perinatal exposure'**/de

#7
'prenatal care'/de OR **'prenatal period'**/de OR **'prenatal exposure'**/de

#6
'pregnant woman'/de

#5
'pregnancy'/exp

#4
#1 OR #2 OR #3

#3
'hepatitis b':ti,ab,kw OR **'hbv'**:ti,ab,kw

#2
'hepatitis b virus'/exp

#1
'hepatitis b'/exp

Appendix A. Literature Search Strategies for Primary Literature

MEDLINE

Database: Ovid MEDLINE(R) <1946 to September Week 2 2017>, Ovid MEDLINE(R) Epub Ahead of Print <September 25, 2017>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <September 25, 2017>, Ovid MEDLINE(R) Daily Update <September 25, 2017>
Search Strategy:

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1 Hepatitis B/
2 Hepatitis B, Chronic/
3 Hepatitis B virus/
4 (hepatitis b or hbv).ti,ab.
5 or/1-4
6 Pregnancy/
7 Pregnancy Trimester, First/
8 Pregnancy Trimester, Second/
9 Pregnancy Trimester, Third/
10 Pregnant women/
11 Prenatal Care/
12 Perinatal Care/
13 Prenatal Diagnosis/
14 Pregnancy Outcome/
15 Pregnancy Complications, Infectious/
16 Infectious Disease Transmission, Vertical/
17 (pregnan$ or prenatal or pre natal or perinatal or peri natal or antenatal or ante natal or antepartum or ante partum or peripartum or peri partum or obstetric$).ti,ab.
18 ((vertical$ or maternal$ or mother or fetomaternal$ or foetomaternal$ or maternofetal$ or maternofoetal$) adj3 (transmission or transmit$ or transfer$)).ti,ab.
19 or/6-18
20 5 and 19
21 Animals/ not (Humans/ and Animals/)
22 20 not 21
23 limit 22 to (english language and yr="1986 -Current")
24 remove duplicates from 23

Appendix A. Literature Search Strategies for Primary Literature

PsycInfo

Database: PsycINFO <1806 to September Week 3 2017>

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1 (hepatitis b or HBV).ti,ab,id.
2 Pregnancy/
3 Prenatal Care/
4 Perinatal Period/
5 Expectant Mothers/
6 Mother Child Relations/
7 Obstetrics/
8 Pregnancy Outcomes/
9 pregnan$.ti,ab,id.
10 prenatal.ti,ab,id.
11 pre natal.ti,ab,id.
12 perinatal.ti,ab,id.
13 peri natal.ti,ab,id.
14 peripartum.ti,ab,id.
15 peri partum.ti,ab,id.
16 obstetric$.ti,ab,id.
17 ((vertical$ or maternal$ or mother or fetomaternal$ or foetomaternal$ or maternofetal$ or maternofoetal$) adj3 (transmission or transmit$ or transfer$)).ti,ab,id.
18 or/2-17
19 1 and 18
20 limit 19 to (english language and yr="1986 -Current")

PubMed [publisher-supplied records]

#5	#4 AND publisher[sb] AND English[Language] AND ("1986"[Date - Publication] : "3000"[Date - Publication])
#4	#1 AND (#2 OR #3)
#3	(vertical*[tiab] OR maternal*[tiab] OR mother[tiab] OR fetomaternal*[tiab] OR foetalmaternal*[tiab] OR maternofetal*[tiab] OR maternofoetal*[tiab]) AND (transmission[tiab] OR tranmit*[tiab] OR transfer*[tiab])
#2	pregnan*[tiab] OR prenatal[tiab] OR “pre natal”[tiab] OR perinatal[tiab] OR “peri natal”[tiab] OR antenatal[tiab] OR “ante natal”[tiab] OR antepartum[tiab] OR “ante partum”[tiab] OR peripartum[tiab] OR “peri partum”[tiab] OR obstetric*[tiab]
#1	"hepatitis b"[tiab] OR hbv[tiab]

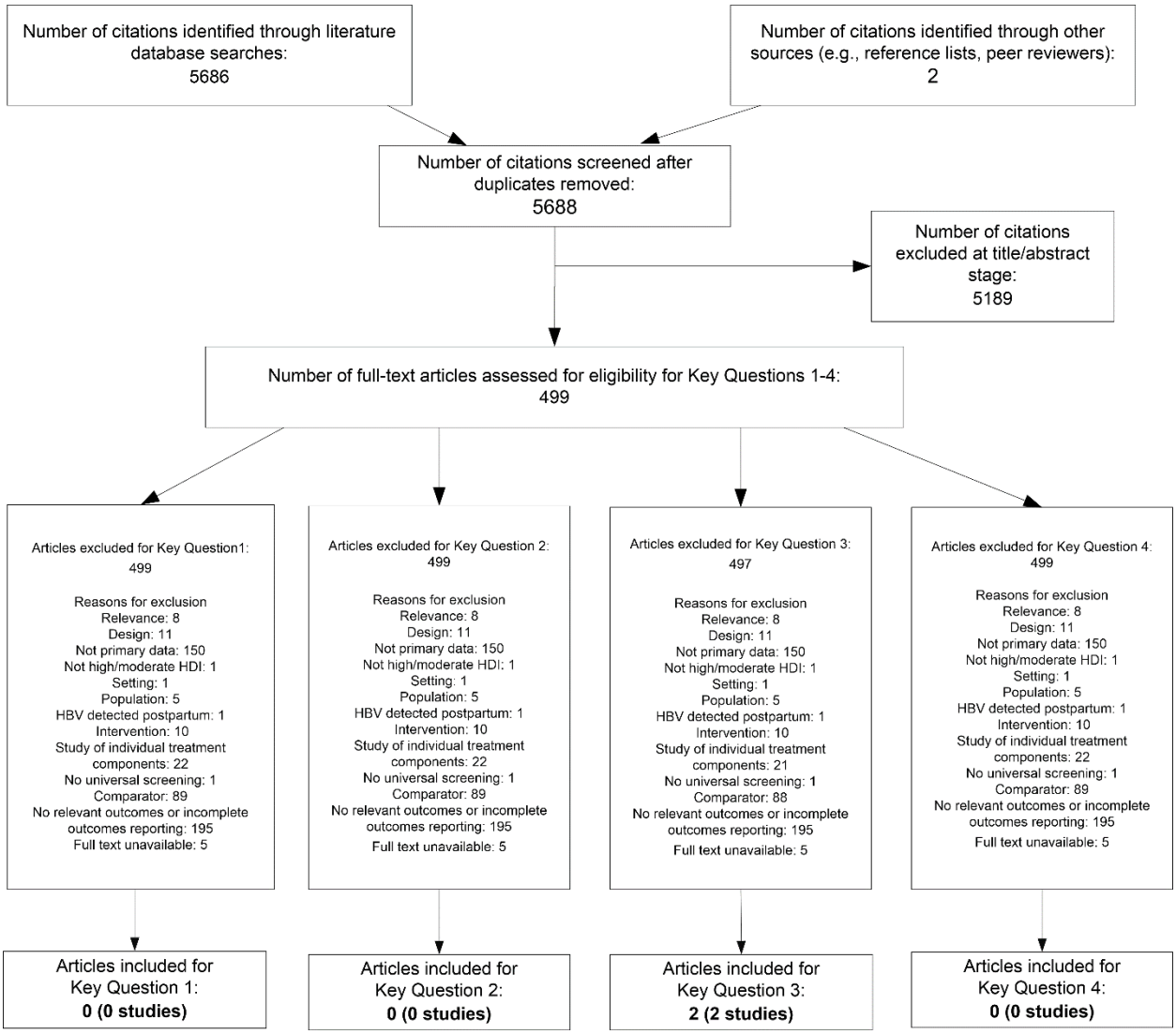
Appendix A Table 1. Inclusion and Exclusion Criteria

	Included	Excluded
Aim	To evaluate the effects of prenatal screening for hepatitis B virus infection on health outcomes and transmission rates and the effects of management and treatment programs among pregnant women with hepatitis B virus infection	
Populations	**KQs 1, 2:** Pregnant women at any gestation who are not known to have an acute or chronic hepatitis B virus infection **KQs 3, 4:** Pregnant women with acute or chronic hepatitis B virus infection	**KQs 1, 2:** Pregnant women who are known to have hepatitis B virus infection; women who are not pregnant; male partners of pregnant women
Interventions	**KQs 1, 2:** Universal screening for hepatitis B surface antigen **KQs 3, 4:** Organized programs aimed at preventing vertical transmission of hepatitis B virus infection among pregnant women; management and followup programs that deliver effective/recommended prophylactic interventions for women and neonates to reduce vertical transmission of hepatitis B virus infection	**KQs 1, 2:** Viral load followup testing among screen-positive women
Comparisons	**KQs 1, 2:** No screening; targeted screening **KQs 3, 4:** Comparisons of vertical transmission of hepatitis B virus infection associated with program implementation across time, geographic sites, or populations, both with and without case management for followup and immunotherapy	
Outcomes	**KQs 1, 3:** Mother-to-child transmission of hepatitis B virus infection; infant morbidity and mortality from perinatal hepatitis B virus infection **KQ 2:** Harms from the screening test or receipt of test results **KQ 4:** Harms from management of screen-detected hepatitis B virus infection; negative effects on maternal and infant health	**KQ 1:** Diagnostic accuracy **KQ 3:** Effects of individual interventions for hepatitis B virus infection (e.g., antiviral treatment) administered outside of a care program **KQ 4:** Harms of specific pharmacologic interventions
Setting	Any health care setting or level of care	Settings where universal vaccination of newborns for hepatitis B virus infection is not recommended or practiced
Country	Studies conducted in countries categorized as “high” to “very high” on the Human Development Index (as defined by the United Nations Development Programme)	Studies conducted in countries not categorized as “high” or “very high” on the Human Development Index
Study Design	**KQ 1:** Randomized or clinical controlled trials, systematic reviews, before-after, and observational cohort and ecologic studies with a historical or geographic comparator **KQs 2–4:** All of the above plus cohort studies, case series, and registry data	**KQs 3, 4:** Trials examining the effectiveness of individual pharmacologic treatments to prevent vertical transmission of hepatitis B virus infection administered outside of a care management program
Language	English-language only	Languages other than English
Study Quality	Fair- or good-quality studies	Poor-quality studies
Publication Dates	1986 to the present	Studies conducted prior to the introduction of vaccination for hepatitis B virus infection

Appendix A Table 2. Quality Rating Criteria

Study Design	Criteria
Cohort studies, adapted from the Newcastle-Ottawa Scale[55]	Was the exposed cohort(s) representative of the general population? Was the non-exposed cohort selected from the same community as the exposed cohort? How was "exposure" ascertained? Was it demonstrated that the outcome of interest was not present at the start of the study? Were the cohorts comparable on the basis of the design or analysis? Were outcome assessors blind? Was followup long enough for outcomes to occur? Was there adequate followup of cohorts?
National Heart, Lung, and Blood Institute tool for before-after (pre-post) studies with no control group[54]	Was the study question or objective clearly stated? Were eligibility/selection criteria prespecified and clearly described? Were participants representative of the general population? Were all eligible participants enrolled? Was the sample size sufficiently large? Was the test/service/intervention clearly described and delivered consistently? Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently? Were outcome assessors blind? Was loss to followup ≤20% and those lost to follow-up accounted for in analysis? Did statistical methods examine changes in outcome measures from before to after the intervention? Were p values provided? Were outcome measures taken multiple times before and after the intervention? If a group-level intervention, did statistical analysis take into account the use of individual-level data to determine group-level effects?

