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Systematic Review

Effectiveness of Hepatitis B Vaccination on Various Populations: A Systematic Review

Dewi Ratna Sulistina[1,2*]

[1] Doctoral Study Program, Faculty of Public Health, Airlangga University, Surabaya, East Java, Indonesia
[2] Sports Science Department, Faculty of Sport Science, State University of Malang, East Java, Indonesia

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CORRESPONDING AUTHOR
Dewi Ratna Sulistina
dewi.ratna.fik@um.ac.id
Doctoral Study Program, Faculty of Public Health, Airlangga University, Surabaya, East Java, Indonesia; Sports Science Department, Faculty of Sport Science, State University of Malang, East Java, Indonesia

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ABSTRACT

Introduction: Hepatitis B vaccination is important to protect individuals from Hepatitis B virus (HBV) infection. The aim of this study was to conduct a systematic review of the necessity of Hepatitis B vaccination among humans, especially among infants, children, teenagers, adults, risk groups, and health care workers.

Methods: Three databases were used in this study, Scopus, Web of Science, and PubMed. We reported the study using PRISMA-P guidelines. The keywords were used in this study (TITLE-ABS-KEY (vaccine) AND TITLE-ABS-KEY (hepatitis AND b) AND TITLE-ABS-KEY (boost)), and we obtained 275 articles. In the web of science, we used ((ALL=(vaccine)) AND ALL= (Hepatitis B)) AND ALL=(Boost), and we obtained 374 articles. In the PubMed, we used ((Vaccine [MeSH Terms]) AND (Hepatitis b [MeSH Terms])) AND (booster immunization [MeSH Terms]), and we obtained 417 articles.

Results: There were 60 articles included in this systematic review. The systematic review results showed that infants, children, and teenagers, as well as adult groups who receive the hepatitis B vaccine, can protect for 5-30 years. Meanwhile, risk group and health care workers were suggested to obtain hepatitis B vaccine booster with low anti-HBsAg titer

Conclusion: It needs to conduct anti-HBs Ag titer testing to decide whether they need a hepatitis B vaccination booster. Hepatitis B vaccine booster required for the group with anti-HBs Ag titer less than 10 mIU/mL.

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INTRODUCTION

Infection with the hepatitis B virus is a significant global health issue. 350–400 million individuals worldwide have Hepatitis B, which affects one-third of the world's population. In Indonesia, between 4.0 and 20.3% of the healthy population have Hepatitis B. In Indonesia, genotype B (66 percent) of the hepatitis B virus predominates, followed by genotypes C (26 percent), D (7 percent), and A (0.8 percent). The Indonesian Ministry of Health released Minister of Health Regulation Number 52 of 2017 regarding guidelines for eliminating HIV, syphilis, and Hepatitis B transmission from mother to child with the aim of elimination by 2022 to lessen the spread of Hepatitis B.

Hepatitis B vaccination is important to protect individuals from Hepatitis B virus (HBV) infection. HBV infection can increase liver disease and hepatocellular carcinoma (HCC) and develop liver cirrhosis [1]. This condition is a public health issue since it affects people worldwide and leads to mortality and morbidity [2]. This study is needed to review the necessity of Hepatitis B vaccination among humans, especially among infants, children, teenagers, adults, risk groups, and health care workers.

MATERIAL AND METHODS

Literature Search Strategy

This study used a systematic review design and focused on the protective effect of Hepatitis B vaccine

booster among humans. We used PRISMA guidelines to report the systematic review [3]. We used three databases, Scopus, Web of Science, and PubMed, between 1989 to 2021. This study used keywords according to medical subject headings (MeSH). In the SCOPUS, we used (TITLE-ABS-KEY (vaccine) AND TITLE-ABS KEY (hepatitis AND b) AND TITLE-ABS-KEY (boost)), and we obtained 275 articles. In the web of science, we used ((ALL=(vaccine)) AND ALL= (Hepatitis B)) AND ALL=(Boost), and we obtained 374 articles. In the PubMed, we used ((Vaccine [MeSH Terms]) AND (Hepatitis b [MeSH Terms])) AND (booster immunization [MeSH Terms]) Filters: English, Humans, and we obtained 417 articles.

