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CLINICAL ARTICLE

Obstetrics

Costs of integrating hepatitis B screening and antiviral prophylaxis into routine antenatal care in Burkina Faso: Treat all versus targeted strategies

Andréa Gosset[1] | Seydou Drabo[1] | Patrizia Carrieri[1] | Abdoul Salam Eric Tiendrebeogo[2] | Jeanne Perpétue Vincent[3] | Yasuhito Tanaka[4] | Roger Sombié[5] | Haoua Tall[5] | Dramane Kania[6] | Sylvie Boyer[1] | Yusuke Shimakawa[3,7]

[1]Aix Marseille University, INSERM, IRD, SESSTIM, Sciences Economiques & Sociales de la Santé & Traitement de l'Information Médicale, ISSPAM, Marseille, France

[2]Laboratoire Mixte International de Vaccinologie (LAMIVAC), Bobo-Dioulasso, Burkina Faso

[3]Institut Pasteur, Université Paris Cité, Unité d'Épidémiologie des Maladies Émergentes, Institut Pasteur, Paris, France

[4]Department of Gastroenterology and Hepatology, Kumamoto University, Kumamoto, Japan

[5]Département d'Hépato-Gastroentérologie, Center Hospitalier Universitaire Yalgado Ouédraogo, Ouagadougou, Burkina Faso

[6]Center Muraz, Institut National de Santé Publique, Bobo-Dioulasso, Burkina Faso

[7]International Research Center for Medical Sciences (IRCMS), Kumamoto University, Kumamoto, Japan

Correspondence
Patrizia Carrieri, SESSTIM UMR 1252, Faculty of Medicine, 27 Bd Jean Moulin, 13005 Marseille, France.
Email: pmcarrieri@aol.com

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Abstract

Objective: Economic feasibility of eliminating mother-to-child transmission (MTCT) of hepatitis B virus (HBV) in highly endemic African countries remains uncertain. Prevention of MTCT (PMTCT) involves screening pregnant women for hepatitis B surface antigen (HBsAg), identifying those with high viral loads or hepatitis B e antigen (HBeAg), and administering tenofovir prophylaxis to high-risk women. We estimated the costs of integrating PMTCT services into antenatal care in Burkina Faso, based on four different strategies to select women for tenofovir prophylaxis: (1) HBV DNA (≥200 000 IU/mL), (2) HBeAg, (3) hepatitis B core-related antigen rapid diagnostic test (HBcrAg-RDT) and (4) all HBsAg-positive women.

Methods: Using a micro-costing approach, we estimated the incremental economic cost of integrating each strategy into routine antenatal care in 2024, compared to neonatal vaccination alone. Sensitivity analyses explored variations in prevalence, service coverage, test and tenofovir prices.

Results: HBcrAg-RDT strategy was the least expensive, with a total economic cost of US$3959689, compared to HBV DNA (US$6128875), HBeAg (US$4135233), and treat-all (US$4141206). The cost per pregnant woman receiving tenofovir prophylaxis varied from US$61.88 (Treat-all) to US$1071.05 (HBV DNA). The Treat-All strategy had the lowest marginal cost due to a higher number of women on tenofovir (66928) compared to HBV DNA (5722), HBeAg (10020), and HBcrAg-RDT (7234). In sensitivity analyses, the treat-all strategy became less expensive when the tenofovir price decreased.

Conclusion: HBcrAg-RDT minimizes resource use and costs, representing 0.61% of Burkina Faso's 2022 health budget. This study highlights the potential economic feasibility of these strategies and provides valuable resources for conducting cost-effectiveness analyses.

