Universitas Ahmad Dahlan

Jurnal Cakrawala Promkes
Vol. 8, No. 1, February 2026 pp. 1-7
p-ISSN: 2654-9980 e-ISSN: 2656-0534
http://journal2.uad.ac.id/index.php/cp/index

A retrospective study of HBV reactivity among blood donors in Bojonegoro

Fatia Rizki Nuraini [a*], Nina Difla Muflikhah [a]

[a] Blood Bank Technology, Stikes Rajekwesi Bojonegoro, Indonesia
* Corresponding author: Fatia Rizki Nuraini fatianuraini88@gmail.com

ARTICLE INFO

Article history
Received : July 19, 2025
Revised : September 22, 2025
Accepted : September 25, 2025

Keywords:
Blood donation;
Hepatitis B;
Transfusion-transmitted infections.

ABSTRACT

Hepatitis B virus (HBV) remains one of the most significant transfusion-transmitted infections (TTIs), posing ongoing challenges to blood safety in Indonesia. Regular monitoring of HBV reactivity among blood donors is crucial for evaluating the effectiveness of screening and guiding public health interventions. This study aimed to assess the prevalence and temporal trends of HBV reactivity among blood donors in Bojonegoro, evaluate the effectiveness of current screening procedures, and support public health interventions. A retrospective cross-sectional study was conducted on 51,351 blood donors at UDD PMI Bojonegoro between January 2020 and December 2021. Blood samples were screened for HBV infection using the Enzyme-Linked Immunosorbent Assay (ELISA). Data were analyzed using descriptive statistics and cross-tabulation. A total of 261 donors tested reactive for hepatitis B, comprising 129 cases in 2020 and 132 in 2021. Although the absolute number of reactive cases increased slightly, the reactivity rate declined from 0.61% to 0.44%, coinciding with an overall increase in the number of donors. Monthly analysis revealed fluctuating patterns, with peaks observed in December 2020 and June 2021. The declining proportion of HBV reactivity suggests improvements in donor selection and public awareness. However, the continued presence of reactive cases highlights the need to strengthen screening systems, expand vaccination coverage, and adopt more sensitive detection technologies, such as Nucleic Acid Testing (NAT). Ongoing regional surveillance remains crucial to support national efforts in controlling HBV and ensuring the safety of blood transfusion services in Indonesia.

1. Introduction

Blood transfusion is an important element of the modern healthcare system, ensuring a safe and compatible blood product supply for patients in urgent situations. This procedure has a significant role in life-saving and curing clinical conditions of the patient, such as heavy bleeding, anemia, hematology disorders, and in surgical procedures and cancer therapy [1]. Blood transfusion is a critical, often life-saving medical intervention, but it inherently carries the risk of transmitting infectious diseases through transfused blood, known as Transfusion-Transmitted Infections (TTIs) [2].

Among the various Transfusion-Transmitted Infections (TTIs), hepatitis B remains a significant concern in many parts of the world, particularly in developing countries such as Indonesia. Indonesia

is categorized as having intermediate to high endemicity for hepatitis B virus (HBV) infection, with chronic HBV infection affecting a substantial proportion of the population [3]. Hepatitis B is a potentially life-threatening liver infection caused by the Hepatitis B virus [4]. The virus is primarily transmitted through contact with infected blood and body fluids, including unsafe injections, sexual activity, and, most notably, blood transfusion [5]. HBV infection can lead to acute or chronic liver disease, cirrhosis, hepatocellular carcinoma, and death [6]. Blood transfusion is a well-recognized route for HBV transmission, especially given the challenges posed by both overt and occult hepatitis B infections among blood donors [7].