Appendix A Figure 1. Literature Flow Diagram



Appendix B. Excluded Studies

Exclusion Criteria Code	Exclusion Criteria
1	Relevance
2	Design
3	Not primary data
4	Not high/moderate Human Development Index
5	Setting does not include universal vaccination
6	Population
7	Hepatitis detected postpartum
8	Not an included intervention
9	Study of individual treatment components
10	No universal screening
11	Lack of relevant comparator
12	No relevant outcomes or incomplete outcomes reporting
13	Full text unavailable

Reference	Exclusion Code
The Cochrane Database of Systematic Reviews - Issue 11 of 2010. *J Evid Based Med*. 2010;3(4):226-7.	3
Further preventing mother to child hepatitis B transmission. *J Paediatr Child Health*. 2017;53(2):201.	3
CDC recommends a comprehensive strategy to eliminate HBV. *Am Fam Physician*. 1992;45(4):1912-4, 7.	3
Many chronically infected HBsAg positive pregnant women are not being identified. *Michigan Nurse*. 2009;82(5):28.	3
Universal prenatal screening for hepatitis B. *Emerg Med.* 1990;22(17):51-4.	3
Prenatal screening for infectious diseases. *ACOG Clin Rev*. 2004;9(2):5-6.	3
Reduction in hepatitis B transmission to infants. *AIDS Hepatitis Digest*. 2011;141:7-8.	13
Test all pregnant women for hepatitis B? *Patient Care*. 1988;22(5):23-4.	3
Abara WE, Cha S, Malik T, et al. Prenatal screening for and prevalence of hepatitis B surface antigen in pregnant women and prevention of transmission to infants born to infected mothers-Guam, 2014. *J Pediatric Infect Dis Soc*. 2018;7(4):290-5.	12
Abara WE, Cha S, Malik T, et al. Hepatitis B surface antigen screening among pregnant women and care of infants of hepatitis B surface antigen-positive mothers - Guam, 2014. *MMWR Morb Mortal Wkly Rep.* 2017;66(19):506-8.	12
Abass F, Thomas RD, Rajkumar A, et al. Controlling perinatally acquired hepatitis B. *Indian J Pediatr*. 2001;68(4):365.	3
Adamo B, Stroffolini T, Sagliocca L, et al. Ad hoc survey of hepatitis B vaccination campaign in newborns of HBsAg positive mothers and in 12-year-old subjects in southern Italy. *Vaccine*. 1998;16(8):775-7.	12