KEYWORDS
Africa, costs, hepatitis B, mother-to-child transmission, screening, tenofovir, treatment

1 | INTRODUCTION

West Africa is one of the regions most affected by hepatitis B virus (HBV) infection, with prevalence ranging from 6% to 17%.[1] Mother-to-child transmission (MTCT) of HBV is particularly concerning, with infected newborns having a 90% risk of developing chronic infection[2] and increased risk of developing liver cirrhosis and hepatocellular carcinoma.[3]

While administration of hepatitis B birth dose vaccine (HepB-BD) within 24 h of birth is the primary intervention to prevent MTCT (PMTCT), a residual risk remains in highly-viremic pregnant women.[4] In addition to HepB-BD, the WHO recommends antenatal screening for hepatitis B surface antigen (HBsAg) and administration of tenofovir disoproxil fumarate (TDF) prophylaxis to HBsAg-positive pregnant women having high HBV DNA levels exceeding 200 000 IU/mL or hepatitis B e antigen (HBeAg).[5]

However, HBV DNA testing remains unaffordable and inaccessible for most pregnant women living in resource-limited countries. HBeAg testing, while less expensive than HBV DNA testing, requires a laboratory-based immunoassay and current rapid diagnostic tests (RDTs) to detect HBeAg lack sensitivity.[6] To ensure high coverage of HBV PMTCT, alternative strategies need to be explored, such as the use of a rapid diagnostic test for hepatitis B core-related antigen (HBcrAg-RDT).[7] This test only requires a drop of capillary blood, without the need for electricity or centrifugation, to identify HBV-infected women eligible for TDF prophylaxis within 45 min.[8] Another strategy being considered is to provide TDF prophylaxis to all HBsAg-positive pregnant women.[9,10]

Addressing HBV PMTCT is a key healthcare priority in Burkina Faso, a West African country with a high HBV prevalence (10.1%).[11] In 2022, HepB-BD was integrated into the national immunization program. The country also developed an ambitious plan for the triple elimination of MTCT of HIV, syphilis and hepatitis B in 2021–2025.[12] Despite the national plan's intention to offer free HBV screening to all pregnant women, the cost of the test is still borne by women. The plan also considers the possibility of universal treatment for all HBsAg-positive pregnant women, given the limited availability of HBV DNA testing or laboratory-based HBeAg assays at the national level.

To inform decision-makers on the economic implications of the HBV PMTCT strategies, we estimated the costs of integrating HBV screening and TDF prophylaxis into routine antenatal care at primary healthcare centers (PHCs) in Burkina Faso. We considered four alternative strategies for selecting HBsAg-positive pregnant women for TDF prophylaxis: (1) HBV DNA ≥200 000 IU/mL, (2) HBeAg-positive, (3) positive for HBcrAg-RDT, and (4) treat all HBsAg-positive women.

2 | MATERIALS AND METHODS

Using a micro-costing approach, we estimated the projected incremental economic costs associated with the integration of each strategy into the existing antenatal care system in Burkina Faso, compared to the current situation in which HepB-BD, along with three subsequent pentavalent vaccines, is administered. The analysis is conducted for the year 2024, considering the national health system perspective.

2.1 | Study setting

Burkina Faso has approximately 20.5 million people, with 79.3% living in rural areas. The country consists of 13 regions, organized into 70 health districts, with 2041 PHCs in 2020. All regions have a high HBV prevalence, ranging from 6.6% to 11.0%.[11] In 2021, 98% of pregnant women received antenatal care from skilled health workers, and 72% completed the four antenatal visits as per the national recommendation. In 2019, 88% of pregnant women were screened for HIV, and 100% of HIV-positive pregnant women received antiretroviral therapy.[13] However, HIV screening remains the only test universally offered during antenatal care visits; rapid test for syphilis or dual test with HIV, as well as HBV screening, are not yet part of routine antenatal care.

We conducted this study as part of the Neonatal Vaccination against Hepatitis B in Africa (NéoVac) program, which aims to assess the impact and cost-effectiveness of integrating HepB-BD into the immunization program in Burkina Faso.[14,15] An ancillary study called "Performance of Diagnostic Test for Hepatitis B in Africa (PREDICT-B)" evaluated the performance of HBcrAg-RDT to identify pregnant women with high HBV DNA levels (≥200 000 IU/mL).[8] The study was approved by the institutional review board of the Institut Pasteur (IRB2018/12) and the Ethics Committee for the Health Research in Burkina Faso (N°2018-12-155). All the participants in the NéoVac and PREDICT-B study provided their informed consent.