Studies in Indonesia have demonstrated that hepatitis B is the most prevalent TTI among blood donors compared to other infectious agents. In Indonesia, reports on the percentage of blood bags with reactive IMLTD screening results from 2007 to 2016 showed that hepatitis B had the highest prevalence. Followed by syphilis, hepatitis C, and HIV [8]. This is supported by several previous studies, such as a large-scale study in Surabaya, which found hepatitis B to have the highest prevalence among all screened TTIs in blood donors between 2018 and 2022 [9]. Previous study reported that the prevalence of positive HBsAg in blood donors in Indonesia ranged from 2.5% to 36.17%, with approximately 350 million HBsAg carriers worldwide, mostly in Asia, including Indonesia [10]. HBV transmission through blood transfusion is a primary cause of infection.

Blood donors undergo strict selection criteria and pre-donation interviews to minimize the risk of transfusion-transmitted infections. However, they may still harbor undetected infections, particularly hepatitis B virus (HBV), which can be present in asymptomatic individuals during the "window period" [11] This window period is the time after initial infection, but before conventional serological markers such as hepatitis B surface antigen (HBsAg) and antibodies become detectable by routine screening tests [12]. During this phase, infected donors may carry high levels of infectious virus particles without showing symptoms or positive serological markers, posing a risk of transmission through blood transfusion [13]. This situation raises concerns about the effectiveness of current screening methods, particularly in developing countries such as Indonesia, where most blood transfusion units still rely on HBsAg testing without the support of more sensitive Nucleic Acid Testing (NAT). As a result, hepatitis B infections may remain undetected, posing a significant risk to blood recipients. The continued detection of reactive cases also reflects the potential for ongoing community transmission, low vaccination coverage, and limited access to diagnostic services. In addition, inadequate reporting and surveillance systems hinder the availability of accurate HBV prevalence data, which, in turn, poses challenges for risk mapping and the implementation of targeted public health interventions.

To enhance the quality of blood transfusion services and reduce the risk of hepatitis B transmission, regionally based and periodically conducted studies on the prevalence of hepatitis B among blood donors are urgently needed. This study plays a crucial role not only in assessing the magnitude of the problem but also in evaluating the effectiveness of donor screening and selection systems, as well as identifying limitations in current procedures. Blood donors represent a pre-screened subset of the general population; therefore, the novelty of this study lies in its potential to provide an indirect indicator of hepatitis B prevalence in the broader community, which has not previously been reported in Bojonegoro. Accordingly, the findings of this study are expected to make a significant contribution to strengthening blood transfusion safety systems and supporting the early detection and control of hepatitis B at both local and national levels.

2. Method

This study employed a quantitative cross-sectional design, utilizing a retrospective review of 51,351 blood donor records collected at the Blood Donor Unit (UDD PMI) in Bojonegoro between

January 2020 and December 2021. Data were collected through purposive sampling, with eligible donors being in good health, as indicated by their medical history, meeting the requirements for blood donation, and providing informed consent. Donors included in the study had hemoglobin levels of at least 12.5 g/dL, a regular pulse, and normal blood pressure. They were further assessed using an administrative questionnaire on transfusion-transmissible infection (TTI) risk factors and a clinical examination in accordance with UDD PMI standards. Blood samples were screened serologically using an enzyme-linked immunosorbent assay (ELISA), and samples testing positive were retested in duplicate to ensure reliability. Donors previously identified as TTI positive were excluded, while those testing negative were treated as new donors. Data were analyzed using cross-tabulation to determine monthly trends, rates, and percentages. All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS, version 20).

3. Results and Discussion

3.1. Results

From 2020 to 2021, the Blood Donor Unit of the Indonesian Red Cross (UDD PMI) Bojonegoro recorded a total of 51,351 blood donors, comprising 21,260 donors in 2020 and 30,091 donors in 2021. Among these, 261 individuals were identified as reactive for hepatitis B based on enzyme-linked immunosorbent assay (ELISA) screening results. When viewed annually, the number of hepatitis B reactive cases increased slightly in 2021, from 129 in 2020 to 132. However, when analyzed as a proportion of the total number of donors, the percentage of reactive cases declined from 0.61% in 2020 to 0.44% in 2021, despite an increase of 8,831 donors. This suggests a downward trend in hepatitis B prevalence among blood donors in the region (Table 1).