Reference	Exclusion Code
Addidle M. Impact of universal hepatitis B vaccination on antenatal hepatitis B prevalence in the Midlands region of the North Island, New Zealand. *N Z Med J*. 2011;124(1332):40-4.	12
Agbim U, Jaffe A, Verna EC, et al. Evaluation of hepatitis B management among peripartum women in an urban setting. *Gastroenterol*. 2017;152(5):S1084.	12
Al-Mandeel HM, Alansary M, Algawahmed F, et al. Seroprevalence of hepatitis B and C, and human immunodeficiency viruses in Saudi pregnant women and rates of vertical transmission. *Kuwait Med J*. 2015;47(3):221-4.	11
al-Owais A, al-Suwaidi K, Amiri N, et al. Use of existing data for public health planning: a study of the prevalence of hepatitis B surface antigen and core antibody in Al Ain Medical District, United Arab Emirates. *Bull World Health Organ*. 2000;78(11):1324-9.	12
Alavian SM. Immigration and knowledge, education, and practices regarding chronic hepatitis B in pregnancy. *Ann Gastroenterol*. 2018;31(3):384.	3
Alavian SM, Ebrahimi E, Abedini M. Necessity for hepatitis B surface antigen screening in pregnant females in Iran. *Iran Red Crescent Med J*. 2016;18(9):e40844.	3
Alswaidi FM, O'Brien SJ. Is there a need to include HIV, HBV and HCV viruses in the Saudi premarital screening program on the basis of their prevalence and transmission risk factors? *J Epidemiol Community Health*. 2010;64(11):989-97.	1
Alter MJ. Epidemiology of hepatitis B in Europe and worldwide. *J Hepatol*. 2003; 39(Suppl 1):S64-9.	3
American Academy of Pediatrics Committee on Infectious Diseases. Universal hepatitis B immunization. *Pediatrics*. 1992;89(4 Pt 2):795-800.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Anderson SR, Righarts A, Maguire H. Surveillance of antenatal infections--HIV, hepatitis B, syphilis and rubella susceptibility in London. *Commun Dis Public Health*. 2004;7(4):251-7.	12
Anonymous. Prevention of transmission of hepatitis B: responsibilities of healthcare providers. *J Arkansas Med Soc*. 1998;94(8):365-6.	3
Anonymous. Prevention of perinatal transmission of hepatitis B virus: prenatal screening of all pregnant women for hepatitis B surface antigen. *JAMA*. 1988;260(2):165, 69-70.	3
Anonymous. Two research projects seek to improve immunization practices. *Bull Pan Am Health Organ*. 1992;26(1):96-7.	3
Anonymous. Universal antenatal screening for hepatitis B and immunisation of babies at risk. *Commun Dis Rep CDR Wkly*. 1998;8(32):281, 4.	3
Anonymous. Should all pregnant women be screened for hepatitis B surface antigen? *Med J Aust*. 1989;150(6):346, 8.	12
Anonymous. Prevalence of HBsAg in UK population. *Br Med J Clin Res Ed.* 1987;294(6563):57.	12
Anonymous. From the Centers for Disease Control and Prevention. Maternal hepatitis B screening practices--California, Connecticut, Kansas, and United States, 1992-1993. *JAMA*. 1994;271(23):1819-20.	12
Anonymous. Hepatitis B alert! *J Okla State Med Assoc*. 1996;89(8):297-9.	3
Anonymous. Universal hepatitis B screening in pregnancy. *Am Fam Physician*. 1988;38(4):92, 4, 7.	3
Anonymous. Perinatal transmission of hepatitis B in Kansas. *Kans Med*. 1993;94(1):20-1.	2
Anonymous. Infant HBV immunisation. *Commun Dis Rep CDR Wkly*. 1992;2(30):133.	11
Arima S, Michitaka K, Horiike N, et al. Change of acute hepatitis B transmission routes in Japan. *J Gastroenterol*. 2003;38(8):772-5.	6
Aydin G. The investigation and follow up of HBsAg positive pregnant women and their babies. *Hepatol Int*. 2015;9(1):S29.	11
Azzopardi Micallef D, Mamo N, Micallef Fava A, et al. Management of pregnancy complicated by hepatitis B and C in Malta. *Int J Gynecol Obstet.* 2012;119(S3):S700-1.	3
Baird J, Hammond M, Barker M. Implementation of universal antenatal screening for HIV and hepatitis B--lessons for future work. *J Public Health Med*. 2003;25(2):171-3.	12
Baker DA, Bienstock J, Metz G, et al. Serologic screening of pregnant women at high risk for transmitting hepatitis B to their newborn. *Bull N Y Acad Med*. 1986;62(3):282-6.	12
Balogun MA, Ramsay ME, Fairley CK, et al. Acute hepatitis B infection in England and Wales: 1985-96. *Epidemiol Infect*. 1999;122(1):125-31.	6
Banatvala JE, Chrystie IL, Palmer SJ, et al. Retrospective study of HIV, hepatitis B, and HTLV-I infection at a London antenatal clinic. *Lancet*. 1990;335(8693):859-60.	12
Barbosa C, Smith EA, Hoerger TJ, et al. Cost-effectiveness analysis of the national Perinatal Hepatitis B Prevention Program. *Pediatrics*. 2014;133(2):243-53.	2
Barr D, Hershow R, Furner S, et al. Assessing prenatal hepatitis B screening in Illinois with an inexpensive study design adaptable to other jurisdictions. *Am J Public Health*. 1999;89(1):19-24.	11
Bascom S, Miller S, Greenblatt J. Assessment of perinatal hepatitis B and rubella prevention in New Hampshire delivery hospitals. *Pediatrics*. 2005;115(5):e594-9.	11
Batayneh N, Bdour S, et al. Risk of perinatal transmission of hepatitis B virus in Jordan. *Infect Dis Obstet Gynecol*. 2002;10(3):127-32.	12
Beck CR, MacGregor V, Makki S, et al. An audit of neonatal and infant hepatitis B immunisation and serological testing in two counties of England, 2007-12. *J Infect Prev*. 2014;15(5):182-8.	11
Bergin H, Wood G, Walker S, et al. Successful implementation of new management guidelines and a specialized clinic for hepatitis B virus positive pregnant women. *Aust N Z J Obstet Gynaecol*. 2016;56(S1):21.	11
Birnbaum JM, Bromberg K. Evaluation of prophylaxis against hepatitis B in a large municipal hospital. *Am J Infect Control*. 1992;20(4):172-6.	12
Biroscak BJ, Fiore AE, Fasano N, et al. Impact of the thimerosal controversy on hepatitis B vaccine coverage of infants born to women of unknown hepatitis B surface antigen status in Michigan. *Pediatrics*. 2003;111(6 Pt 1):e645-9.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Borchardt SM, Kocharian A, Hopfensperger D, et al. Prevention of perinatal transmission of hepatitis B virus: assessment among Wisconsin maternity hospitals. *WMJ*. 2016;115(2):74-9; quiz 80.	12
Borgia G, Maraolo AE, Gentile I. Hepatitis B mother-to-child transmission and infants immunization: we have not come to the end of the story yet. *Infect Dis (Lond)*. 2017;49(8):584-7.	3
Børresen ML, Koch A, Biggar RJ, et al. Effectiveness of the targeted hepatitis B vaccination program in Greenland. *Am J Public Health*. 2012;102(2):277-84.	11
Bortolotti F, Cadrobbi P, Armigliato M, et al. Prognosis of chronic hepatitis B transmitted from HBsAg positive mothers. *Arch Dis Child*. 1987;62(2):201-3.	11
Boxall E. Universal immunization of babies against hepatitis B. *AIDS Hepatitis Digest*. 2005;108:2-3.	3
Boxall EH. Antenatal screening for carriers of hepatitis B virus. *BMJ*. 1995;311(7014):1178-9.	3
Boyles S. Is universal better than selective immunization in developing world? Vaccines (HBV). *Hepatitis Wkly*. 1998;7-8.	3
Boyles S. Transmission (HBV). Centralized management key to preventing perinatal hepatitis. *Health Letter CDC*. 1997;13-4.	13
Bracciale L, Fabbiani M, Sansoni A, et al. Impact of hepatitis B vaccination in children born to HBsAg-positive mothers: a 20-year retrospective study. *Infection*. 2009;37(4):340-3.	12
Bracebridge S, Irwin D, Millership S. Prevention of perinatal hepatitis B transmission in a health authority area: an audit. *Commun Dis Public Health*. 2004;7(2):138-41.	11
Brady M. Preventing the perinatal spread of hepatitis B. *J Pediatr Health Care*. 1989;3(1):49-51.	3
Braillon A, Nguyen-Khac E. Pregnancy and hepatitis B in Europe. *Liver Int*. 2009;29(9):1447; author reply 1447-8.	3
Brook MG, Lever AM, Kelly D, et al. Antenatal screening for hepatitis B is medically and economically effective in the prevention of vertical transmission: three years experience in a London hospital. *Q J Med*. 1989;71(264):313-7.	11
Burgis JC, Kong D, Salibay C, et al. Perinatal transmission in infants of mothers with chronic hepatitis B in California. *World J Gastroenterol.* 2017;23(27):4942-9.	11
Cabrié T. Women diagnosed with chronic hepatitis B. *Aust Nurs Midwifery J.* 2015;22(9):50.	3
Cai HD, Liu M. The strategy of antivirus treatment in reproductive women infected with hepatitis B virus [Chinese]. *Zhonghua Gan Zang Bing Za Zhi.* 2008;16(2):159-60.	3
Cairns JA, Shackley P. Assessing value for money in medical screening. *J Med Screen*. 1994;1(1):39-44.	3
Caley M, Fowler T, Greatrex S, et al. Differences in hepatitis B infection rate between ethnic groups in antenatal women in Birmingham, United Kingdom, May 2004 to December 2008. *Euro Surveill.* 2012;17(30):26.	12
Cambrea SC, Dumea E, Ilie MM, et al. Materno-foetal transmision of B viral hepatitis in Constanta. *J Gastrointest Liver*. 2012;21(4):60-1.	11
Capar M, Kosić-Andrasević V, Popić G, et al. The need and value of routine screening of all pregnant women for hepatitis B surface antigen. *Acta Med Croatica*. 1995;49(4-5):161-4.	12
Carey I, et al. Preventing mother to child transmission of HBV in an ethnically diverse South London population: an effective multidisciplinary clinical pathway. *Hepatology*. 2016;63(1):890A.	11
Carlson NS. Current resources for evidence-based practice, May/June 2017. *J Midwifery Womens Health*. 2017;62(3):373-9.	3
Centers for Disease Control (CDC). Screening for hepatitis B virus infection among refugees arriving in the United States, 1979-1991. *MMWR Morb Mortal Wkly Rep.* 1991;40(45):784-6.	12
Centers for Disease Control. Hepatitis B screening and follow-up vaccination of infants of carrier mothers--Atlanta, 1988 and 1989. *MMWR Morb Mortal Wkly Rep.* 1990;39(24):405-7.	12
Centers for Disease Control and Prevention (CDC). Postvaccination serologic testing results for infants aged ≤24 months exposed to hepatitis B virus at birth - United States, 2008-2011. *MMWR Morb Mortal Wkly Rep*. 2012;61(38):768-71.	11
Centers for Disease Control. Prevention of perinatal transmission of hepatitis B virus: prenatal screening of all pregnant women for hepatitis B surface antigen. *MMWR Morb Mortal Wkly Rep*. 1988;37(22):341-6, 351.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Centers for Disease Control and Prevention. Hepatitis B vaccination--United States, 1982-2002. *MMWR Morb Mortal Wkly Rep.* 2002;51(25):549-52, 63.	12
Centers for Disease Control and Prevention. Assessing completeness of perinatal hepatitis B virus infection reporting through comparison of immunization program and surveillance data--United States. *MMWR Morb Mortal Wkly Rep.* 2011;60(13):410-3.	12
Centers for Disease Control and Prevention. Program to prevent perinatal hepatitis B virus transmission in a health-maintenance organization--Northern California, 1990-1995. *MMWR Morb Mortal Wkly Rep.* 1997;46(17):378-80.	12
Centers for Disease Control and Prevention. Postvaccination serologic testing results for infants aged <=24 months exposed to hepatitis B virus at birth: United States, 2008-2011. *MMWR Morb Mortal Wkly Rep.*. 2012;61:768-71.	9
Centers for Disease Control and Prevention. Prevention of perinatal hepatitis B through enhanced case management--Connecticut, 1994-95, and the United States, 1994. *MMWR Morb Mortal Wkly Rep.* 1996;45(27):584-7.	12
Chae HB, Kim JH, Kim JK, et al. Current status of liver diseases in Korea: hepatitis B. *Korean J Hepatol.* 2009;15(Suppl 6):S13-24.	3
Chandrapalan S, Smyth C, Lau S, et al. Audit on antenatal care of patients with hepatitis B in a multi-professional clinic in a non-regional centre. *United Eur Gastroenterol J.* 2015;2(Suppl 1):A516.	12
Chang MS, Tuomala R, Rutherford AE, et al. Postpartum care for mothers diagnosed with hepatitis B during pregnancy. *Am J Obstet Gynecol*. 2015;212(3):365.e1-7.	12
Chang MS, Wharam JF, Zhang F, et al. Peripartum maternal hepatitis B care in a US nationwide data set. *J Clin Gastroenterol.* 2018 Aug 24. [Epub ahead of print]	12
Chang YH, Choi GS, Jeong WJ, et al. Epidemiologic study of hepatitis B in pregnant Korean women. *Korean J Intern Med*. 1986;1(2):233-42.	12
Chauvin P, Ekra D, Plotkin SA. The cost of not implementing routine neonates immunization programmes in HBsAg high prevalence countries. *Vaccine*. 2002;20(23-24):2848-50.	12
Chen AL, et al. Strategies for the prevention of hepatitis B. *The Washington Nurse*. 1998;28(2):26-8.	3
Chen DS, Hsu HM, Bennett CL, et al. A program for eradication of hepatitis B from Taiwan by a 10-year, four-dose vaccination program. *Cancer Causes Control.* 1996;7(3):305-11.	11
Chen G, Block JM, Evans AA, et al. Gateway to Care campaign: a public health initiative to reduce the burden of hepatitis B in Haimen City, China. *BMC Public Health*. 2014;14:754.	12
Chen HL, Chang MH, Ni YH, et al. Seroepidemiology of hepatitis B virus infection in children: ten years of mass vaccination in Taiwan. *JAMA*. 1996;276(11):906-8.	1
Chen HL, Lin LH, Hu FC, et al. Breakthrough infection in children born to hepatitis B virus carrier mothers: a reappraisal of screening in pregnant women and universal immunization strategy. *J Hepatol*. 2011;54:S354.	9
Cheng EH, Witharana S, Haque M. The impact of maternal chronic hepatitis B infection in obstetric outcomes. *Hepatol Int*. 2014;8(Suppl 1):S147-8.	11
Cheng E, Go G, Fereday E, et al. Hepatitis B vertical transmission risk assessment and follow up in the gastroenterology clinic: an Australian tertiary centre experience. *Hepatol Int*. 2013;7:S271.	12
Chernesky MA, Blajchman, et al. Analysis of a pregnancy-screening and neonatal-immunization program for hepatitis B in Hamilton, Ontario, Canada, 1977-1988. *J Med Virol*. 1991;35(1):50-4.	7
Chien YC, Jan, et al. Nationwide hepatitis B vaccination program in Taiwan: effectiveness in the 20 years after it was launched. *Epidemiol Rev*. 2006;28(1):126-35.	9
Choe BH. A disappearing vertical infection: will hepatitis B be a forgotten disease in children? *Korean J Intern Med*. 2014;29(3):296-300.	3
Chongsuvivatwong V, Patamasucon P, Chandeying V, et al. Hepatitis B insurance for the newborn. *Lancet*. 1989;2(8665):749-50.	12
Christopher PJ. Should all pregnant women be screened for hepatitis B surface antigen? *Med J Aust*. 1989;150(11):668.	3
Chrystie I, Sumner D, Palmer S, et al. Screening of pregnant women for evidence of current hepatitis B infection: selective or universal? *Health Trends*. 1992;24(1):13-5.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Chuang CH. Hepatitis B control program in Taiwan. *Acta Paediatr Jpn*. 1989;31(6):645-8.	8
Clark C. Hepatitis B (prevention). HMO tracking system helps prevent infection in newborns. *Health Letter CDC*. 1997;1-2.	13
Clarke V, Alfaham M, Evans M, et al. Missed opportunities for preventing perinatal hepatitis B infection. *Arch Dis Child Fetal Neonatal Ed.* 2000;82(3):F259-60.	11
Cowan SA. Denmark scales up hepatitis B screening and vaccination for risk groups. *Euro Surveill.* 2005;10(11):E051103.4.	3
Cowan SA, Bagdonaite J, Qureshi K. Universal hepatitis B screening of pregnant women in Denmark ascertains substantial additional infections: results from the first five months. *Euro Surveill.* 2006;11(6):E060608.3.	12
Crovari P. Epidemiology of viral hepatitis B in Italy. *Vaccine*. 1995;13(Suppl 1):S26-30.	3
Cruz AC, Frentzen BH, Behnke M. Hepatitis B: a case for prenatal screening of all patients *Am J Obstet Gynecol*. 1987;156(5):1180-3.	11
Cui F, Li L, Hadler SC, et al. Factors associated with effectiveness of the first dose of hepatitis B vaccine in China: 1992-2005. *Vaccine*. 2010;28(37):5973-8.	8
Cui F, Luo H, Wang F, et al. Evaluation of policies and practices to prevent mother to child transmission of hepatitis B virus in China: results from China GAVI project final evaluation. *Vaccine*. 2013;31(Suppl 9):J36-42.	12
Cui F, Shen L, Li L, et al. Prevention of chronic hepatitis B after 3 decades of escalating vaccination policy, China. *Emerg Infect Dis*. 2017:23(5):765-72.	1
Fernandes CN, Alves Mde M, de Souza ML, et al. Prevalence of hepatitis B and C seropositivity in pregnant women [Portuguese]. *Rev Esc Enferm USP.* 2014;48(1):89-96.	12
Da Villa G. Rationale for the infant and adolescent vaccination programmes in Italy. *Vaccine*. 2000;18(Suppl 1):S31-4.	12
Dalmartello M, Parazzini F, Pedron M, et al. Coverage and outcomes of antenatal tests for infections: a population based survey in the Province of Trento, Italy. *J Matern Fetal Neonatal Med.* 2019;32(12):2049-55.	12
Dankner WM, Dixon SD, Lane TA, et al. Hepatitis B in a prenatal population. *JAMA*. 1993;269(5):589-90.	12
Datta SK, Gulati AK, Pandey LK, et al. Hepatitis B virus carriage in pregnant women. *J Commun Dis.* 1988;20(3):209-12.	12
Day E. Hepatitis B antenatal care in the community. *Aust Nurs Midwifery J.* 2015;23(6):51.	3
De Gascun CF, Fraher M, Crean M, et al. The importance of being earnest: following up a low level hepatitis B surface antigen (HBsAg) result. *J Clin Virol*. 2010;49(2):79-81.	3
De Groote K, Van Damme P, Deprettere A, et al. Prevention of vertical transmission of hepatitis B virus infection. Is there a standard policy in Flanders (Belgium)? *Acta Gastroenterol Belg*. 1997;60(4):255-8.	12
De Souza NC, Botelho CA, Honer MR. Retrospective study of a pioneer antenatal screening program with 8,477 pregnant women in Brazil. *Clin Exp Obstet Gynecol*. 2004;31(3):217-20.	12
del Canho R, Grosheide PM, Mazel JA, et al. Ten-year neonatal hepatitis B vaccination program, The Netherlands, 1982-1992: protective efficacy and long-term immunogenicity. *Vaccine*. 1997;15(15):1624-30.	9
Deng L, Reekie J, Ward JS, et al. Trends in the prevalence of hepatitis B infection among women giving birth in New South Wales. *Med J Aust*. 2017;206(7):301-5.	12
Denis F, Ranger-Rogez S, Alain S, et al. Screening of pregnant women for hepatitis B markers in a French Provincial University Hospital (Limoges) during 15 years. *Eur J Epidemiol*. 2004;19(10):973-8.	12
Ding Y, Sheng Q, Ma L, et al. Chronic HBV infection among pregnant women and their infants in Shenyang, China. *Virol J*. 2013;10:17.	11
Dong Y, Liu SL, Zhai XJ, et al. A serological and molecular survey of hepatitis B in children 15 years after inception of the national hepatitis B vaccination program in eastern China. *J Med Virol*. 2009;81(9):1517-24.	1
dos Santos JI, Lopes MA, Deliège-Vasconcelos E, et al. Seroprevalence of HIV, HTLV-I/II and other perinatally-transmitted pathogens in Salvador, Bahia. *Rev Inst Med Trop Sao Paulo*. 1995;37(4):343-8.	12
Driscoll DW. Perinatal transmission of hepatitis B. *RN*. 1992;55(4):65.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Drăghicenoiu RN, Mărdărescu M, et al. Hepatitis B in children - 18 years after vaccine approval in Romania - clinical and epidemiological observations. *J Gastrointest Liver Dis*, 2012;21:59.	11
Duffell EF, van de Laar MJ, Amato-Gauci AJ. Enhanced surveillance of hepatitis B in the EU, 2006-2012. *J Viral Hepat*. 2015;22(7):581-9.	11
Dunn J, Shukla R, Neal K. Survey of neonatal hepatitis B vaccination in Leicestershire. *Commun Dis Public Health.* 1999;2(3):218-9.	12
Dunn J, Shukla R, Neal K. Integration of hepatitis B vaccination into national immunisation programmes. Alternative strategies must be considered before universal vaccination is adopted. *BMJ*. 1997;315(7100):121-2.	12
Durand AM, Sabino H Jr, Mahoney F. Success of mass vaccination of infants against hepatitis B. *JAMA*. 1996;276(22):1802-4.	8
Dusheiko G. Interruption of mother-to-infant transmission of hepatitis B: time to include selective antiviral prophylaxis? *Lancet*. 2012;379(9830):2019-21.	3
Dusheiko G, Easterbrook P. Bringing to an end mother-to-child transmission of hepatitis B: a role for quantitative hepatitis B surface antigen? *Hepatology*. 2016;64(5):1408-10.	3
Dwyer MJ, McIntyre PG. Ante-natal screening for hepatitis B surface antigen: an appraisal of its value in a low prevalence area. *Epidemiol Infect*. 1996;117(1):121-31.	2
Dyson J, Michael E, Turley A, et al. Pregnant mothers with chronic hepatitis B (HBV): how often is treatment needed? *Gut*. 2012;61:A139.	12
Eisa MG, Gurtin D, Oliver T, et al. The outcome of hepatitis B immunoprophylaxis on vertical transmission: a 5-year observational hospital-based study. *Unit Eur Gastroenterol J.* 2015;3(5):A515.	11
Elefsiniotis IS, Brokalaki H, Tsoumakas K, et al. Current vaccination coverage against hepatitis B among pregnant women in Greece: far away from the ideal target. *Eur J Obstet Gynecol Reprod Biol*. 2010:152(2):227-8.	12
Elefsiniotis IS, Papadakis MA, Vlahos G, et al. Passive-active immunoprophylaxis for all infants born from HBeAG-negative chronic HBV-infected mothers: is it a cost-effective strategy? *Hepatol Res*. 2007;37(7):577-8.	3
Elefsiniotis IS, Vezali E, Brokalaki H, et al. Hepatitis B markers and vaccination-induced protection rate among Albanian pregnant women in Greece. *World J Gastroenterol.* 2009;15(43):5498-9.	12
Erdem G, Tekinalp G, Yurdakök M, et al. Perinatal transmission of hepatitis B virus infection. *Lancet*. 1994;343(8892):289.	9
Eto T, Shiraki K. National project on the prevention of mother-to-infant infection by hepatitis B virus in Japan. *Acta Paediatr Jpn*. 1989;31(6):681-4.	11
Euler GL, Copeland JR, Rangel MC, et al. Antibody response to postexposure prophylaxis in infants born to hepatitis B surface antigen-positive women. *Pediatr Infect Dis J*. 2003;22(2):123-9.	11
Euler GL, Wooten KG, Baughman AL, et al. Hepatitis B surface antigen prevalence among pregnant women in urban areas: implications for testing, reporting, and preventing perinatal transmission. *Pediatrics*. 2003;111(5 Pt 2):1192-7.	12
Evans AA, Cohen C, Huang P, et al. Prevention of perinatal hepatitis B transmission in Haimen City, China: results of a community public health initiative. *Vaccine*. 2015;33(26):3010-5.	11
Fan R, Yin X, Liu Z, et al. A hepatitis B-free generation in China: from dream to reality. *Lancet Infect Dis*. 2016;16(10):1103-5.	3
Farghaly AG, Hassan EM, Gawish S, et al. Vertical transmission of HBsAg in Alexandria. *J Egypt Public Health Assoc*. 1990;65(3-4):377-90.	11
Farràs Llobet A, et al. Hepatitis B virus infection in pregnant women. *J Perinat Med*. 2015;43.	11
Fischer G, Wang S, Ahring S, et al. An investigation of perinatal hepatitis B virus infections among a high risk population: the delivery hospital as a safety net. *Pediatr Infect Dis J*. 2009;28(7):593-7.	9
Fujisawa T, Onoue M, Inui A, et al. Serial changes in titers of antibody to hepatitis B surface antigen after immunization of infants born to mothers with hepatitis B e antigen. *J Pediatr Gastroenterol Nutr*. 1996;23(3):270-4.	9
Furuncuoglu Y, Bolukbas FF, Bolukbas C, et al. Changes in the prevalence of HBV infection in pregnant women in Turkey between 1995 and 2015: a 20-year evaluation. *Postgrad Med J*. 2016;92(1091):510-3.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Ganju SA, Goel A. Sero-surveillance of HIV, HBV and HCV infections in antenatal and STD clinic attendees *J Commun Dis*. 2004;36(1):60-2.	12
Gao Y, Zhou H, Singh NS, et al. Progress and challenges in maternal health in western China: a countdown to 2015 national case study. *Lancet Glob Health*. 2017;5(5):e523-36.	12
Garcia Ruiz I, et al. Hepatitis B infection and pregnancy. Experience from a reference hospital in Barcelona. *J Matern Fetal Neonatal Med.* 2014;27:173.	11
Gascón A, et al. Incidence and perinatal results of hepatitis B complicated pregnancies. *J Matern Fetal Neonatal Med.* 2012;25:61.	9
Gay N, Miller E, et al. Antenatal screening for hepatitis B. *J Med Screen*. 1998;5(1):53.	3
Gibson-Helm M, Teede H, Block A, et al. Maternal health and pregnancy outcomes among women of refugee background from African countries: a retrospective, observational study in Australia. *BMC Pregnancy Childbirth*. 2014;14:392.	12
Giles ML, Grace R, Tai A, et al. Prevention of mother-to-child transmission of hepatitis B virus (HBV) during pregnancy and the puerperium: current standards of care. *Aust N Z J Obstet Gynaecol*. 2013;53(3):231-5.	12
Gilleand C. Perinatal transmission of the hepatitis B virus. *J Newborn Nurs.* 1999;16-8.	3
Giraudon I, Forde J, Maguire H, et al. Antenatal screening and prevalence of infection: surveillance in London, 2000-2007. *Euro Surveill.* 2009;14(9):8-12.	12
Godbole G, Irish D, Basarab M, et al. Management of hepatitis B in pregnant women and infants: a multicentre audit from four London hospitals. *BMC Pregnancy Childbirth*. 2013;13:222.	12
Goh KT. Prevention and control of hepatitis B virus infection in Singapore. *Ann Acad Med Singapore*. 1997;26(5):671-81.	3
Goh KT, Doraisingham S, Tan KL, et al. The hepatitis B immunization programme in Singapore. *Bull World Health Organ*. 1989;67(1):65-70.	11
Goldwater PN. Hepatitis B in Australia: on course for universal vaccination. *Med J Aust*. 1996:165(6):300-1.	3
Gonsalkorala E, et al. The landscape of pregant women with hepatitis B in a single centre. *Hepatology*. 2014;60:1010A.	12
Gonzalez A, et al. Infectious diseases in pregnancy: normalising the antenatal care for women who screen positive for hepatitis B in a London teaching hospital with two main hospital sites. *BJOG.* 2017;124:106-7.	12
González-Quintero VH, Katz D, Pandya-Smith I, et al. Assessing perinatal hepatitis B screening and neonatal prophylaxis in a large, multiethnic county. *J Reprod Med*. 2006;51(2):101-8.	12
Graham S, Guy RJ, Cowie B, et al. Chronic hepatitis B prevalence among Aboriginal and Torres Strait Islander Australians since universal vaccination: a systematic review and meta-analysis. *BMC Infect Dis*. 2013;13:403.	2
Greenspoon JS, Martin J, Greenspoon RL, et al. Necessity for routine obstetric screening for hepatitis B surface antigen. *J Reprod Med*. 1989;34(9):655-8.	12
Grimes RM, Richards EP, Rathbun KC, et al. Hepatitis B, syphilis, and human immunodeficiency virus: are different approaches to prenatal screening justified? *Pediatr AIDS HIV Infect*. 1997;8(2):98-101.	3
Grob PJ. Report on Working Group 2: Austria, Belgium, Bulgaria, Germany, Greece, Hungary, Malta, Russia, Switzerland, Turkey and Uzbekistan. [Erratum appears in *Vaccine*. 1999;17(19):2472] *Vaccine*. 1998;16(Suppl):S61-2.	3
Grosheide PM, Klokman-Houweling JM, Conyn-van Spaendonck MA. Programme for preventing perinatal hepatitis B infection through screening of pregnant women and immunisation of infants of infected mothers in The Netherlands, 1989-92. National Hepatitis B Steering Committee. *BMJ*. 1995;311(7014):1200-2.	12
Grosheide PM, Wladimiroff JW, Heijtink RA, et al. Proposal for routine antenatal screening at 14 weeks for hepatitis B surface antigen. Dutch Study Group on Prevention of Neonatal Hepatitis. *BMJ*. 1995;311(7014):1197-9.	12
Guan R. Hepatitis B virus infection in Singapore. *Gut*. 1996;38(Suppl 2):S13-7.	3
Guirgis M, Zekry A, Yan K, et al. Chronic hepatitis B infection in an Australian antenatal population: seroprevalence and opportunities for better outcomes. *J Gastroenterol Hepatol*. 2009;24(6):998-1001.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Guo Y, Liu J, Meng L, et al. Survey of HBsAg-positive pregnant women and their infants regarding measures to prevent maternal-infantile transmission. *BMC Infect Dis*. 2010;10:26.	11
Gupta I, Ganguly, et al. Neonatal and maternal immunoprophylaxis against hepatitis B virus. *Bull Postgrad Inst Med Ed Res Chandigarh*. 1994;28(4):149-52.	3
Gust ID. Control of hepatitis B in Australia. The case for alternative strategies. *Med J Aust*. 1992;156(12):819-21.	3
Hahné S, van den Hoek A, Baayen D, et al. Prevention of perinatal hepatitis B virus transmission in the Netherlands, 2003-2007: children of Chinese mothers are at increased risk of breakthrough infection. *Vaccine*. 2012;30(9):1715-20.	9
Hann HW, Hann RS, Maddrey WC. Hepatitis B virus infection in 6,130 unvaccinated Korean-Americans surveyed between 1988 and 1990. *Am J Gastroenterol*. 2007;102(4):767-72.	11
Hansen N, Hay G, Cowan S, et al. Hepatitis B prevalence in Denmark - an estimate based on nationwide registers and a national screening programme, as on 31 December 2007. *Euro Surveill.* 2013;18(47). pii: 20637.	12
Harder KM, Cowan S, Eriksen MB, et al. Universal screening for hepatitis B among pregnant women led to 96% vaccination coverage among newborns of HBsAg positive mothers in Denmark. *Vaccine*. 2011;29(50):9303-7.	11
Hardie J. Hepatitis B, immunization, and pregnancy. *Probe (Adelaide)*. 1988;22(2):79-82.	3
Harpaz R, McMahon BJ, Margolis HS, et al. Elimination of new chronic hepatitis B virus infections: results of the Alaska immunization program. *J Infect Dis*. 2000;181(2):413-8.	8
Hartmann P, et al. The introduction of viral hepatitis B preventive vaccination to the Republic of Maldives. *J Prev Med Hyg*. 1994;35(1-2):53-4.	13
Has R, Yüksel A, Topuz S. Hepatitis B infection in pregnancy: is it really not harmful to the fetus? *Prenat Diagn*. 2001;21(8):701-2.	12
Healy CM, Cafferkey MT, Butler KM, et al. Antenatal hepatitis B screening - is there a need for a national policy? *Ir Med J*. 2001;94(4):111-2, 114.	11