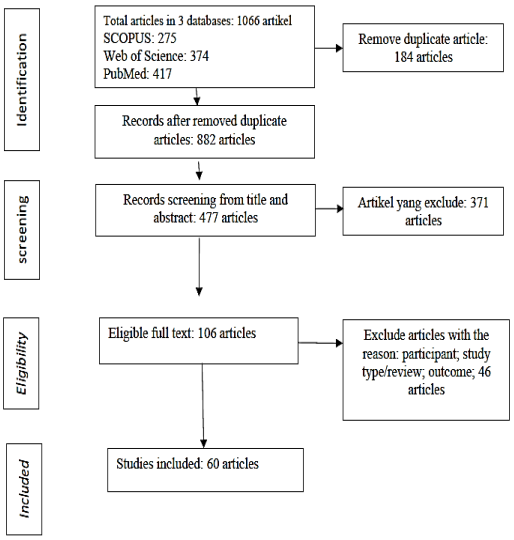

Fig. 1. Flowchart of the Study selection

Study Selection

The population in this study was all humans who get booster Hepatitis B vaccine, and we divided it into several groups, adults, health care workers, risk groups, infants, children, and adolescents. We only included original studies that had already been published. We excluded not original articles and not in English. The outcome of this study was whether the human groups necessary to do booster Hepatitis B vaccine based on their antibody. We evaluated the articles using the JBI Critical Appraisal checklist. We used a checklist to appraise the original article; scores less than 50% were excluded from the study.

RESULTS

Fig. 1 showed the flowchart of study selection. According to the review's findings, there were three articles on the adult and healthy population. According to study data from two cohort publications, the Hepatitis B vaccine could also protect people for 30 years. The other article, however, measured the anti-HBs titer following a booster shot and revealed an increase in the anti-HBs titer. A previous study mentioned that adult population is ≥ 16 years old [4]. In Table 1, the population of this study was ≥ 16 years old.

According to the review's findings, there were eight papers about the Hepatitis B vaccine for medical professionals or students. Before starting their jobs and visiting medical facilities, health professionals needed a booster vaccination; those who had one could have an increase in anti-HBs (6 articles). Because a booster immunization is not required for medical professionals who are in excellent health and have had the Primary vaccine as an infant, two sources advise getting one if the anti-HBs titer is less than ten mIU/m.

The review's findings revealed ten articles on the hepatitis B vaccine in groups at risk or experiencing pain, including hemodialysis patients, children with thalassemia, babies born to mothers who had the virus (3 articles), recipients of liver transplants, homosexuals, alcoholics, and kids with infectious diseases. According to every source, anti-HBs Ag titer testing and an anti-HBs Ag booster are necessary for the at-risk population. The Hepatitis B vaccination booster should be administered immediately if the Anti-HBs Ag titer is less than ten mIU/mL.

Thirty-nine articles were found in the review of papers on the population of newborns, children, and teenagers. The review's findings indicate that healthy individuals who got the Primary vaccine as infants do not require a booster because the Hepatitis B vaccine can provide 5-23 years of protection.

Table 1. Adult

Study	Follow up	Design	Age	Region	Vaccine	N	Result
Bryan et al., 1997 [5]	38 months	Cross-sectional	25-38 years old	-	five µg recombinant Hepatitis B	71	Increased levels of anti-Hepatitis B surface antigen
Van Damme et al., 2019 [6]	20-30 years	Cohort	40-60 years old	-	three doses of recombinant HB vaccine earlier	103	Long-term immunity and protection 20–30 years following a primary HBsAg vaccine in its entirety
Bruce et al., 2016 [7]	30 years	Cohort	Adult < 35 ≥ 50	-	Primary Hepatitis B vaccination	243	According to this study, ≥90% of participants had proof of safety 30 years afterward. There is no need for booster vaccination doses.