Table 1. HBV Infection Data at UDD PMI Bojonegoro

Year	N	Reactive	%
2020	21260	129	0.61
2021	30091	132	0.44

Based on the monthly trend, the number of reactive hepatitis B cases varied across different months (Table 2 and Figure 1). In 2020, the highest prevalence of hepatitis B reactivity was recorded in December, reaching 1.03%. In contrast, the lowest rate occurred in May, with a prevalence of only 0.18%, as only 2 of 1,083 tested samples were reactive. In 2021, the highest number of cases was observed in June, with 28 out of 2,578 donors reactive, corresponding to a prevalence of 1.09%. A notable observation occurred in January 2021, when the number of donors reached its highest level in two years, totaling 10,334 individuals. Despite this large volume, only two reactive cases were detected during that month.

Table 2. Hepatitis B cases data in 2020-2021 (per month) N=51,351

Month	2020			2021		
	Tested	*Reactive*	%	*Tested*	*Reactive*	%
January	2309	18	0.78	10334	2	0.02
February	1533	3	0.20	1099	6	0.55
March	1831	8	0.44	1577	6	0.38
April	1768	16	0.90	2017	14	0.69
May	1083	2	0.18	1794	7	0.39
June	1926	11	0.57	2578	28	1.09
July	1401	3	0.21	867	7	0.81
August	1828	14	0.77	2073	14	0.68
September	1743	6	0.34	1701	11	0.65
October	2123	14	0.66	2064	17	0.82
November	2060	17	0.83	1874	11	0.59
December	1655	17	1.03	2113	9	0.43

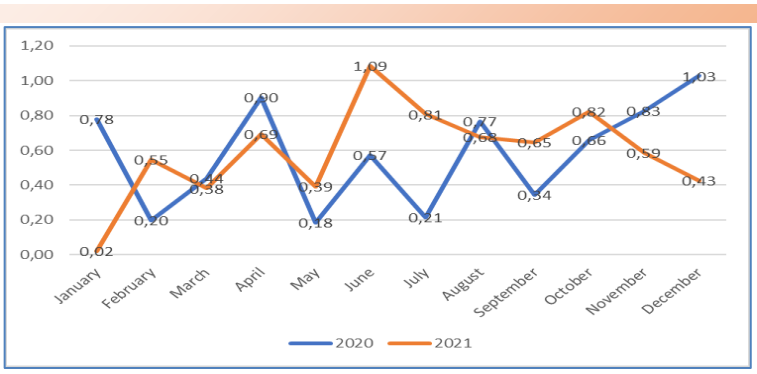

Figure 1. Confirmed HBV reactive cases between 2020 to 2021

3.2. Discussion

Hepatitis B is one of the most common transfusion-transmitted infections (TTIs), mainly due to the multiple transmission routes associated with the hepatitis B virus (HBV) [5]. The virus can spread through contact with infected blood or body fluids and through non-sterile medical practices, including the use of unhygienic syringes, tattoos, piercings, and acupuncture [14–17]. HBV is highly resilient in the external environment, remaining infectious for up to seven days outside the human body. The incubation period ranges from 30 to 180 days, and the primary infection is often asymptomatic [18]. Infections acquired during infancy or childhood carry a substantially higher risk of progressing to chronic hepatitis B, which may lead to severe complications such as liver cirrhosis and hepatocellular carcinoma [19].