Reference	Exclusion Code
Heininger U, Vaudaux B, Nidecker M, et al. Evaluation of the compliance with recommended procedures in newborns exposed to HBsAg-positive mothers: a multicenter collaborative study. *Pediatr Infect Dis J*. 2010;29(3):248-50.	11
Henning KJ, Pollack DM, Friedman SM. A neonatal hepatitis B surveillance and vaccination program: New York City, 1987 to 1988. *Am J Public Health*. 1992;82(6):885-8.	12
Hepburn I, Babenko N, Schade R. Chronic viral hepatitides in females of reproductive age in Ukraine. *Am J Gastroenterol*. 2011;106(Suppl 2):S422-3.	12
Hepburn I, Schade R, et al. High prevalence of chronic hepatitis B among pregnant women in Ukraine: an opportunity lost. *Hepatology*. 2011;54(Suppl 1):590A-1.	12
Hetenyi G, et al. Prevention of HBsAg positive mothers' newborns against hepatitis B infection with vaccination - economic view of countrywide program in Hungary. *Int J Gynecol Obstet.* 2009;107(Suppl 2):S633.	12
Hill LL, Hovell M, Benenson AS. Prevention of hepatitis B transmission in Indo-Chinese refugees with active and passive immunization. *Am J Prev Med*. 1991;7(1):29-32.	11
Hokama T, Yara A, Hirayama K, et al. A survey on the vaccination practice for perinatal hepatitis B virus infection at a clinic in Okinawa, Japan. *Asia Pac J Public Health*. 1998;10(1):46-8.	11
Hollinger FB. Controlling hepatitis B virus transmission in North America. The North American Regional Study Group. *Vaccine*. 1990;8(Suppl):S122-8; discussion S134-8.	12
Hong Z, Smart G, Zaniewski G, et al. Epidemiological study of hepatitis B virus infection in Manitoba, Canada, 1992-2003. *Eur J Clin Microbiol Infect Dis*. 2005;24(7):464-70.	1
Honigman B. Selected serology: pregnancy testing, hepatitis A and B, and infectious mononucleosis. *Emerg Med Clin North Am*. 1986;4(2):299-314.	3
Houweling H, Wittevrongel CF, Verweij M, et al. Public vaccination programmes against hepatitis B in The Netherlands: assessing whether a targeted or a universal approach is appropriate. *Vaccine*. 2010;28(49):7723-30.	3
Hsu HM, Chen DS, Chuang CH, et al. Efficacy of a mass hepatitis B vaccination program in Taiwan. Studies on 3464 infants of hepatitis B surface antigen-carrier mothers. *JAMA*. 1988:260(15):2231-5.	11

Appendix B. Excluded Studies

Reference	Exclusion Code
Hu Y, Zhang S, Luo C, et al. Gaps in the prevention of perinatal transmission of hepatitis B virus between recommendations and routine practices in a highly endemic region: a provincial population-based study in China. *BMC Infect Dis*. 2012;12:221.	11
Huang LM, Chang MH, Hong JY, et al. Changing aetiologic patterns of acute viral hepatitis in Taiwanese children. *J Gastroenterol Hepatol*. 1989;4(4):339-44.	12
Huang Y, Li L, Sun X, et al. Screening of pregnant women for hepatitis B virus surface antigen (HBsAg) and subsequent management, Qiandongnan prefecture, Guizhou, China, 2010. *Vaccine*. 2013;31(Suppl 9):J62-5.	11
Hutin Y, Hennessey K, Cairns L, et al. Improving hepatitis B vaccine timely birth dose coverage: lessons from five demonstration projects in China, 2005-2009. *Vaccine*. 2013;31(Suppl 9):J49-55.	12
Huynh C, Minuk GY, Uhanova J, et al. Serological and molecular epidemiological outcomes after two decades of universal infant hepatitis B virus (HBV) vaccination in Nunavut, Canada. *Vaccine*. 2017;35(35 Pt B):4515-22.	2
Ikeda RM, Birkhead GS, Flynn MK, et al. Use of multiple reporting sources for perinatal hepatitis B surveillance and follow-up. *Am J Epidemiol.* 1995;142(7):765-70.	11
Ishizaki A, Bouscaillou J, Luhmann N, et al. Survey of programmatic experiences and challenges in delivery of hepatitis B and C testing in low- and middle-income countries. *BMC Infect Dis*. 2017;17(Suppl 1):696.	12
Iwarson S. Report from Working Group 3 (the Czech Republic, Denmark, Finland, Norway, The Netherlands, Slovakia, Sweden and the UK). *Vaccine*. 1998;16(Suppl):S63-4.	3
Jain DC, Jain RK, Ichhpujani RL, et al. Prevalence of hepatitis B virus in pregnant women. *J Commun Dis*. 1994;26(4):233-4.	12
Jensen L, Heilmann C, Smith E, et al. Efficacy of selective antenatal screening for hepatitis B among pregnant women in Denmark: is selective screening still an acceptable strategy in a low-endemicity country? *Scand J Infect Dis*. 2003;35(6-7):378-82.	12
Jeong SH, Yim HW, Yoon SH, et al. Changes in the intrafamilial transmission of hepatitis B virus after introduction of a hepatitis B vaccination programme in Korea. *Epidemiol Infect*. 2010;138(8):1090-5.	6