Table 2. Health Care Worker

Study	Follow up	Design	Age	Region	Vaccine	N	Result
Wang, Boland, van Hattum, & de Gast, 2004 [8]	Ten years	Cohort	34-58 (health care worker 18 female 13 male	-	ten µg Hepatitis B vaccination at 0, 1, 6 months	31	HBsAg-specific T cell memory can last for at least ten years. In healthy recipients of the Hb vaccination, additional booster shots are not required.
Bassal et al., 2017 [9]	eight weeks	Cross-sectional zero survey	19-55 who already received full immunization in infancy and tested negative for anti-HBs antibody	-	Hepatitis B Vaccine	1273	Before beginning work at the healthcare facility, we advise healthcare professionals to receive a booster dose.
Chiaramonte et al., 1995 [10]	Six years	Cohort	Healthcare workers	-	1. Primary immunization 2. Two months after Primary immunization 3. Six years after two doses schedule	30	An additional dose of the primary HB vaccine might help 25% of those who do not respond.
Cumberland, Sloss, Green, Masterton, & Sims, 1995 [11]	8-12 weeks	-	17-65 service health care personal	-	Doses given 0,1,2 months	3253	Anti-HBs emerged upon boosting
Stefanati et al., 2019 [12]	15 years after Primary vaccination	Cross-sectional study	Medical students and resident doctors	-	three doses of recombinant HBV vaccine	678	A booster is required if the anti-HBs titer is under ten mIU/mL.
Gara et al., 2015 [13]	1,7,21 after booster immunization	-	Adult 18-60 as health care workers	High	Three doses series	159	After 10-31 years, anti-HBs levels decline, and booster immunization does not appear to be required for healthcare workers.
Chan et al., 2014 [14]	2-4 months	Cohort	17-23 age years old Medical and nursing students		Neonatal immunization and 3-dose booster	212	97.1 percent of patients had anti-HBs two to four months following the third booster dosage. 100 mIU/mL
Coppeta et al., 2019 [15]	20 years	Cohort	Health care workers and medical student		Primary immunization	734	When hired for the first time, a sizable portion of HCWs had a non-protective anti-HBs titer.

Table 3. Risk Group

Study	Follow up	Design	Age	Region	Vaccine	N	Result
Buti et al., 1992 [16]	three years after Primary Hepatitis	Cohort	24-87 years Hemodialysis patients	-	Four doses of 20 µg HBV vaccine	60	Respondents should receive a booster dose if their antibody level falls below ten mIU/mL.
Gomber, Yadav, Dewan, Ramachandra, & Puri, 2021 [17]	Five years	Cohort	Children with thalassemia 5-20 years	-	Primary immunization	85	only one booster after five years. Children with thalassemia major receive sufficient primary vaccination.
Gu et al., 2013 [18]	6-12 months after the third dose	Cohort	The infant with HBsAg-positive mothers	-	Primary vaccine and booster for infant	101	For infants of HBsAg-positive moms, one booster dosage is typically sufficient.
Günther et al., 2006 [19]	28 days	Cross-sectional	Liver transplant recipient	-	Double-dosed conventional Hepatitis B vaccine	11	Following booster immunization, the anti-HBs titer considerably rose.

Hadler et al., 1986 [20]	six months	-	Homosexual men	-	Double dose Hepatitis B	773	A modest antibody is produced in a poor response after the second round of vaccinations.
Moses et al., 2012 [21]	four weeks after the booster	Cross-sectional	Children with inflammatory disease	-	Booster dose recombinant vaccine	100	Patients without protective antibodies should think about getting a booster vaccination.
Nalpas et al., 1993 [22]	one month	-	Mean 41 years old Alcoholic patients with minimal liver disease	-	Booster was given one week after alcohol withdrawal	28	A thorough vaccination regimen can protect a sizable fraction of drinkers from the Hepatitis B virus.
Powis et al., 2012 [23]	1 month	Cohort	HIV	-	Booster was given for individuals with loss of protective HBsAb	6	Boosters successfully reinduced HBsAb protective levels.
Tajiri et al., 1991 [24]	4-8 weeks after the third injection of the HBV vaccine	-	Infants born to HBsAg positive HBV carrier mothers.	-	0 and 2 months of age and three doses of 10 mcg plasma-derived HBV vaccine at 2, 3, and 5 months of age	203	In newborns born to HBeAg positive HBV carrier mothers, we advise performing a follow-up blood test 4–8 weeks after the third HBV vaccine injection to confirm a response of anti-HBs to the vaccine. We also advise giving infants not responding well to the HBV immunization a very away booster shot.
Boxall, J, El-Shuhkri, & Kelly, 2004 [25]	15 years	Cohort	Children who were immunized as infants and were born to mothers who had the hepatitis B virus	-	Vaccinated during infancy	116	Most newborns who receive the Hepatitis B vaccine maintain their immunity for 15 years.