This study provides a comprehensive overview of hepatitis B prevalence trends among blood donors at the Blood Donor Unit (UDD PMI) in Bojonegoro from 2020 to 2021. Of the 51,351 samples screened, 261 were reactive, resulting in an overall prevalence of 0.51%. Notably, although the absolute number of reactive cases increased slightly from 129 in 2020 to 132 in 2021, the proportion declined from 0.61% to 0.44%, corresponding with a substantial increase in donor numbers from 21,260 to 30,091. This reduction in prevalence, despite a higher donor volume, may reflect improvements in the quality of donor screening. Such enhancements were indicated not only by the declining reactivity rate but also by stricter donor selection criteria, more rigorous pre-donation interviews, and the implementation of continuous education programs for both donors and health workers [20,21]. These combined efforts indicate that transfusion services are progressively more effective in excluding high-risk donors.

Further analysis revealed monthly fluctuations in the number of reactive hepatitis B cases. In 2020, the highest reactivity rate was recorded in December (1.03%), while the lowest was observed in May (0.18%). In 2021, the peak occurred in June (1.09%), whereas the lowest rate was noted in January (0.02%). Demographic differences among donors, community behavioral patterns, and the effectiveness of preliminary screening procedures may influence these variations. Seasonal trends in donor availability, as reported in other studies, also play a role, with certain months associated with increased mobilization campaigns or reduced donations due to holidays and public health restrictions. Additionally, the ongoing COVID-19 pandemic in 2021 likely disrupted donor mobilization and operational policies, contributing to irregularities in both the donor pool and case detection.

When compared to studies from other regions in Indonesia, the prevalence of hepatitis B in Bojonegoro falls within a moderate range. In Balikpapan, 96 hepatitis B cases were reported among 15,994 samples, predominantly in the 25–44 age group [22]. At the Blood Donor Unit in Depok City, 242 reactive cases were recorded among 27,519 donors in 2019 (0.88%), and 171 cases were reported among 20,926 donors in 2020 (0.82%) [23]. Meanwhile, data from Surabaya indicate a relatively low and stable reactivity rate, ranging from 0.30% to 0.39% between 2018 and 2022 [24]. Thus, the prevalence rate in Bojonegoro remains within the nationally reported range.

Despite the declining trend in reactivity in Bojonegoro, the persistent detection of reactive cases highlights the need for continuous reinforcement of prevention efforts. These efforts should include strengthening donor education on the risks of hepatitis B transmission, improving donor screening and selection systems, and expanding comprehensive health promotion programs. Prioritizing the identification of behavioral risk factors, promoting vaccination, and enhancing public health literacy are essential components of effective infection control and compliance with blood safety policies. Beyond local interventions, national strategies to strengthen transfusion safety should be supported by the adoption of more sensitive screening technologies, such as nucleic acid testing (NAT), which can detect infections during the window period and identify cases of occult hepatitis B infection (OBI). The integration of technological advancements, routine surveillance, and region-based interventions will be crucial in achieving national targets for hepatitis B elimination and ensuring the safety of blood transfusion services.

4. Conclusion

This study highlights the ongoing significance of the hepatitis B virus (HBV), particularly in the context of blood donation services. Based on data from 51,351 donors at UDD PMI Bojonegoro from 2020 to 2021, a total of 261 reactive cases were identified, yielding an overall prevalence of 0.51%. Although the absolute number of reactive cases increased slightly in 2021, the overall prevalence declined, suggesting potential improvements in donor screening procedures, public awareness, and health promotion initiatives. Monthly fluctuations in prevalence were observed, likely influenced by demographic differences, community behaviors, and operational factors, including disruptions related to the COVID-19 pandemic. Compared with other regions in Indonesia, the prevalence rate in Bojonegoro falls within a moderate range, highlighting the need for continued monitoring.

Despite the downward trend, the persistent detection of reactive cases emphasizes the importance of reinforcing HBV prevention strategies through enhanced donor risk assessment, expanded health education, vaccination promotion, and improved public health literacy. The adoption of more sensitive screening technologies, particularly nucleic acid testing (NAT), is also crucial for identifying window period and occult HBV infections, thereby improving transfusion safety. While this study provides valuable insights into HBV reactivity among blood donors in Bojonegoro, certain limitations should be noted. Since the dataset was derived from blood bags already registered in the UDD system, demographic analysis could not be performed, resulting in the absence of such information. Overall, these findings underscore the importance of region-specific surveillance in informing national HBV elimination strategies and in strengthening the development of a safer and more reliable blood transfusion system in Indonesia.