Reference	Exclusion Code
Jessop AB, Watson B, Mazar R, et al. Assessment of screening, treatment, and prevention of perinatal infections in the Philadelphia birth cohort. *Am J Med Qual.* 2005;20(5):253-61.	12
Jimenez G, Alex G, Paxton G, et al. B alert: hepatitis B virus infection in children in Victoria. *J Paediatr Child Health*. 2013;49(3):E213-6.	11
Jindal A, Singh A, Sarin SK. Prevention of peripartum hepatitis B transmission. *N Engl J Med*. 2016;375(15):1496-7.	3
Jonas MM. Hepatitis B in pregnancy. *Liver Int*. 2009;29(9):1447-8.	3
Jonas MM, Reddy RK, DeMedina M, et al. Hepatitis B infection in a large municipal obstetrical population: characterization and prevention of perinatal transmission. *Am J Gastroenterol*. 1990;85(3):277-80.	11
Jordan R, Law M. An appraisal of the efficacy and cost effectiveness of antenatal screening for hepatitis B. *J Med Screen*. 1997;4(3):117-27.	2
Jowitt D. Contribution of hepatitis B vaccination programmes initiated by Alexander Milne and Dr Christopher Moyes to the decline in prevalence of hepatitis B infection in pregnant women in the Midlands region of the North Is, New Zealand. *N Z Med J*. 2011;124(1334):123-4.	1
Kaldor JM, Plant AJ, Thompson SC, et al. The incidence of hepatitis B infection in Australia: an epidemiological review. *Med J Aust*. 1996;165(6):322-6.	3
Kane MA, Hadler SC, Lee L, et al. The inception, achievements, and implications of the China GAVI Alliance Project on Hepatitis B Immunization. *Vaccine*. 2013;31(Suppl 9):J15-20.	3
Kane MA, Hadler SC, Margolis HS, et al. Routine prenatal screening for hepatitis B surface antigen. *JAMA*. 1988:259(3):408-9.	3
Kawabe Y, Sugiyama K, Wada Y, et al. 3-year study for the prevention of perinatal HBV infection under the standard method of the Ministry of Health and Welfare, Japan. *Acta Paediatr Jpn*. 1989;31(6):659-62.	8
Keane FE, Neale J, Phillips T, et al. Offering routine antenatal testing for HIV and hepatitis B in the rural setting of Cornwall. *Sex Transm Infect*. 2002;78(2):133-4.	12
Khan NR, Sadiq F. Prenatal screening for hepatitis B virus. *Int J Gynaecol Obstet*. 1996;55(1):79-80.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Kiel FW. Increasing compliance over five years in a hepatitis B infant immunization program in Saudi Arabia. *Ann Saudi Med*. 1991:11(4):439-42.	11
Kim JH, Kim JS, Lee JJ, et al. Survey of perinatal hepatitis B virus transmission after Korean National Prevention Program in a tertiary hospital. *Korean J Intern Med*. 2014;29(3):307-14.	11
Kim JW. Hepatitis B virus infection in South Korea: three decades after universal vaccination. *Korean J Intern Med*. 2013;28(4):408-9.	3
Klein ME. Hepatitis B virus: perinatal management. *J Perinat Neonatal Nurs*. 1988;1(4):12-23.	3
Kligman E, Kwo PY. Confirming what we believed: reducing and eliminating vertical transmission of hepatitis B. *Gastroenterology*. 2017;152(5):1239-41.	3
Ko SC, Fan L, Smith EA, et al. Estimated annual perinatal hepatitis B virus infections in the United States, 2000-2009. *J Pediatric Infect Dis Soc*. 2016;5(2):114-21.	2
Ko SC, Schillie SF, Walker T, et al. Hepatitis B vaccine response among infants born to hepatitis B surface antigen-positive women. *Vaccine*. 2014;32(18):2127-33.	11
Ko TM, Lin KH, Ho MM, et al. Perinatal transmission of hepatitis B virus in the Taoyuan area. *Taiwan Yi Xue Hui Za Zhi*. 1986;85(4):341-51.	11
Koc ÖM, Konsten S, Jansen G, et al. Influence of the ethnic status in chronic hepatitis B patients: comparing the Netherlands, Belgium and Turkey. *Hepatology*. 2015;62(Suppl 1):996A-7A.	12
Kohn MA, Farley TA, Scott C. The need for more aggressive follow-up of children born to hepatitis B surface antigen-positive mothers: lessons from the Louisiana Perinatal Hepatitis B Immunization Program. *Pediatr Infect Dis J*. 1996;15(6):535-40.	11
Kolgelier S, Sumer S, Demir NA, et al. Monitoring and treatment results of 88 HBsAg-positive pregnant women. *Clin Exp Obstet Gynecol*. 2016;43(6):866-70.	11
Komatsu H, Inui A. Chronic hepatitis B in children in the United States and Canada: international origins place the disease burden on children even in the era of universal vaccination. *Transl Pediatr*. 2016;5(1):1-4.	3
Komatsu H, Inui A, Fujisawa T, et al. Transmission route and genotype of chronic hepatitis B virus infection in children in Japan between 1976 and 2010: a retrospective, multicenter study. *Hepatol Res*. 2015;45(6):629-37.	5
Komatsu H, Inui A, Sogo T, et al. Source of transmission in children with chronic hepatitis B infection after the implementation of a strategy for prevention in those at high risk. *Hepatol Res*. 2009;39(6):569-76.	12
Koplan JP. Prenatal screening for hepatitis B. *JAMA*. 1988;259(23):3408-9.	3
Koruk I, Koruk ST, Çopur AÇ, et al. An intervention study to improve HBsAg testing and preventive practices for hepatitis B in an obstetrics hospital. *TAF Prev Med Bull*. 2011;10(3):287-92.	12
Koumans EH, Rosen J, van Dyke MK, et al. Prevention of mother-to-child transmission of infections during pregnancy: implementation of recommended interventions, United States, 2003-2004. *Am J Obstet Gynecol*. 2012;206(2):158.e1-11.	12
Koyama T, Matsuda I, Sato S, et al. Prevention of perinatal hepatitis B virus transmission by combined passive-active immunoprophylaxis in Iwate, Japan (1981-1992) and epidemiological evidence for its efficacy. *Hepatol Res*. 2003;26(4):287-92.	9
Kravchuk I, Chumak NF, Schade RR, et al. Hepatitis B in pregnancy in Ukraine: wasted chance. *J Hepatol*. 2015;62(Suppl 2):S829-30.	12
Kretzschmar M, de Wit A. Universal hepatitis B vaccination. *Lancet Infect Dis*. 2008;8(2):85-7; author reply 90.	3
Kripke C. Hepatitis B vaccine for infants of HBsAg-positive mothers. *Am Fam Physician*. 2007;75(1):49-50.	3
Krugman S. Hepatitis B virus and the neonate. *Ann N Y Acad Sci*. 1988;549:129-34.	3
Kubo A, Marks A, Lakritz D, et al. The effectiveness of immunoprophylaxis program for neonatal transmission of hepatitis B within a large HMO. *Am J Epidemiol*. 2012:175(11 Suppl):S42.	11
Kubo A, Shlager L, Corley DA. Vertical transmission of hepatitis B virus--in response. *Ann Intern Med*. 2014;161(10):763.	3
Kuehn BM. Report: too little surveillance, treatment for US patients with hepatitis B and C. *JAMA*. 2010;303(8):713-14.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Kuhn BS, Cohen SM. Care of the HBV positive mother and her infant. *Health Care Women Int*. 1986;7(4):329-40.	3
Kuncio DE, Newbern EC, Ma L, et al. Capture-recapture: using existing data sources to improve perinatal hepatitis B surveillance, Philadelphia, 2008-2014. *Public Health Rep*. 2017;132(3):376-80.	12
Kunoee A, Nielsen J, Cowan S. Hepatitis B vaccination coverage and risk factors associated with incomplete vaccination of children born to hepatitis B surface antigen-positive mothers, Denmark, 2006 to 2010. *Euro Surveill*. 2016;21(7). pii=30136.	12
Kuzmin V. Risk of sequelae after viral infection during pregnancy. *J Matern Fetal Neonatal Med.* 2014;27:154-155.	12
Ladhani SN, Flood JS, Amirthalingam G, et al. Epidemiology and clinical features of childhood chronic hepatitis B infection diagnosed in England. *Pediatr Infect Dis J*. 2014;33(2):130-5.	12
Lambert JS, et al. A 3-year review of infections in pregnancy at a busy inner city maternity hospital. *HIV Med*. 2010;11:70.	12
Langer B, Caneva MP, Schlaeder G. Routine prenatal care in Europe: the comparative experience of nine departments of gynaecology and obstetrics in eight different countries. *Eur J Obstet Gynecol Reprod Biol*. 1999;85(2):191-8.	12
Lao TT, Cheung KL, Wong V. Hepatitis B vaccine response among infants born to hepatitis B surface antigen-positive women. *Vaccine*. 2015;33(1):15-6.	12
Lao TT, Sahota DS, Suen SS, et al. Impact of neonatal hepatitis B vaccination programme on age-specific prevalence of hepatitis B infection in teenage mothers in Hong Kong. *Epidemiol Infect*. 2013;141(10):2131-9.	12
Łapiński TW, Stepaniuk J, Tomasiewicz K, et al. Effect of hepatitis B virus (HBV) infection on the course of pregnancy and newborns' health status. *Clin Exp Hepatol.* 2015;1(3):112-6.	9
Larcher VF, Bourne J, Aitken C, et al. Overcoming barriers to hepatitis B immunisation by a dedicated hepatitis B immunisation service. *Arch Dis Child*. 2001;84(2):114-9.	11
Larson E. Trends in neonatal infections. *J Obstet Gynecol Neonatal Nurs.* 1987;16(6):404-9.	3
Lavanchy D. Public health measures in the control of viral hepatitis: a World Health Organization perspective for the next millennium. *J Gastroenterol Hepatol (Aust)*. 2002;17(Suppl 4):S452-9.	3
Le ST, Sahhar L, Spring S, et al. Antenatal maternal hepatitis B care is a predictor of timely perinatal administration of hepatitis B immunoglobulin. *Intern Med J*. 2017;47(8):915-22.	11
Lee D, et al. Cost-effectiveness of antiviral prophylaxis during pregnancy to prevent perinatal hepatitis B infection in South Korea. *Value Health*. 2017;20(5):A76.	2
Lei L, et al. Economic evaluation on hepatitis B vaccination strategies for preventing mother-to-child transmission in China. *Value Health*. 2014;17(7):A805.	2
Leung N. Chronic hepatitis B in Asian women of childbearing age. *Hepatol Int*. 2009;3(Suppl 1):24-31.	3
Lewin JC. Hepatitis B in Hawaii. *Hawaii Med J.* 1988;47(1):7-8.	3
Li ZY, et al. A sero-epidemiological study on hepatitis B virus infection among pregnant women in Beijing. *Clin Microbiol Infect.* 2012;18:673-4.	12
Liang X, Bi S, Yang W, et al. Evaluation of the impact of hepatitis B vaccination among children born during 1992-2005 in China. *J Infect Dis*. 2009;200(1):39-47.	10
Lidman K, Magnius, et al. Viral hepatitis in pregnant women at term. *Scand J Infect Dis Suppl.* 1990;71:39-44.	3
Lin CC, Hsieh HS, Huang YJ, et al. Hepatitis B virus infection among pregnant women in Taiwan: comparison between women born in Taiwan and other southeast countries. *BMC Public Health*. 2008;8:49.	12
Lin CL, et al. Does positive maternal hepatitis B surface antigen state effect pregnancy outcome? *Gastroenterology*. 2012;142(5):S992.	12
Lin CL, Kao JH. Prevention of mother-to-child transmission: the key of hepatitis B virus elimination. *Hepatol Int*. 2018;12(2):94-6.	3
Lin HH, Kao JH, Chang TC, et al. Secular trend of age-specific prevalence of hepatitis B surface and e antigenemia in pregnant women in Taiwan. *J Med Virol*. 2003;69(4):466-70.	12
Lin HH, Wang LY, Hu CT, et al. Decline of hepatitis B carrier rate in vaccinated and unvaccinated subjects: sixteen years after newborn vaccination program in Taiwan. *J Med Virol*. 2003;69(4):471-4.	1