Table 4. Infant, Children, and Adolescents

Study	Follow up	Design	Age	Region	Vaccine	N	Result
Brunskole Hummel, Huber, Wenzel, & Jilg, 2016 [26]	6-14 years	Cohort	Children and adolescents who get the vaccine in the first three years old	-	Hepatitis B Vaccine	232	6–14 years after receiving an infant immunization, half of those who received it have lost their protective antibodies.
Alfaleh et al., 2008 [27]	18 years	Cohort	School students between 16-18	High, intermediate, and low	Primary vaccine	1355	The adult population does not appear to require a booster dosage.
Aypak, Yüce, Yıkılkan, & Görpelioğlu, 2012 [28]	12 years	Retrospective	2-12 years old children	-	Three doses of HBV vaccination in their infancy	530	The HBV vaccine can provide long-lasting protection.
Bialek et al., 2008 [29]	15 years	Cohort	Adolescent	-	Three doses of Primary vaccine	105	Eight percent of subjects had signs of prior HB virus infection fifteen years after receiving the first immunization beginning at birth, but none developed a chronic infection.
But et al., 2008 [30]	22 years	Cohort	Children	-	A primary vaccine without a boost	318	In the 22-year study period, no one tested positive for HBsAg.
Chang et al., 2014 [31]	15 years	Retrospective cross-sectional	6-18 years old	-	Infant vaccination and elementary school	6950 students	HBV booster shots did not provide any further defense against HBsAg carriage.

Y. S. Chen, Chu, Wang, Lin, & Chang, 2016 [32]	Six weeks	Cross-sectional	The first grade of senior high school	-	Primary vaccination and booster at 15 years old	887	About six weeks following the booster injection, 100 mIU/mL reactivated anti-HBs titers were reactivated.
Y. Chen et al., 2014 [33]	-	-	5-15 years old	-	Primary vaccination and booster at 5-15 years of age	2106	Children who test negative for HBs require three booster doses after just one.
Chiara et al., 2013 [34]	12 years	Cohort	Mean: 22.7	-	Participants displaying anti-HBs titer < 10 IU/L were given a booster	4486	The findings of this study support the notion that booster doses are not required following the Primary HBV vaccine series.
Coursaget et al., 1986 [35]	Seven years	Cohort	Children	High endemic	Initial vaccination	143	A second booster is required five years after the first in the high endemic areas for optimum protection.
Duval et al., 2005 [36]	15 years	Cohort	Children 8-10	-	Primary vaccination	1129	At least five years after the primary immunization, the immunity is still present.
Gabbuti et al., 2007 [37]	12 years	Cohort	Adolescents	-	Primary vaccination	480	The hepatitis B vaccine can provide long-lasting immunity.
Giambi et al., 2008 [38]	15 months	Cohort	Children	-	Primary immunization Booster for children with anti-HBs titers < 10 mIU/ml	237	A significant difference in anti-HBs titers was noticed fifteen months after administering the third dose.
Gilca et al., 2010 [39]	5-10 years	Cohort	School-age children	-	Three doses of RB and the persistence of anti-HBs post-booster dose administration	513	In almost every vaccination recipient, three doses of RB given between the ages of 8 and 10 result in a 10-year immunity. When looking out ten years, the booster does not seem to be required.
Gilca et al., 2009 [40]	5-10 years	Cohort	8-10 years old	Low	Three pediatric doses and the effect of booster dose given 5 or 10 years later	559	Three pediatric doses of Engerix-B administered between 8 and 10 years result in a strong, long-lasting immunity lasting at least ten years.
Gonzalez, Gonzalez, Salva, & Lardinois, 1993 [41]	7 years	Cohort	Children	-	a booster dose 9iven to 34 children who showed anti-HBs titers low	79	Anti-HBs titers measured after the initial vaccination, much like in adults, show when newborns should have a booster shot.
Hammitt et al., 2007 [42]	15 years	Cohort	Children	-	Primary vaccination Booster at 14.6 years	37	Thirty-seven subjects, with a mean age of 14.6 years, were all negative for anti-HBc.
Keck et al., 2014 [43]	7 to 9 years	Cohort	Children	-	Primary vaccine Booster	104	Less than half of the subjects had levels below 10 mIU/ml of anti-HBs 7 to 9 years following the booster dose of the hepatitis B vaccine.
Lee, Lee, Huang, & Chang, 1995 [44]	Annually up to 5 years	Cohort	Infant	-	Primary vaccine	171	Recombinant HB vaccination provides adequate long-term protection, negating the need for a second booster shot before age five.