2.2 | Strategies for selecting HBsAg-positive women for TDF prophylaxis

In all strategies, we assumed that pregnant women receiving routine antenatal care at PHCs are systematically screened for HBsAg. This screening procedure involves collecting capillary blood by finger prick and using an on-site RDT (SD Bioline HBsAg RDT, Abbott, USA) to provide same-day results. Conversely, eligibility for TDF prophylaxis varied according to the specific strategy considered.

Strategy 1: HBV DNA

Following HBsAg screening, pregnant women with a positive result undergo venipuncture at the PHCs. Blood samples are sent to a regional laboratory for HBV DNA quantification using a real-time PCR. Pregnant women later return to the PHC to receive results. TDF prophylaxis is administered to those with HBV DNA levels ≥200 000 IU/mL.

Strategy 2: HBeAg

Similar to the HBV DNA strategy, this strategy involves collecting venous blood samples from HBsAg-positive pregnant women and sending them to the regional laboratory. HBeAg is detected using an enzyme-linked immunosorbent assay (ELISA). Pregnant women return to the PHC to receive results. Only those positive for HBeAg undergo TDF prophylaxis.

Strategy 3: HBcrAg-RDT

A single finger prick yields two drops of capillary blood: one for HBsAg screening, and the second is placed into a tube containing a pretreatment solution.[7] When the HBsAg screening test turns positive, the pretreated sample is dropped on an HBcrAg-RDT cassette (Espline, Fujirebio, Japan). HBcrAg-RDT results are available within 30 min. Women who test positive for HBcrAg-RDT initiate TDF prophylaxis on the same day as HBsAg screening.

Strategy 4: Treat-all

Following HBsAg screening test, no secondary testing is performed. All pregnant women testing positive for HBsAg start TDF prophylaxis.

2.3 | Cost estimates

We calculated the total economic costs of each strategy by considering that each resource required for the strategy implementation has an opportunity costs as it is no longer available for an alternative use.[16]

In each strategy, we categorized resources into the following activities: preintroduction, social mobilization, supervision and monitoring, training, transportation and storage of consumables, screening (comprising both HBsAg screening and the second test), treatment, and health information system. This classification methodology was adapted from a previous cost estimate.[15] For each of these activities, we considered both recurrent costs (including consumables and salaries) and capital costs, referring to equipment with a lifespan of 1 year or more. Preintroduction costs, allocated for the first year of intervention implementation, were considered as capital costs.[16] Table 1 provides detailed information about the activities, resources, and unit costs.

We allocated the costs associated with transportation, storage, and waste management as the proportion of the total annualized cost linked to HBV screening and treatment. We estimated this proportion as the volume required for the HBV tests and treatment relative to the total volume used. We assumed an 80% equipment capacity utilization,[17] and annualized capital costs using a 3% discount rate. Given the one-year time frame, no further discounting was required. We assumed a wastage factor of 1% for tests and TDF drugs. We allocated the target population to each PHC in Burkina Faso based on the proportion of the national population covered by each PHC. We initially valued all costs in CFA francs and subsequently converted them to 2022 US$ using the average annual exchange rate for 2022 (US$ 1 = FCFA 623.76).[18] We performed cost analyses using R version 4.3.1. Details on data collection are provided in the Data S1.

2.4 | Base-case analysis and sensitivity analyses

In the base-case analysis, we assumed 90% HBsAg screening coverage for pregnant women. For the first three "targeted" strategies, we assumed that 90% of HBsAg-positive pregnant women would undertake the second test. Then, we assumed that 90% of eligible women would receive TDF prophylaxis in all strategies, and that all would receive three bottles of 30 TDF tablets to cover the period from the 28th week of pregnancy until delivery (Table 2).

For sensitivity analysis, we varied each of the following: HBsAg screening coverage rates (80%–95%), the second test uptake rates (80%–100%), the TDF uptake among eligible women (80%–100%), HBsAg prevalence (8%–12%), the proportion of HBsAg-positive pregnant women with a high viral load (6%–15%), and the prices of screening tests and TDF (variation of ±25%). Finally, we included a scenario in which pregnant women receive TDF up to 1 month after delivery, necessitating four TDF bottles (120 tablets).