Acknowledgment

We would like to thank all contributors who do not meet the criteria for authorship, and they should be acknowledged in the text, especially the UDD PMI Bojonegoro, as the location of this study.

Conflict of Interest

The authors report no conflicts of interest.

REFERENCES

1. Mohammed N, Fung BCM, Hung PCK, Lee C. Anonymizing healthcare data. Proceedings of the 15th ACM SIGKDD international conference on Knowledge discovery and data mining. New York, NY, USA: ACM; 2009. p. 1285–94. https://doi.org/10.1145/1557019.1557157

2. Vidja PJ, Vachhani JH, Sheikh SS, Santwani PM. Blood Transfusion Transmitted Infections in Multiple Blood Transfused Patients of Beta Thalassaemia. Indian Journal of Hematology and Blood Transfusion. 2011;27:65–9. https://doi.org/10.1007/s12288-011-0057-3
3. Lusida MI, Juniastuti, Yano Y. Current hepatitis B virus infection situation in Indonesia and its genetic diversity. World J Gastroenterol. Baishideng Publishing Group Co; 2016. p. 7264–74. https://doi.org/10.3748/wjg.v22.i32.7264
4. Yano Y. Hepatitis B virus infection in Indonesia. World J Gastroenterol. 2015;21:10714. https://doi.org/10.3748/wjg.v21.i38.10714
5. Takuissu GR, Kenmoe S, Amougou Atsama M, Atenguena Okobalemba E, Mbaga DS, Ebogo-Belobo JT, et al. Global epidemiology of occult hepatitis B virus infections in blood donors, a systematic review and meta-analysis. PLoS One. 2022;17:e0272920. https://doi.org/10.1371/journal.pone.0272920
6. Iannacone M, Guidotti LG. Immunobiology and pathogenesis of hepatitis B virus infection. Nat Rev Immunol. 2022;22:19–32. https://doi.org/10.1038/s41577-021-00549-4
7. Seo DH, Whang DH, Song EY, Han KS. Occult hepatitis B virus infection and blood transfusion. World J Hepatol. 2015;7:600–6. https://doi.org/10.4254/wjh.v7.i3.600
8. Pusdatin Kemenkes. Situasi Pelayanan Darah di Indonesia. 2014.
9. Lukita Ariani N, Luh Putu Eka Sudiwati N, Panggayuh A, Widuri S, Kemenkes Malang P, PMI Kota Surabaya U. Prevalensi Penyakit Infeksi Menular Leawat Transfusi Darah (IMLTD) Darah Donor di UUD PMI Kota Surabaya Tahun. Care: Jurnal Ilmiah Ilmu Kesehatan. 2024;12:153–65. https://doi.org/10.33366/jc.v12i1.5749
10. Oktavia D, Yaswir R, Harminarti N. Frekuensi Hepatitis B dan Hepatitis C Positif pada Darah Donor di Unit Transfusi Darah Cabang Padang pada Tahun 2012. Jurnal Kesehatan Andalas. 2017;6:147. https://doi.org/10.25077/jka.v6i1.661
11. Vermeulen M, Dickens C, Lelie N, Walker E, Coleman C, Keyter M, et al. Hepatitis B virus transmission by blood transfusion during 4 years of individual-donation nucleic acid testing in South Africa: estimated and observed window period risk. Transfusion (Paris). 2012;52:880–92. https://doi.org/10.1111/j.1537-2995.2011.03355.x
12. Kucirka LM, Sarathy H, Govindan P, Wolf JH, Ellison TA, Hart LJ, et al. Risk of Window Period Hepatitis-C Infection in High Infectious Risk Donors: Systematic Review and Meta-Analysis. American Journal of Transplantation. 2011;11:1188–200. https://doi.org/10.1111/j.1600-6143.2011.03460.x
13. Lelie N, Busch M, Kleinman S. Residual risk of transfusion-transmitted hepatitis B virus (TT-HBV) infection by NAT-screened blood components: A review of observed versus modeled infectivity from donors with window period and occult HBV infections. Transfusion (Paris). 2021;61:3190–201. https://doi.org/10.1111/trf.16675
14. Al-Busafi SA, Al-Harthi R, Al-Naamani K, Al-Zuhaibi H, Priest P. Risk Factors for Hepatitis B Virus Transmission in Oman. Oman Med J. 2021;36:e287. https://doi.org/10.5001/omj.2021.99
15. Hyun MH, Kim JH, Jang JW, Song JE, Song DS, Lee HW, et al. Risk of Hepatitis C Virus Transmission through Acupuncture: A Systematic Review and Meta-Analysis. The Korean Journal of Gastroenterology. 2023;82:127–36. https://doi.org/10.4166/kjg.2023.060
16. van Santen DK, Boyd A, Matser A, Maher L, Hickman M, Lodi S, et al. The effect of needle and syringe program and opioid agonist therapy on the risk of HIV, hepatitis B and C virus infection for people who inject drugs in Amsterdam, the Netherlands: findings from an emulated target trial. Addiction. 2021;116:3115–26. https://doi.org/10.1111/add.15503
17. Foerster M, Zins M, Goldberg M, Ribet C, Kab S, Hosseini B, et al. Tattoo practices and risk of hepatitis B and hepatitis C infection in the general population. 2024. https://doi.org/10.1101/2024.10.25.24316096
18. Waheed U, Saba N, Wazeer A, Ahmed S. A Systematic Review and Meta-Analysis on the Epidemiology of Hepatitis B and Hepatitis C Virus among Beta-Thalassemia Major Patients in Pakistan. J Lab Physicians. 2021;13:270–6. https://doi.org/10.1055/s-0041-1731110
19. Annisa. Virus Hepatitis B di Indonesia dan Risiko Penularan Terhadap Mahasiswa Kedokteran. Anatomica Medical Journal Fakultas Kedokteran [Internet]. 2019;2. https://jurnal.umsu.ac.id/index.php/AMJ/article/view/3008