Appendix B. Excluded Studies

Reference	Exclusion Code
Liu H, et al. Preventing from mother to child transmission of hepatitis B virus infection. *Hepatol Int*. 2017;11(1):S704.	11
Liu Z, et al. An epidemiological study on clinical characteristics of chronic HBV infection during pregnancy: interim report of Shield Project. *Hepatol Int*. 2017;11(1):S271-2.	12
Loo NM, Kim WR, Larson JJ, et al. Hepatitis B screening in a US academic primary care practice. *Arch Intern Med*. 2012;172(19):1517-9.	12
Lu SN, Liu JH, Wang JH, et al. Secular trends of HBeAg prevalence among HBsAg-positive delivery mothers in a hepatitis B endemic area. *J Trop Pediatr*. 2000;46(2):121-3.	12
Luo Z, et al. Impact of the implementation of a vaccination strategy on hepatitis B virus infections in China over a 20-year period. *Int J Infect Dis.* 2012;16(2):e82-8.	3
Macinko J, Marinho de Souza Mde F, Guanais FC, et al. Going to scale with community-based primary care: an analysis of the family health program and infant mortality in Brazil, 1999-2004. *Soc Sci Med*. 2007;65(10):2070-80.	8
Mahaba HM, El-Tayeb Ael K, El-Sekibi DK, et al. Pattern of HBsAg positivity in selected groups at King Khalid General Hospital - Hail Region, Kingdom of Saudi Arabia. *J Family Community Med*. 1997;4(1):30-6.	12
Mahony JB, Chernesky MA. Vertical transmission of viral hepatitis. *Transfus Med Rev*. 1993;7(2):112-20.	3
Maini MK, Bertoletti A. HBV in 2016: global and immunotherapeutic insights into hepatitis B. *Nat Rev Gastroenterol Hepatol*. 2017;14(2):71-2.	3
Malecki JM, Guarin O, Hulbert A, et al. Prevalence of hepatitis B surface antigen among women receiving prenatal care at the Palm Beach County Health Department. *Am J Obstet Gynecol*. 1986;154(3):625-6.	12
Malhotra P, et al. Seroprevalence of hepatitis B infection during pregnancy in a tertiary care centre. *J Clin Exp Hepatol*. 2013;3(1):S50.	12
Manos M, Darbinian, et al. Variations in chronic hepatitis B screening and management among Asian-American ethnic groups in a California managed care program. *Hepatology*. 2011;54:880A-1.	12
Marillier EA, Holmes NR, Macleod AJ, et al. Direct communication with general practitioners improves management of infants at risk of hepatitis B. *Commun Dis Public Health*. 2000;3(1):63-4.	12
Marwick C. Routine screening considered to end perinatal hepatitis transmission. *JAMA*. 1987;257(15):1999.	3
Masia G, et al. An evaluation of the application and the effectiveness of preventive measures against the hepatitis viral infection in Sardinia. *J Prev Med Hyg*. 2005;46(3):108-10.	12
Masoumy EP, Stansfield BK. Breakthrough in the prevention of mother-to-child hepatitis B transmission? *J Perinatol*. 2017;37(4):333-4.	3
Massey J, Nair A, Dietz S, et al. Hospital, maternal, and birth factors associated with hepatitis B vaccination at birth - West Virginia, 2015. *Pediatr Infect Dis J.* 2018;37(7):691-6.	12
Mast EE, Mahoney FJ, Alter MJ, et al. Progress toward elimination of hepatitis B virus transmission in the United States. *Vaccine*. 1998;16(16 Suppl):S48-51.	3
Matthews HC, et al. Perinatal hepatitis B in a high prevalence inner city population: direct electronic referral improves care. *Gut.* 2012;61:A79-80.	12
McGinty DL, Toffler WL. Prenatal evaluation for hepatitis B surface antigen. *West J Med*. 1989;150(2):198.	3
McGregor K, Gonzalez, et al. Infectious diseases in pregnancy: making a difference for women who screen positive for hepatitis B in a London teaching hospital. Department of Obstetrics and Gynaecology, Royal Free London NHS Foundation Trust, London. 2017.	12
Meints L, Chescheir N. Screening for infectious diseases in pregnant, foreign-born women from multiple global areas. *J Reprod Med*. 2010;55(9-10):382-6.	12
Mercier CE, Barry SE, Paul K, et al. Improving newborn preventive services at the birth hospitalization: a collaborative, hospital-based quality-improvement project. *Pediatrics*. 2007;120(3):481-8.	12
Meyer MC, Mead PB, Capeless EL. Hepatitis B surface antigen screening in a nonindigent population. *J Reprod Med*. 1992;37(12):953-5.	12
Meyers D. Preventing neonatal hepatitis B virus infection. *J Neonatal Nurs.* 1991;10(2):11-5.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Michigan Department of Community Health. Perinatal hepatitis B prevention. *Mich Med*. 2009;108(4):17.	3
Michitaka K, Akbar F, Onji M, et al. Prevention of hepatitis B virus infection by vaccination: progress and problems. *Hepatol Res*. 2007;37(9):673-5.	3
Miller R, et al. Routine HIV and HBV antibody screening. *Br J Midwifery*. 2002;10(7):428-32.	12
Minuk GY, Zhang M, Wong SG, et al. Viral hepatitis in a Canadian First Nations community. *Can J Gastroenterol.* 2003;17(10):593-6.	12
Mittal R, et al. Health care disparity in delivering optimal care to chronic hepatitis B pregnant mothers. *Hepatology*. 2015;62:976A.	12
Mittal R, et al. Impact of clinical alerts within electronic health record on infant immunization born to CHB pregnant mothers. *Gastroenterology*. 2016;150(4):S152-S153.	12
Miyakawa Y, Yoshizawa H. Immunoprophylaxis of perinatal infection with hepatitis B virus on the national scale. *Hepatol Res*. 2006;36(4):255-8.	3
Mohan N, Kamsakul W, Wirth S, et al. Hepatitis B and C: report of the FISPGHAN working group. *J Pediatr Gastroenterol Nutr*. 2012;55(5):631-6.	3
Monna T, Kuroki T, Oka H, et al. Prevention of vertical transmission of HBV by administration of hepatitis B vaccine combined with HBIG and long-term follow-up of HBsAb titer. *Osaka City Med J*. 1988;34(1):9-17.	9
Morgan-Capner P. Viral infections in pregnancy. *Br J Hosp Med*. 1991;45(3):150-7.	3
Murray-Lyon IM. Strategies for preventing hepatitis B. *Q J Med*. 1989;71(264):277-8.	3
Myers HI, Spracklen CN, Ryckman KK, et al. A retrospective study of administration of vaccination for hepatitis B among newborn infants prior to hospital discharge at a midwestern tertiary care center. *Vaccine*. 2015;33(20):2316-21.	12
Nabulsi MM, Khalil AM, Farah AE, et al. Prevalence of hepatitis B surface antigen in pregnant Lebanese women. *Int J Gynaecol Obstet*. 1997;58(2):243-4.	12
Nair IS. Prevention of mother-to-child transmission of hepatitis B infection. *Perinatology*. 2013;14(3):114-8.	13

Reference	Exclusion Code
Nakano LA, Katayose JT, Abreu RM, et al. Assessment of the prevalence of vertical hepatitis B transmission in two consecutive generations. *Rev Assoc Med Bras (1992)*. 2018;64(2):154-8.	2
National Toxicology Program. Hepatitis B virus. *Rep Carcinog.* 2011;12:216-8.	3
Newell ML, et al. Mother-to-child transmission of hepatitis B infection. *Fetal Matern Med Rev*. 1998;10(2):109-19.	3
Newell ML, Thorne C, Pembrey L, et al. Antenatal screening for hepatitis B infection and syphilis in the UK. *Br J Obstet Gynaecol*. 1999;106(1):66-71.	12
Ni YH, Huang LM, Chang MH, et al. Two decades of universal hepatitis B vaccination in Taiwan: impact and implication for future strategies *Gastroenterology*. 2007;132(4):1287-93.	12
Niederau C, Amani A, Thiel A. Long-term follow-up of HBsAg-positive patients in Germany. *Eur J Gastroenterol Hepatol*. 2016;28(1):48-56.	6
Noto H, Terao T, Ryou S, et al. Combined passive and active immunoprophylaxis for preventing perinatal transmission of the hepatitis B virus carrier state in Shizuoka, Japan during 1980-1994. *J Gastroenterol Hepatol*. 2003;18(8):943-9.	11
O'Connell K, Cormican M, Hanahoe B, et al. Prevalence of antenatal hepatitis B virus carriage in the west of Ireland. *Ir Med J*. 2010;103(3):91-2.	12
O'Leary ST, Nelson C, Duran J. Maternal characteristics and hospital policies as risk factors for nonreceipt of hepatitis B vaccine in the newborn nursery. *Pediatr Infect Dis J*. 2012;31(1):1-4.	12
Oats JJ. Routine antenatal screening: a need to evaluate Australian practice. *Med J Aust*. 2000;172(7):311-2.	3
Okun NB, Larke RP, Waters JR, et al. Success of a program of routine prenatal screening for hepatitis B surface antigen: the first 2 years. *CMAJ.* 1990;143(12):1317-21.	11
Ona S, et al. Sexually tramsmitted infection screening and follow-up in a high-risk urban obstetric clinic. *Sex Transm Infect.* 2015;91:A164.	12
Op de Coul EL, Hahné S, van Weert YW, et al. Antenatal screening for HIV, hepatitis B and syphilis in the Netherlands is effective. *BMC Infect Dis*. 2011;11:185.	12
Osterholm MT. Hepatitis B infection in Minnesota: a case for universal immunization. *Pediatr Infect Dis J*. 1998;17(7 Suppl):S30-4.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Otgonbayar B, et al. Mother to child transmission of HBV and HCV in Mongolia. *Hepatol Int*. 2015;9(1):S32.	11
Ozaras R, Balkan II, Yemisen M, et al. Elimination of mother-to-child transmission of hepatitis B. *Lancet Infect Dis*. 2016;16(1):20-1.	3
Ozsoylu S. Prevention of perinatal transmission of hepatitis B virus infection. *Am J Dis Child*. 1993;147(6):610-1.	9
Pan CQ, Han G, Wang W. Prevention of peripartum hepatitis B transmission. *N Engl J Med*. 2016;375(15):1497-8.	3
Panaretto KS, Mitchell MR, Anderson L, et al. Sustainable antenatal care services in an urban Indigenous community: the Townsville experience. *Med J Aust*. 2007;187(1):18-22.	12
Panda SK, Gupta A, Datta R, et al. Transplacental transmission of hepatitis B virus. *Lancet*. 1986;2(8512):919-20.	11
Pantazis KD, Elefsiniotis IS, Brokalaki H. New data concerning the epidemiology of hepatitis B virus infection in Greece. *Gastroenterol Res Pract*. 2008;2008:580341.	3
Papaevangelou G. Hepatitis B immunization programme: lessons learnt in Greece. *Vaccine*. 1998;16(Suppl):S45-7.	12
Papaevangelou V, Hadjichristodoulou C, Cassimos D, et al. Adherence to the screening program for HBV infection in pregnant women delivering in Greece. *BMC Infect Dis*. 2006;6:84.	12
Park NH, Chung YH, Lee HS. Impacts of vaccination on hepatitis B viral infections in Korea over a 25-year period. *Intervirology*. 2010;53(1):20-8.	3
Parker PJ, Gyorkos TW, Dylewski JS, et al. Prevention of perinatal hepatitis B virus transmission in an obstetric/infant population. *Can J Infect Dis.* 1993;4(5):288-91.	11
Paul C, Thomas M. Screening for hepatitis B carriers: a perspective from New Zealand. *Aust N Z J Med*. 1997;27(6):698-705.	3
Petermann S, Ernest JM. Intrapartum hepatitis B screening. *Am J Obstet Gynecol*. 1995;173(2):369-73; discussion 373-4.	12
Petersen J. HBV treatment and pregnancy. *J Hepatol*. 2011;55(6):1171-3.	3
Pierce RL, Smith S, Rowe-West B, et al. Hepatitis B maternal screening, infant vaccination, and infant prophylaxis practices in North Carolina. *Arch Pediatr Adolesc Med*. 1999;153(6):619-23.	12