3 | RESULTS

3.1 | Target population

The care cascade and cost estimates are presented in Table 3. In the base-case scenario for 2024, a total of 729 059 pregnant women in Burkina Faso are estimated to undergo HBsAg screening, of whom 74 364 test positive. Subsequently, 66 928 women receive the second test. Finally, the number of women starting TDF prophylaxis is 5722 (HBV DNA strategy), 10 020 (HBeAg), 7234 (HBcrAg-RDT), and 66 928 (Treat-All).

3.2 | Cost estimates and drivers

The total economic cost in 2024 is estimated at $6 128 875 (HBV DNA strategy), $4 135 233 (HBeAg), $3 959 689 (HBcrAg-RDT), and $4 141 206 (Treat-All) (Table 3). The economic cost per pregnant woman screened for HBsAg is estimated at $8.41 (HBV DNA), $5.67 (HBeAg), $5.43 (HBcrAg-RDT), and $5.68 (Treat-All). The economic cost per woman receiving TDF prophylaxis is estimated at $1071.05 (HBV DNA), $412.71 (HBeAg), $547.36 (HBcrAg-RDT), and $61.88 (Treat-All).

TABLE 1 Overview of cost components, resources and unit costs.

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
Preintroduction	Advocacy	Central	Two day meeting in Ouagadougou			
			One DRS per region +1 hepatologist per CHU and CHR +3 communicators	Per diem/day	Capital	16.03
			Two support staff +1 administrator	Per diem/day	Capital	8.02
				Meeting room rental/day	Capital	80.19
				Coffee break + lunch/person and day	Capital	8.02
				Fuel/km	Capital	0.16
	Advocacy	District	One day meeting in each district. Participants are per health district		Capital	
			Two communicators	Per diem/day	Capital	16.03
			One MCD, + 1 deputy +2 physicians +1 support staff +1 driver	Per diem/day	Capital	8.02
				Meeting room rental/day	Capital	32.07
				Coffee break + lunch/person and day	Capital	5.61
				Fuel/km	Capital	0.16
	Two reinforced supervisions during the first year	PHC	Supervisors can visit 2 PHC per day		Capital	
			Two supervisors	Per diem/day	Capital	16.03
			One driver	Per diem/day	Capital	8.02
				Fuel/km	Capital	0.16

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
Social mobilization	Posters and leaflets to raise awareness of the importance of HBV screening in pregnant women.	PHC	One poster +1 leaflet per health facility	Printout of a poster	Recurrent—consumable	0.48
				Printout of a brochure (10 pages)	Recurrent—consumable	1.36
	Daily talks to answer pregnant women's questions, concerns and raise awareness	PHC	Talks led by midwifes or skilled birth attendants who work 2346 h per year 10 min/day to talk about HBV screening on consultation days	Midwife average salary/h	Recurrent—Salary	2.33
	ASBC		One day/month in each of the 8228 villages	ASBC salary average/year	Recurrent—Salary	384.76
Monitoring and supervision	Monitoring activities of health districts	District	Monitoring activities are semi-annual and last one day per district, we assumed half a day for HBV alone			
			One monitor	Per diem/day	Recurrent—Salary	43.28
			One driver shared by four monitors for different activities	Per diem/day	Recurrent—Salary	25.65
	Monitoring activities of PHC	PHC	Monitoring activities are semi-annual and last half a day per PHC, we assumed that half of this time is dedicated to HBV alone			
			One monitor	Per diem/day	Recurrent—Salary	32.07
			One driver shared by four monitors for different activities	Per diem/day	Recurrent—Salary	8.02
	Specific supervision for the elimination of mother-to-child transmission (including HIV, HBV, syphilis) at the district level	District	Supervision is semi-annual and lasts 1 day per district, we assumed half a day for HBV alone			
			Two supervisors	Per diem/day	Recurrent—Salary	43.28
			One driver	Per diem/day	Recurrent—Salary	25.65
	Specific supervision for the elimination of mother-to-child transmission (HIV, HBV, syphilis) at the PHC level	PHC	Supervision is quarterly. Supervisors can visit 2 PHC per day. We assumed that half of the time is specifically for HBV			
			Two supervisors	Per diem/day	Recurrent—Salary	16.03
			One driver	Per diem/day	Recurrent—Salary	8.02
	Supervision of ASBCs	PHC	Supervision is semi-annual and lasts one day per PHC. We assumed half a day for HBV alone			
			Two supervisors +2 OBCs	Per diem/day	Recurrent—Salary	4.01
			One 1 RPS	Per diem/day	Recurrent—Salary	48.11
	For each of the monitoring and supervision activity	All levels		Fuel/km	Recurrent—consumable	0.16