Mendy et al., 2013 [45]	-	Cross-sectional serological	1-28 years	-	Primary vaccination	1276	In the rural Gambia, Hepatitis B vaccination administered during infancy or early childhood offers excellent protection against HBV chronic infection for at least 24 years, according to the study's major finding.
Miao, Zheng, Sun, Zhang, & Wang, 2020 [46]	12 years	Cohort	Children	-	Birth dose and Primary series and having all three doses administered by 12 months age	2014	Booster doses were linked to increases in anti-HBs antibody levels; however, our research did not find any justification for this clinical practice.
Milne et al., 1992 [47]	Five years	Cohort	Children	-	Primary immunization	318	Booster doses are unnecessary for at least five years to stop the spread of Hepatitis B in children living in endemic areas.
Moyes, Milne, & Waldon, 1990 [48]	Four years	Cohort	Children	-	Three very low doses	78	A long-lasting, efficient immunological memory follows a response to the Hepatitis B vaccine in a child.
Poovorawan et al., 2011 [49]	20 years	Cohort	Children	High	Primary vaccination	222	Recombinant Hepatitis B immunization is given to infants as a primary preventative measure offers long-term protection from clinical illness.
Poovorawan et al., 2000 [50]	-	Cross-sectional serological study	6 months – 10 years	-	Primary vaccination	742	Booster, which is still debatable, does not appear to be necessary to prevent Hepatitis B virus infection.
Qiu & Ren, 2020 [51]	8 years	Cohort	5-15 years old	-	Primary vaccination	4170	Children with anti-HBs titers between 1 and 10 mIU/ml may benefit from 1-dose revaccination.
Romanò et al., 2017 [52]	18-19 years	Cohort	Teenagers and adult	-	Primary vaccination	409	After giving newborns or teenagers a primary round of vaccinations, a strong immunological memory lasts for at least 18–19 years.
H. Saffar, Khalilian, Saffar, & Ajami, 2018 [53]	15-17 years	Cohort	15-17 years adolescents	-	Primary vaccination	180	Immunity brought on by vaccination remained until the ages of 15 to 17.
M. J. Saffar & Rezai, 2004 [54]	10 years	Cohort	Healthy children 10-11 years	-	Primary vaccination	453	Healthy immunocompetent vaccine recipients do not require routine booster administration, serologic testing for HBV infection, or serologic testing for anti-HBs status, at least within 10 years of receiving the primary HB vaccine in infancy.
Salama et al., 2016 [55]	1-6 months after the booster	-	Nine months to 16 years	-	Primary vaccine	1070	In children with undetectable anti-HBs titers, a booster dose of the HB vaccination may not be able to produce a strong enough immune response.
Shih et al., 1999 [56]	10 years	Cohort	Children	-	The primary vaccine in infancy	1337	The universal vaccination program in infancy offers sufficient protection against Hepatitis B virus infection, and a booster vaccination is not advised for school-age children.