Reference	Exclusion Code
Plitt SS, Somily AM, Singh AE. Outcomes from a Canadian public health prenatal screening program for hepatitis B: 1997-2004. *Can J Public Health*. 2007;98(3):194-7.	11
Polakoff S. Immunoprophylaxis of infants born to hepatitis B virus exposed mothers. *Arch Dis Child*. 1986;61(12):1242-7.	3
Polatti F, et al. The value of serologic screening for hepatitis B virus in pregnancy for the control of HBV infection. *Ital J Gynaecol Obstet*. 1996;8(3):99-102.	11
Pongpipat D. Prevention of hepatitis B virus infections. *Asian Pac J Allergy Immunol*. 1986;4(1):1-3.	3
Poovorawan Y. Success of Thai universal immunization program in preventing perinatal hepatitis B virus infection. *Hepatol Res*. 2010;40(7):726.	8
Poovorawan Y, Chongsrisawat V, Theamboonlers A, et al. Evidence of protection against clinical and chronic hepatitis B infection 20 years after infant vaccination in a high endemicity region. *J Viral Hepat*. 2011;18(5):369-75.	9
Poovorawan Y, Sanpavat S, Pongpunlert W, et al. Protective efficacy of a recombinant DNA hepatitis B vaccine in neonates of HBe antigen-positive mothers. *JAMA*. 1989;261(22):3278-81.	9
Porgo TV, Gilca V, De Serres G, et al. Dramatic reduction in hepatitis B through school-based immunization without a routine infant program in a low endemicity region. *BMC Infect Dis*. 2015;15:227.	8
Poustchi H, Ostovaneh, et al. Impact of universal neonatal immunization to prevent mother-to-infant transmission of HBV. *Hepatol Int*. 2013;7:S262.	11
Pressman A, et al. Vertical transmission of hepatitis B virus (HBV) due to immunization failure: a United States (US) population study. *J Hepatol*. 2012;56:S190.	11
Przybilla J, Johnson A, Hooker C. Perinatal hepatitis B prevention: adapting Public Health Services to meet the changing needs of a diverse community. *Public Health Rep*. 2009;124(3):454-7.	12
Pujol FH, Rodríguez I, Martínez N, et al. Viral hepatitis serological markers among pregnant women in Caracas, Venezuela: implication for perinatal transmission of hepatitis B and C. *Gen*. 1994;48(1):25-8.	12
Puliyel J. Vaccine uptake rather than disease mitigation seems to be aim of universal hepatitis B vaccination in the UK. *BMJ*. 2013;347:f5187.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Punzalan CM, et al. Factors associated with immunoprophylaxis failure against vertical transmission of hepatitis B virus among a cohort of New York City children and mothers. *Hepatology*. 2012;56:638A.	11
Punzalan C, et al. Changing trends in the evaluation and management of pregnant women chronically infected with hepatitis B virus (HBV) in a New York city public health network, 2004-2010. *Hepatology*. 2011;54:885A.	12
Qin G, Zhuang X. Cost-effectiveness of augmenting current perinatal hepatitis B prevention program with maternal antiviral therapy. *Hepatology*. 2017;65(3):1074-5.	3
Qirbi N, Hall AJ. Epidemiology of hepatitis B virus infection in the Middle East. *East Mediterr Health J.* 2001;7(6):1034-45.	3
Qirko R, et al. Evaluation of hepatitis B infection in pregnancy and fetal outcome. *J Perinat Med*. 2013;41.	12
Quak SH. Hepatitis B vaccination programme in Singapore. *Sing Paediatr J*. 2001;43(4):124-5.	12
Radoń-Pokracka M, Piasecki M, Lachowska A, et al. Assessment of the implementation of the infectious diseases screening programmes among pregnant women in the Lesser Poland region and comparison with similar programmes conducted in other European Union countries. *Ginekol Pol*. 2017;88(3):151-155.	12
Rahim MN, et al. Outcomes of screening for hepatitis B virus during pregnancy. *Gut*. 2016;65:A271.	12
Raimondo G, Tanzi E, et al. HBV transmission from mother to offspring. *J Prev Med Hyg*. 1993;34(1-2):9-10.	11
Rajbhandari R, Barton, Juncadella AC, et al. Discontinuity of care for mothers with chronic hepatitis B diagnosed during pregnancy. *J Viral Hepat*. 2016;23(7):561-8.	12
Rajbhandari R, Juncadella AC, et al. Inadequate hepatitis B care in mothers after pregnancy. *Hepatology*. 2014;60:945A.	12
Ramia S, Arif M. Perinatal transmission of hepatitis B virus infection: a recommended strategy for prevention and control. A review. *Br J Obstet Gynaecol*. 1991;98(2):141-6.	3
Rani M. Progress in hepatitis B vaccination and its impact on hepatitis B transmission in the Western Pacific region. *Hepatol Res*. 2010;40(7):726-7.	3
Read JS, Cannon MJ, Stanberry LR, et al. Prevention of mother-to-child transmission of viral infections. *Curr Probl Pediatr Adolesc Health Care*. 2008;38(9):274-97.	3
Reekie J, Gidding HF, Kaldor JM, et al. Country of birth and other factors associated with hepatitis B prevalence in a population with high levels of immigration. *J Gastroenterol Hepatol*. 2013;328(9):1539-44.	12
Reznik RB. A hepatitis B vaccination programme for inner metropolitan Sydney neonates. *Med J Aust*. 1991;155(3):153-6.	11
Roome A, Rak M, Hadler J. Follow-up of infants of hepatitis B-infected women after hepatitis B vaccination, Connecticut, 1994 to 1997. *Pediatr Infect Dis J*. 2000;19(6):573-5.	11
Ropero Álvarez AM, Pérez-Vilar S, Pacis-Tirso C, et al. Progress in vaccination towards hepatitis B control and elimination in the Region of the Americas. *BMC Public Health*. 2017;17(1):325.	8
Ross JW. Prenatal screening for hepatitis B antigen. *JAMA*. 1989;261(12):1727-8.	12
Roure C. Overview of epidemiology and disease burden of hepatitis B in the European region. *Vaccine*. 1995;13(Suppl 1):S18-21.	12
Rushworth RL, Bell SM, Morrell S, et al. Validation of hepatitis B surveillance data. *Aust N Z J Public Health*. 1997;21(2):217.	12
Russell WJ. A retrospective study of the management of HIV, hepatitis B and hepatitis C-positive pregnancies in Edinburgh, UK from 1997-2002. *McGill J Med*. 2004;7(2):135-142.	11
Ryoo, YG, Chang YH, Choi GS, et al. Hepatitis B viral markers in pregnant women and newborn infants in Korea. *Korean J Intern Med*. 1987;2(2):258-68.	11
Sahhar L, et al. Prevention of vertical transmission of hepatitis B: an evaluation of adherence rates and risk factors for failure to provide immunoprophylaxis therapy in a single Australian centre. *J Hepatol*. 2015;62:S544.	12
Sainato RJ, Simmons EG, Muench DF, et al. Management of infants born to women infected with hepatitis B in the military healthcare system. *BMC Res Notes*. 2013;6:338.	11
Salemi JL, Spooner KK, Mejia de Grubb MC, et al. National trends of hepatitis B and C during pregnancy across sociodemographic, behavioral, and clinical factors, United States, 1998-2011. *J Med Virol*. 2017;89(6):1025-32.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Salihu HM, Connell L, Salemi JL, et al. Prevalence and temporal trends of hepatitis B, hepatitis C, and HIV/AIDS co-infection during pregnancy across the decade, 1998-2007. *J Womens Health (Larchmt).* 2012;21(1):66-72.	12
Salkin IF. Letter from America: incidence of acute hepatitis B in the United States, 1990-2002. *AIDS Hepatitis Dig.* 2004;6(100):6.	3
Sapuri M, Babona DM, Klufio CA, et al. Hepatitis B surface and e antigen seropositivity in mothers and cord blood at Port Moresby General Hospital: implications for a control program. *P N G Med J*. 1991;34(4):234-7.	12
Sarkar M, Terrault NA. Ending vertical transmission of hepatitis B: the third trimester intervention. *Hepatology*. 2014;60(2):448-51.	3
Satodia P, Owoeye, et al. Maternal hepatitis B-does an integrated care pathway help in achieving complete immunisation schedule in babies? *Arch Dis Child Fetal Neonatal Ed.* 2014;99:A30.	11
Schalm SW, Mazel JA, de Gast GC, et al. Prevention of hepatitis B infection in newborns through mass screening and delayed vaccination of all infants of mothers with hepatitis B surface antigen. *Pediatrics*. 1989;83(6):1041-8.	9
Schalm SW, Pit-Grosheide P. Prevention of hepatitis B transmission at birth. *Lancet*. 1989;1(8628):44.	3
Schillie S, Walker T, Veselsky S, et al. Outcomes of infants born to women infected with hepatitis B. *Pediatrics*. 2015;135(5):e1141-7.	11
Schiraldi O, Dentico P. Virus B hepatitis and pregnancy. The fetus as a patient '88: Proceedings of the 4th International Symposium "The Fetus as a Patient" held in Bari, Italy, 22-24 September 1988 (International congress series): Excerpta Medica; 1989. p. 167-74.	11
Schoen EJ. Special perinatal services in a large health maintenance organization. *Curr Opin Pediatr*. 1996;8(2):188-93.	12
Schultz R, Romanes F, Krause V. Hepatitis B prevalence and prevention: antenatal screening and protection of infants at risk in the Northern Territory. *Aust N Z J Public Health*. 2008;32(6):575-6.	12
Schwarz KB. More lessons from the Taiwanese hepatitis B virus vaccine program. *J Infect Dis*. 2012;205(5):702.	3
Sekla LH, Hammond G, Stackiw W, et al. Testing pregnant women for HBsAg: a pilot study in Manitoba. *Can Dis Wkly Rep*. 1988;14(31):137-40.	12
Sellier P, Lopes A, Bergmann JF, et al. Vertical transmission of hepatitis B virus. *Ann Intern Med*. 2014;161(10):762-3.	3
Sharts-Hopko NC. Preventing hepatitis B in infants. *Am J Matern Child Nurs.* 1992;17(6):336.	3
Shiraki K. Blocking of mother-to-infant transmission of hepatitis B virus. *Asian Med J.* 1988;31(6):348-54.	12
Siney C. Routine antenatal hepatitis B (HBV) screening. *MIDIRS Midwifery Dig.* 1999;9(4):443-4.	3
Smith N, Yusuf H, Averhoff F. Surveillance and prevention of hepatitis B virus transmission. *Am J Public Health*. 1999;89(1):11-13.	3
Spada E, Tosti ME, Zuccaro O, et al; Collaborating Study Group. Evaluation of the compliance with the protocol for preventing perinatal hepatitis B infection in Italy. *J Infect*. 2011;62(2):165-71.	12
Specialist Panel on Chronic Hepatitis B in the Middle East. A review of chronic hepatitis B epidemiology and management issues in selected countries in the Middle East. *J Viral Hepat*. 2012;19(1):9-22.	3
Steben M. HBV Screening during pregnancy. *Can Fam Physician*. 1989;35:470-2.	3
Stevens CE. Perinatal hepatitis B virus infection: screening of pregnant women and protection of the infant. *Ann Intern Med*. 1987;107(3):412-3.	3
Stratton LE, et al. Improving referral of women with chronic hepatitis B from antenatal services to a specialist hepatitis clinic: the Northern Ireland experience. *J Hepatol*. 2015;62:S550.	12
Stroffolini T, Bianco E, Szklo A, et al. Factors affecting the compliance of the antenatal hepatitis B screening programme in Italy. *Vaccine*. 2003;21(11-12):1246-9.	12
Stroffolini T, Pasquini P. Five years of vaccination campaign against hepatitis B in Italy in infants of hepatitis B surface antigen carrier mothers. *Ital J Gastroenterol*. 1990;22(4):195-7.	12
Stroffolini T, Pasquini P, Mele A. A nationwide vaccination programme in Italy against hepatitis B virus infection in infants of hepatitis B surface antigen-carrier mothers *Vaccine*. 1989;7(2):152-4.	12