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
Training	Training of trainers	Central	Two-day training specific to the elimination of mother-to-child transmission of HBV			
			Four people train the trainers	Per diem/day	Recurrent—Salary	40.09
			Three trainers per region	Per diem/day	Recurrent—Salary	43.28
				Meeting room rental/day	Recurrent—consumable	80.19
				Office supplies/ person	Recurrent—consumable	7.22
				Coffee break + lunch/ person and day	Recurrent—consumable	8.02
	Training at the district level	District	Two-day training in each district			
			Three trainers	Per diem/day	Recurrent—Salary	43.28
			Three administrators +3 participants/ PHC (head nurse, head of maternity ward, midwife)	Per diem/day	Recurrent—Salary	16.03 8.02
			Five resident participants from the district management team	Per diem/day	Recurrent—Salary	8.02
				Office supplies/ person	Recurrent—consumable	7.22
				Coffee break + lunch/ person and day	Recurrent—consumable	5.61
				Fuel/km	Recurrent—consumable	0.16
	ASBC training at the PHC level	PHC	Two-day training in each PHC			
			Two trainers/ PHC	Per diem/day	Recurrent—Salary	8.02
			Two OBC/ PHC	Per diem/day	Recurrent—Salary	4.01
			Nine ASBS/ PHC	Per diem/day	Recurrent—Salary	2.41
				Coffee break + lunch/ person and day	Recurrent—consumable	4.81

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
Transportation and storage	Transport of screening tests and TDF at the regional level	Central	Transport from CAMEG central agencies to CAMEG regional agencies once a month			
			One driver	Per diem/day	Recurrent—Salary	16.03
			One apprentice	Per diem/day	Recurrent—Salary	8.02
				Truck 13 T (50 m^3)	Capital	89188.72
				Vehicle maintenance/year	Recurrent—consumable	9622.68
				Fuel/km	Recurrent—consumable	0.16
	Transport of screening tests and TDF at the district level	Region	Transportation from regional to district level, once a month			
			One driver	Per diem/day	Recurrent—Salary	8.02
				Van (20 m^3)	Capital	36290.61
				Vehicle maintenance/year	Recurrent—consumable	5% of vehicle cost
				Fuel/km	Recurrent—consumable	0.16
	Transport of screening tests and TDF at the PHC level	PHC	Transportation from district to PHC level, once a month			
			Head nurse	Head nurse average salary/year	Recurrent—Salary	2108.77
				Moto	Capital	2405.64
				Vehicle maintenance/year	Recurrent—consumable	5% of vehicle cost
				Fuel/km	Recurrent—consumable	0.06
	Storage of screening tests and TDF at the central level	Central	Surface of a central storage area = 4000 m^2 equivalent to an available storage volume of 20000 m^3	Construction price/m^2	Capital	80.19
			Staff in charge of stock management			
			Two pharmacists	Pharmacist average salary/year	Recurrent—Salary	5963.83
			Two pharmacy assistants	Pharmacy assistant average salary/year	Recurrent—Salary	4809.54