Y. Wang et al., 2017 [57]	-	-	10-14 years	-	Adolescent booster	9793	In adulthood, having a mother who tested positive for HBsAg was an independent risk factor for developing HBV infection in children who had received vaccine protection.
Z. Z. Wang et al., 2017 [58]	15-17 years	Cohort	Adolescents 15-17	-	Primary vaccine, a booster dose	180	After receiving a Primary HB immunization in infancy, 89.3% (158/177) of individuals had vaccine-induced immunity that lasted for up to 15–17 years.
Q. Wu et al., 2011 [59]	23 years	Cohort	Children 5-9 years	High	Primary vaccine	261	Booster doses should not be required for over 20 years following a full dose. children's primary immunization
Z. Wu et al., 2018 [60]	5years	Cohort	Children	-	Booster vaccination at age 10-15 years	559	For patients with protective antibodies, a booster dose is effective and necessary.
Yao et al., 2011 [61]	One month after the booster	-	Children	-	Primary vaccination and Booster 0, 1, 6 months join this study	841	After receiving HepB Basic vaccine at ages 11 to 15, anti-HBs titer levels decreased to 10 mIU/ml, necessitating booster immunization.
Zanetti et al., 2005 [62]	Ten years	Cohort	Infants and adolescents	-	Primary vaccination	1212 children 445 Italian air force	Strong immunological memory endures more than ten years after primary vaccinations for newborns and adolescents.
Zanetti et al., 2010 [63]	Five years	Randomized, control	Children	-	Primary vaccination	1543	Immunological memory appears to endure in children with anti-HBs concentrations less than 10 mIU/mL five years after receiving hexavalent vaccinations, indicating that booster doses are not required.
Zhu et al., 2021 [64]	1 month after each dose (3 doses)	-	Children	-	Booster on children	940	This study reveals that three booster doses of vaccination have a long-lasting effect, regardless of whether patients live in locations with a low, intermediate, or high disease prevalence.

DISCUSSION

In people without certainly risk health, the hepatitis B vaccine protected for 30 years, and anti-Hepatitis B titers increased following a booster shot. If a health professional or student has received the hepatitis B vaccine, they should get a booster shot before working or attending a healthcare facility. Respondents who received a booster that could raise Anti-HBs can attest to this. Before administering a booster, an anti-HBs titer check is required because if the anti-HBs titer is below 10 mIU/mL, health professionals or students do not require one because they have already had the Primary vaccine as a child. The effects of newborn vaccinations might linger for up to ten years. Hemodialysis patients, children with thalassemia, babies whose mothers have the disease, those receiving liver transplants, homosexuals, alcoholics, and kids with infectious diseases are among the populations who should receive the hepatitis B vaccine. Anti-HBs Ag titer screening is advised for specific at-risk populations to boost anti-HBs Ag levels. It is advised to immediately provide a booster dose of the Hepatitis B vaccine if the anti-HBs Ag titer is less than 10 mIU/mL. There is no requirement for a booster shot because vaccination data in the baby, child, and teenage populations show that the healthy population received the Primary vaccine as an infant because the Hepatitis B vaccine can provide 5-23 years of protection.

The results of the systematic review showed that infants, children, and teenagers, as well as adults' group who receive the hepatitis B vaccine, can protect for 5-30

years. Meanwhile, risk groups and health care workers need to conduct booster if the Anti-HBs Ag titer is less than ten mIU/mL. The limitation of this study should be considered. This study conducted a systematic review and has not yet measured the quantitative effect of the effect of Hepatitis B booster vaccination. Further study is needed to conduct a meta-analysis design.

CONCLUSION

The adult group showed that the hepatitis B vaccine could protect people for 30 years. This group is similar to newborns, children, and adolescents. These groups do not require a booster because the Hepatitis B vaccine can provide 5-23 years of protection. Meanwhile, among the risk group, we have to conduct anti-HBs Ag titer testing to decide whether they need a hepatitis B vaccination booster. If the Anti-HBs Ag titer is less than ten mIU/mL, the risk group should receive the booster. Further, health care provider needs a booster vaccine to increase anti-HBs. Based on this review results, it can be concluded that Hepatitis B vaccination requires the group that anti-HBs titer is less than ten mIU/mL.

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CONFLICT OF INTEREST

The author states that they have no competing interests.

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