20. Ogolla CO, Guya B, Maima AO. Effectiveness of Blood Transfusion Screening Procedures in Preventing Transfusion-Related Infections. 2025. https://doi.org/10.21203/rs.3.rs-5723162/v1
21. Marx LJH, Van Walraven SM, van Zelm R, Sassen B. Health promotion for blood donors: A scoping review. Public Health in Practice. 2025;9:100604. https://doi.org/10.1016/j.puhip.2025.100604
22. Rahmatullah W, Asnija Avenina R, Dewi Lukita Sari A. Prevalensi Hepatitis B Pada Darah Donor. Jurnal Amanah Kesehatan, 2022, 4.1: 1-10. https://ojs.stikesamanahpadang.ac.id/index.php/JAK/article/download/154/95/
23. Hippy NSI, Ukma N. Prevalensi kasus reaktif hbsag pada pendonor dengan metode chlia dan elisa berdasarkan usia dan jenis kelamin di udd pmi kota depok pada tahun 2019-2020. 2021;3:1–7. http://jurnal.ensiklopediaku.org
24. Ariani NL, Sudiwati NLPE, Panggayuh A, Widuri S. Prevalensi Penyakit Infeksi Menular Leawat Transfusi Darah (IMLTD) Darah Donor di UUD PMI Kota Surabaya Tahun. Care: Jurnal Ilmiah Ilmu Kesehatan. 2024;12:153–65. https://doi.org/10.33366/jc.v12i1.5749