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
	Storage of screening tests and TDF at the regional level	Region	Surface of a regional storage area = 2000 m^2	Construction price/m^2	Capital	80.19
			Staff in charge of stock management			
			Two pharmacists	Pharmacist average salary/year	Recurrent—Salary	5963.83
			Two pharmacy assistants	Pharmacy assistant average salary/year	Recurrent—Salary	4809.54
	Storage of screening tests and TDF at the district level	District	Surface of a district storage area = 45 m^2	Construction price/m^2	Capital	80.19
			Staff in charge of stock management			
			One pharmacist	Pharmacist average salary/year	Recurrent—Salary	4809.54
	Storage of screening tests and TDF at the PHC	PHC	Surface of a PHC storage area = 11 m^2	Construction price/m^2	Capital	80.19
			Staff in charge of stock management			
			One manager	Average salary/year	Recurrent—Salary	384.76
	For the storage of consumables at all levels	All levels	Electric consumption (lighting + air conditioning) 250 kWh/m^2/year	Electricity/kWh	Recurrent—consumable	0.44
	HBsAg screening test		Volume of a test = 0.000021 m^3 Volume of a lancet = 0.0000075 m^3			
	HBcrAg-RDT		Volume of a test = 0.000201 m^3			
	HBeAg, and HBV DNA tests		Volume of a tube 0.5 mL = 0.000084 m^3 Volume of a needle = 0.000011 m^3			
	For HBsAg, HBeAg, and HBV DNA tests		Unit volume of consumables (cotton, alcohol, gloves) = 0.0000143 m^3			
	Tenofovir		Volume per tablet pack = 0.000123 m^3			

(Continues)

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
Screening—HBsAg	HBsAg screening test	PHC	SD Bioline HBsAg test	Test	Recurrent—consumable	2.17
				Lancet	Recurrent—consumable	0.05
			Working time: 3 min for administrating the test +3 min for reading the result	Midwife average salary/h	Recurrent—Salary	2.33
Screening—second test	HBeAg test	PHC	ELISA HBeAg test For these tests, blood samples are collected at the PHCs and sent to the regional laboratory	Test	Recurrent—consumable	9.62
			Working time: 5 min for the blood sample + 3 min for labelling and storing in the fridge + an additional consultation of 10 min for the results	Midwife average salary/h	Recurrent—Salary	2.33
	HBV DNA test	PHC	Real-time PCR test. For these tests, blood samples are collected at the PHCs and sent to the regional laboratory	Test	Recurrent—consumable	40.09
			Working time: 5 min for the blood sample + 3 min for labelling and storing in the fridge + an additional consultation of 10 min for the results	Midwife average salary/h	Recurrent—Salary	2.33

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
	For HBeAg and HBV DNA tests	PHC		Vacutainer needle	Recurrent—consumable	0.11
				Tube	Recurrent—consumable	0.11
				Tourniquet	Capital	3.21
				Tray	Capital	16.03
				55 L fridge	Capital	1547.69
				Tube holder	Capital	6.41
			10 L cooler can hold 2×40 tube holders, or 80 tubes.	10 L cooler	Capital	24.05
				Cold accumulator	Capital	2.00
				Courier/day	Recurrent—Salary	13.15
				Fuel/km	Recurrent—consumable	0.16
	HBcrAg-RDT	PHC	HBcrAg-RDT (Espline, Fujirebio, Japan)	Test (unit)	Recurrent—consumable	10.00
			Working time: 3 min for administrating the test +3 min for reading the result	Midwife average salary/h	Recurrent—Salary	2.33
	For HBsAg, HBeAg, and HBV DNA tests	PHC	1 g consumption per unit	Cotton/500 g	Recurrent—consumable	3.72
			2 mL consumption per unit	Alcohol/L	Recurrent—consumable	1.05
				Glove/unit	Recurrent—consumable	0.15
Screening—all tests	Waste management	All health facilities	One incinerator per PHC. Incineration capacity = 75 kg/day	Incinerator	Capital	6577.64
			Fuel consumption 1080 L/ year	Fuel/L	Recurrent—consumable	1.12
				Landfill costs/year	Recurrent—consumable	272.17
				Water and electricity/year	Recurrent—consumable	192.45
				Maintenance technician salary/year	Recurrent—Salary	1154.29 on Ouagadougou and Bobo-Dioulasso, 577.15 outside
				Incinerator maintenance	Recurrent—consumable	48.11