Appendix B. Excluded Studies

Reference	Exclusion Code
Stroffolini T, Pasquini, Mele A. HBsAg carriers among pregnant women in Italy: results from the screening during a vaccination campaign against hepatitis B. *Public Health*. 1988;102(4):329-33.	12
Struve J. Hepatitis B virus infection among Swedish adults: aspects on seroepidemiology, transmission, and vaccine response. *Scand J Infect Dis Suppl.* 1992;82:1-57.	12
Su WJ, Chen HL, Chang MH. Breakthrough hepatitis B virus (HBV) infection from mother-to-infant transmission is the key problem hindering HBV eradication. *J Infect Dis*. 2013;208(6):1036-7.	3
Su WJ, Liu CC, Liu DP, et al. Effect of age on the incidence of acute hepatitis B after 25 years of a universal newborn hepatitis B immunization program in Taiwan. *J Infect Dis*. 2012;205(5):757-62.	12
Su WJ, et al. Reduction of the incidence of acute hepatitis B after universal hepatitis B immunization program in Taiwan. *Hepatol Int*. 2010;4(1):104.	12
Sugiura T, et al. Implementation of a new protocol to prevent mother-to-child transmission of hepatitis B virus infection in Japan. *J Pediatr Gastroenterol Nutr*. 2016;63:S204-5.	11
Sugiyama A, Ohisa M, Nagashima S, et al. Reduced prevalence of hepatitis B surface antigen positivity among pregnant women born after the national implementation of immunoprophylaxis for babies born to hepatitis B virus-carrier mothers in Japan. *Hepatol Res*. 2017;47(12):1329-34.	12
Sugiyama H, et al. Factors in vertical transmission of HBV. *Acta Paediatr Jpn.* 1986;28(3):317-22.	3
Sun HY, Ko WC, Tsai JJ, et al. Seroprevalence of chronic hepatitis B virus infection among Taiwanese human immunodeficiency virus type 1-positive persons in the era of nationwide hepatitis B vaccination. *Am J Gastroenterol*. 2009;104(4):877-84.	6
Sung JL. Hepatitis B virus eradication strategy for Asia. The Asian Regional Study Group. *Vaccine*. 1990;8(Suppl):S95-9.	12
Sweet LE, Brown MG, Lee SH, et al. Hepatitis B prenatal screening survey, Nova Scotia, 1990-1991. *Can J Public Health*. 1993;84(4):279-82.	12
Tada H, Uga N, Fuse Y, et al. Prevention of perinatal transmission of hepatitis B virus carrier state. *Acta Paediatr Jpn*. 1992;34(6):656-9.	9
Tada H, et al. Combined passive and active immunization for preventing perinatal transmission of hepatitis B virus carrier state. *Acta Paediatr Jpn.* 1986;28(3):306-1.	9
Takahashi K, Kobayashi J, Sugiura Y. The relevance of Japan's hepatitis vaccine policy to national hepatitis B prevention and control. *J Public Health Policy*. 2012;33(1):136-8.	3
Takano T, Tajiri H, Hosono S. Natural history of chronic hepatitis B virus infection in children in Japan: a comparison of mother-to-child transmission with horizontal transmission. *J Gastroenterol*. 2017;52(9):1041-50.	1
Tam FK, et al. Antenatal hepatitis B screening in women from the Mainland China versus local residents. *Hepatol Int*. 2009;3(1):128.	12
Tan SS, Chua A. Preventing mother-to-child transmission of hepatitis B virus - a success story which can be enhanced. *Med J Malaysia*. 2013;68(2):103-4.	3
Tang JR, Hsu HY, Lin HH. Hepatitis B surface antigenemia at birth: a long-term follow-up study. *J Pediatr*. 1998;133(3):374-7.	11
Tao G, et al. Suboptimal prenatal testing for syphilis and other STDs among commercially-insured women in the United States, 2013. *Sex Transm Infect*. 2015;91:A154-5.	12
Tash E, Cacciottolo T, Wright N, et al. Hepatitis B prevalence in a multi-ethnic community in South England: a 3 year retrospective study. *Public Health*. 2014;128(8):764-5.	12
Taylor MJ, Liversedge H, et al. Implementation of an NHS first trimester screening clinic. *Ultrasound*. 2008;16(2):105-9.	12
Tehami N, et al. Outcome of the management of hepatitis B infection in pregnancy. *Gut*. 2011;60:A248-9.	12
Tekin Koruk S, Batirel A, Kose S, et al. Evaluation of hepatitis B virus transmission and antiviral therapy among hepatitis B surface antigen-positive pregnant women. *J Obstet Gynaecol Res*. 2015;41(12):1870-6.	9
Terrault NA, Lok AS, McMahon BJ, et al. Update on prevention, diagnosis, and treatment of chronic hepatitis B: AASLD 2018 hepatitis B guidance. *Hepatology*. 2018;67(4):1560-99.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Thanuntaseth C, Theppisai U, Chiewsilp P, et al. Prevalence of HBe Ag (hepatitis B e antigen) and anti-HBe (anti-hepatitis B e) in asymptomatic HBs Ag carrier mothers and HBV infection in their families. *J Med Assoc Thai*. 1988;71(Suppl 1):98-101.	12
Thies N. Universal neonatal immunization for hepatitis B. *J Paediatr Child Health*. 2002;38(2):211; author reply 211-2.	3
Thomas AR, Fiore AE, Corwith HL, et al. Hepatitis B vaccine coverage among infants born to women without prenatal screening for hepatitis B virus infection: effects of the Joint Statement on Thimerosal in Vaccines. *Pediatr Infect Dis J*. 2004;23(4):313-8.	12
Thompson SC. Perinatal transmission of hepatitis B virus: an Australian experience. *Med J Aust*. 2009;191(6):357; author reply 357.	3
Thompson SC, Oman K. Why should Australia adopt universal infant hepatitis B vaccination? *Aust N Z J Public Health*. 1996;20(4):436-9.	3
Thompson SC, Stevenson E, Wilby R, et al. Hepatitis B infection in Victoria 1992: time to review the high-risk vaccination strategy. *Med J Aust*. 1993;159(8):562-3.	12
Thursz M, Njie R, Lemoine M. Hepatitis: global eradication of hepatitis B--feasible or fallacy? *Nat Rev Gastroenterol Hepatol*. 20129(9):492-4.	3
Thye HM, deCosta C. Screening for hepatitis B in antenatal patients. *Med J Aust*. 1987;147(4):202.	12
Torii Y, Kimura H, Hayashi K, et al. Causes of vertical transmission of hepatitis B virus under the at-risk prevention strategy in Japan. *Microbiol Immunol*. 2013;57(2):118-21.	11
Torii Y, Kimura H, Ito Y, et al. Clinicoepidemiologic status of mother-to-child infections: a nationwide survey in Japan. *Pediatr Infect Dis J*. 2013;32(6):699-701.	11
Tormans G, Van Damme P, Carrin G, et al. Cost-effectiveness analysis of prenatal screening and vaccination against hepatitis B virus--the case of Belgium. *Soc Sci Med*. 1993;37(2):173-81.	2
Tran TT. Hepatitis B virus in pregnancy. *Clin Liver Dis*. 2013;2(1):29-33.	3
Tran TT, et al. Management of the pregnant hepatitis B patient. *Curr Hepat Rep*. 2008;7(1):12-7.	3
Tran TT, Martin P. Hepatitis B: epidemiology and natural history. *Clin Liver Dis*. 2004;8(2):255-66.	3
Tuinakelo LR, Tayler-Smith K, Khogali M, et al. Prevalence of anaemia, syphilis and hepatitis B in pregnant women in Nausori, Fiji. *Public Health Action*. 2013;3(1):72-5.	12
Turine-Neto P, Figueiró-Filho EA, et al. Frequency of sexually transmitted diseases in pregnant women from Brazil. *Int J Gynecol Obstet.* 2009;107:S574.	12
Ugbebor OU, et al. Risk reduction approach for the prevention of maternal-infant transmission of viral hepatitis B in high endemic areas. *J Clin Exp Hepatol*. 2013;3(1):S48.	11
Umar M, Hamama-Tul-Bushra, Umar S, et al. HBV perinatal transmission. *Int J Hepatol*. 2013;2013:875791.	3
Van Damme P, Leuridan E, Hendrickx G, et al. Should Europe have a universal hepatitis B vaccination programme? *BMJ.* 2013;347:f4057.	3
van Schalkwyk J, Nourmoussavi M, Massey A, et al. Missed opportunities for prevention of perinatal transmission of hepatitis B: a retrospective cohort study. *Can J Gastroenterol Hepatol.* 2014;28(10):525-8.	11
van Steenbergen JE, Baayen D, Peerbooms PG, et al. Much gained by integrating contact tracing and vaccination in the hepatitis B antenatal screening program in Amsterdam, 1992-1999. *J Hepatol.* 2004;40(6):979-85.	12
van Steenbergen JE, Leentvaar-Kuijpers, Baayen D, et al. Evaluation of the hepatitis B antenatal screening and neonatal immunization program in Amsterdam, 1993-1998. *Vaccine*. 2001;20(1-2):7-11.	11
Vegnente A, Iorio R, de Rosa E. Universal hepatitis B immunization: the dose of HBIg that should be administered at birth. *Pediatrics*. 1994;94(2 Pt 1):242-3.	3
Ramanan PV, Premkumar S, Khanna P, et al. Seroconversion rate after postnatal immunoprophylaxis for exposed infants in prevention of hepatitis B vertical transmission. *J Trop Pediatr*. 2011;57(5):399.	4
Walker TY, Smith EA, Fenlon N, et al. Characteristics of pregnant women with hepatitis B virus infection in 5 US public health jurisdictions, 2008-2012. *Public Health Rep*. 2016;131(5):685-94.	12
Walz A, Wirth S, Hucke J, et al. Vertical transmission of hepatitis B virus (HBV) from mothers negative for HBV surface antigen and positive for antibody to HBV core antigen. *J Infect Dis*. 2009;200(8):1227-31.	11

Appendix B. Excluded Studies

Reference	Exclusion Code
Wang AL, Qiao YP, Wang LH, et al. Integrated prevention of mother-to-child transmission for human immunodeficiency virus, syphilis and hepatitis B virus in China. *Bull World Health Organ*. 2015;93(1):52-6.	12
Wang F, Zhang G, Zheng H, et al. Post-vaccination serologic testing of infants born to hepatitis B surface antigen positive mothers in 4 provinces of China. *Vaccine*. 2017;35(33):4229-35.	11
Wang F, Zheng H, Zhang G, et al. Effectiveness of prevention of mother-to-child transmission practice in three provinces of Southern China. *Hum Vaccin Immunother*. 2015;11(8):2061-7.	11
Wang SH, et al. Comprehensive management of pregnant hepatitis B patients in a community health setting: the Hepatitis B Moms Program. *Hepatology*. 2012;56:360A.	12
Ward JW, Byrd KK. Hepatitis B in the United States: a major health disparity affecting many foreign-born populations. *Hepatology*. 2012;56(2):419-21.	3
Waters JR. Universal prenatal screening for hepatitis B, Alberta, 1985-1988. *Can Dis Wkly Rep.* 1989;15(6):29-32.	12
Waters VV. Prevalence of hepatitis B in pregnant women. *JAMA*. 1992;267(14):1919; author reply 1920.	3
Weerasinghe I, Bannister N, Huang V, et al. The role of the patient-centered medical home in addressing hepatitis B perinatal transmission: Charles B. Wang Community Health Center's Hep B Moms Program. *AAPI Nexus.* 2014;12(1-2):140-60.	12
Weis N, Cowan S, Hallager S, et al. Vertical transmission of hepatitis B virus during pregnancy and delivery in Denmark. *Scand J Gastroenterol*. 2017;52(2):178-84.	11
Wendland A, Ehmsen BK, Lenskjold V, et al. Undocumented migrant women in Denmark have inadequate access to pregnancy screening and have a higher prevalence hepatitis B virus infection compared to documented migrants in Denmark: a prevalence study. *BMC Public Health*. 2016;16:426.	12
West DJ, Margolis HS. Prevention of hepatitis B virus infection in the United States: a pediatric perspective. *Pediatr Infect Dis J*. 1992;11(10):866-74.	3
White CB, Pratt SR, Bass JW, et al. Prenatal screening for hepatitis B infection in the military population in Hawaii. *Pediatr Infect Dis J*. 1988;7(2):138-40.	12
Willis BC, Wortley P, Wang SA, et al. Gaps in hospital policies and practices to prevent perinatal transmission of hepatitis B virus. *Pediatrics*. 2010;125(4):704-11.	12
Wiseman E, Fraser MA, Holden S, et al. Perinatal transmission of hepatitis B virus: an Australian experience. *Med J Aust*. 2009;190(9):489-92.	11
Withers J, Bradshaw E. Preventing neonatal hepatitis-B infection. *Am J Matern Child Nurs*. 1986;11(4):270-2.	3
Wong WC, Tsang KK. A mass hepatitis B vaccination programme in Taiwan: its preparation, results and reasons for uncompleted vaccinations. *Vaccine*. 1994;12(3):229-34.	11
Wood N, Warlow M, Quinn H, et al. Establishment of a surveillance system (utilising Midwifes Data Collection Systems) for monitoring the impact of hepatitis B vaccination on the population prevalence of chronic hepatitis B virus infection in Australia. *Aust N Z J Public Health*. 2008;32(3):272-5.	12
Wozniak TM, Smith M, Maher L. Hepatitis B. *N S W Public Health Bull*. 2013;24(2):94.	3
Wu CH, Hsu TY, Kung FT, et al. Changes in the prevalence of HBsAg and HBeAg: a study of 8696 parturients in a well vaccinated area. *Sci Rep*. 2017;7(1):1212.	8
Wu DY, et al. Inadequate treatment of chronic hepatitis B in pregnant women at high risk for vertical transmission. *Hepatology*. 2015;62:1001A.	12
Xiaoyan Wet al. Analysis of testing and infection status of hepatitis B among maternities during 2012-2014 in China. *Hepatol Int*. 2017;11(1):S32.	12
Xu Y, et al. The next step in controlling HBV in China: focus on preventing perinatal transmission of the virus. *BMJ.* 2013;347(7918).	3
Yang M, et al. Five years epidemiological trends and virological traits of hepatitis B virus infection in pregnant women and neonates. *Hepatol Int*. 2017;11(1):S72-3.	11
Yano M, et al. Prevention of HBV mother-infant transmission. *Acta Paediatr Jpn.* 1986;28(3):300-5.	9
Yao JL. Perinatal transmission of hepatitis B virus infection and vaccination in China. *Gut*. 1996;38(Suppl 2):S37-8.	3
Yap PS, Moons V. Hepatic problems during pregnancy. *Neth J Med*. 2002;60(9):340-2.	3

Appendix B. Excluded Studies

Reference	Exclusion Code
Yee Leung NW. How to prevent HBV infection in infants born to high viraemic carriers. *J Gastroenterol Hepatol*. 2012;27:25.	3
Yeh CT, Lai MW. Eliminating hepatitis B virus through neonatal vaccination: can we make it? *J Hepatol*. 2012;57(3):484-5.	3
Yeo Y, Gwack J, Kang S, et al. Viral hepatitis and liver cancer in Korea: an epidemiological perspective. *Asian Pac J Cancer Prev*. 2013;14(11):6227-31.	3
Yonghao G, Pumei D, Jianhui Y, et al. A retrospective study of hepatitis B mother-to-child transmission prevention and postvaccination serological test results of infants at risk of perinatal transmission in two counties of middle China. *J Viral Hepat*. 2017;24(8):687-95.	9
Yoo KY. Viral hepatitis and liver cancer in Korea: an epidemiologic perspective. *Hepatol Int*. 2012;6(1):10.	12
Yoshizawa H. Trends of hepatitis virus carriers; *Hepatol Res*; 2002;24(Suppl 1):S28-39.	12
Yusuf HR, Mahoney FJ, Shapiro CN, et al. Hospital-based evaluation of programs to prevent perinatal hepatitis B virus transmission. *Arch Pediatr Adolesc Med*. 1996;150(6):593-7.	12
Zahirovic A, et al. Comparation of congenital and perinatal infections in Bosnia as increasing number in last decade. *Intensive Care Med*. 2011;37:S436.	3
Zanetti AR. Maternal-neonatal transmission of hepatitis B virus. Epidemiology and prevention. *Ann Ist Super Sanita*. 1987;24(2):277-84.	3
Zhai X, et al. Prevention of perinatal transmission of hepatitis B: a retrospective cohort study in China. *Hepatology*. 2015;62:982A.	11
Zhang F, Zhang Y. Perinatal transmission of hepatitis B virus: could hospitals be doing more? *Exp Rev Anti Infect Ther.* 2010;8(7):735-8.	3
Zhang L, Gui X, Wang B, et al. A study of immunoprophylaxis failure and risk factors of hepatitis B virus mother-to-infant transmission. *Eur J Pediatr*. 2014;173(9):1161-8.	11
Zhang L, Ko S, Lv J, et al. Perinatal hepatitis B prevention program in Shandong Province, China. Evaluation and progress. *Hum Vaccin Immunother*. 2014;10(9):2755-60.	12
Zhao Z, Murphy TV, Jacques-Carroll L. Progress in newborn hepatitis B vaccination by birth year cohorts-1998-2007, USA. *Vaccine*. 2011;30(1):14-20.	12
Zhou Y, He H, Deng X, et al. Significant reduction in notification and seroprevalence rates of hepatitis B virus infection among the population of Zhejiang Province, China, aged between 1 and 29 years from 2006 to 2014. *Vaccine*. 2017;35(34):4355-61.	12
Zimmerman R. Prenatal screening for hepatitis B. *J Fam Pract*. 1990;30(4):392-3.	3
Zuckerman E, et al. Hepatitis B virus infection after the implementation of the vaccine program in Israel. *Hepatology*. 2017;66:1030A-1.	12