TABLE 1 (Continued)

Activity	Description	Level of the health system	Basic assumptions	Resource type	Cost type	Unit cost (US$)
Treatment delivery	Tenofovir prophylaxis	PHC	One tablet daily	Tenofovir 300 mg/30 tablets	Recurrent—consumable	4.48
	Consultation time	PHC	15 min consultation for all eligible pregnant women	Midwife average salary/h	Recurrent—Salary	2.33
Health information system	Reporting activities data	Districts	Supply of materials and data validation workshop: we considered 1/12th of the costs for HBV screening	Supply of materials/ year and district	Recurrent—consumable	7698.14
				Data validation workshops/year and district	Recurrent—consumable	3144.90
		All health facilities	5 min to report each HBsAg-positive case per midwife	Midwife average salary/h	Recurrent—Salary	2.33
			5 min to report each eligible case to TDF per midwife	Midwife average salary/h	Recurrent—Salary	2.33
			5 min per midwife for notification of each pregnant woman on tenofovir	Midwife average salary/h	Recurrent—Salary	2.33
			Two persons from district staff in charge of data management (2 PHC visited per day): we considered 1/12th of the costs for HBV screening	Per diem/day	Recurrent—Salary	8.02

Abbreviations: CHU, university hospital center; CHR, regional hospital center; DRS, Regional Health Directorate; HBV, hepatitis B virus; MCD, District Medical Officer; PHC, primary healthcare center; RDT, rapid diagnostic test; TDF, tenofovir disoproxil fumarate.

TABLE 2 Key demographic, epidemiological, and screening information.

	Input	Source
Total number of pregnant women in 2024	810065	United Nations[19]
Prevalence of HBsAg in pregnant women	10.2	Lingani et al.[20]
Proportion of HBsAg-positive pregnant women with high viral load (≥200000 IU/mL)	9.5	Guingané et al.[21]
Sensitivity of HBsAg RDT to detect the presence of HBsAg	1	
Specificity of HBsAg RDT to detect the presence of HBsAg	1	
Sensitivity and specificity of the tests to detect HBV DNA ≥200000 IU/mL		
Viral load quantification (real-time PCR)—Sensitivity	1	
Viral load quantification (real-time PCR)—Specificity	1	
HBeAg test (ELISA)—Sensitivity	0.846	Boucheron et al.[6]
HBeAg test (ELISA)—Specificity	0.905	Boucheron et al.[6]
HBcrAg test (RDT)—Sensitivity	0.826	Shimakawa et al.[7]
HBcrAg test (RDT)—Specificity	0.954	Shimakawa et al.[7]
Number of primary health care facilities in 2024	2302	Estimated using a linear regression from the number of PHC facilities from 2016 to 2020 and the estimated total population Lingani et al.[19]
Coverage rate of HBsAg screening among pregnant women	90%	
Uptake of the second test among HBsAg-positive women	90%	
Uptake of tenofovir prophylaxis among eligible pregnant women	90%	

TABLE 3 Cost estimates and the cascade of screening and treatment for each strategy.

	HBV DNA strategy	HBeAg strategy	HBcrAg-RDT strategy	Treat-All strategy
Total incremental economic cost	6128875	4135233	3959689	4141206
Number of pregnant women screened for HBsAg	729059	729059	729059	729059
Cost per pregnant woman screened for HBsAg	8.41	5.67	5.43	5.68
Number of pregnant women screened HBsAg+	74364	74364	74364	74364
Cost per HBsAg+ pregnant woman	82.42	55.61	53.25	55.69
Number of pregnant women screened with a second test	66928	66928	66928	-
Cost per pregnant woman screened with a second test	91.57	61.79	59.16	-
Number of pregnant women positive at second test	6358	11133	8038	-
Cost per pregnant woman positive at second test	963.94	371.44	492.62	-
Number of pregnant women receiving TDF prophylaxis	5722	10020	7234	66928
Cost per pregnant woman receiving TDF prophylaxis	1071.05	412.71	547.36	61.88

Recurrent costs associated with consumables are the predominant contributor to the total economic cost in all strategies, accounting for 82.8% (HBV DNA), 74.3% (HBeAg), 75.7% (HBcrAg-RDT), and 75.7% (Treat-All) (Table 4). Recurrent costs associated with salaries accounted for 14.2% (HBV DNA), 21.2% (HBeAg), 21.1% (HBcrAg-RDT), and 21.0% (Treat-All). To implement each strategy effectively, the additional number of healthcare workers required at the PHC level would be 125 (HBV DNA), 127 (HBeAg), 119 (HBcrAg-RDT), and 181 (Treat-All).

The screening activity, including both the HBsAg screening test and the second test, was the primary cost driver, accounting for 78.7%, 66.8%, 66.1%, and 46.5% of the total cost in the HBV DNA, HBeAg, HBcrAg-RDT, and the Treat-All strategies, respectively (Figure 1). Specifically, the cost of the HBsAg screening accounted for 26.1% (HBV DNA), 38.7% (HBeAg), 40.4% (HBcrAg-RDT), and 38.6% (Treat-All) of the total cost, while the second test represented 44.2% (HBV DNA), 15.7% (HBeAg), and 17.1% (HBcrAg-RDT).

3.3 | Sensitivity analysis

For all strategies, the economic cost per pregnant woman screened for HBsAg was most sensitive to variations in the prices of the HBsAg screening test and the second test (Table 5). For all variations in the parameters considered, the HBcrAg strategy was the least expensive, except when the TDF price decreased by 25%, in which case the Treat-All strategy became the least expensive.

TABLE 4 Cost estimates by cost component and cost type for each strategy.

Cost component	HBV DNA strategy US$ (%)	HBeAg strategy US$ (%)	HBcrAg-RDT strategy US$ (%)	Treat-All strategy US$ (%)
Preintroduction				
Subtotal	71 940 (1.17)	71 940 (1.74)	71 940 (1.82)	71 940 (1.74)
Social mobilization				
Recurrent—consumables	4244 (0.07)	4244 (0.10)	4244 (0.11)	4244 (0.10)
Recurrent—salaries	188 886 (3.08)	188 886 (4.57)	188 886 (4.77)	188 886 (4.56)
Subtotal	193 130 (3.15)	193 130 (4.67)	193 130 (4.88)	193 130 (4.66)
Supervision and monitoring				
Recurrent—consumables	79 494 (1.30)	79 494 (1.92)	79 494 (2.01)	79 494 (1.92)
Recurrent—salaries	173 855 (2.84)	173 855 (4.20)	173 855 (4.39)	173 855 (4.20)
Subtotal	253 349 (4.13)	253 349 (6.13)	253 349 (6.40)	253 349 (6.12)
Training				
Recurrent—consumables	304 562 (4.97)	304 562 (7.37)	304 562 (7.69)	304 562 (7.35)
Recurrent—salaries	251 315 (4.10)	251 315 (6.08)	251 315 (6.35)	251 315 (6.07)
Subtotal	555 877 (9.07)	555 877 (13.44)	555 877 (14.04)	555 877 (13.42)
Transportation and storage				
Recurrent—consumables	14 858 (0.24)	15 438 (0.37)	17 307 (0.44)	20 407 (0.49)
Recurrent—salaries	8766 (0.14)	9109 (0.22)	10 211 (0.26)	12 061 (0.29)
Capital	46 718 (0.76)	48 542 (1.17)	54 416 (1.37)	64 276 (1.55)
Subtotal	70 343 (1.15)	73 088 (1.77)	81 934 (2.07)	96 744 (2.34)
Screening				
Recurrent—consumables for HBsAg screening	1 754 342 (28.62)	1 754 342 (42.42)	1 754 342 (44.31)	1 754 342 (42.36)
Recurrent—salaries for HBsAg screening	171 908 (2.80)	171 908 (4.16)	171 908 (4.34)	171 908 (4.15)
Capital for HBsAg screening	386 (0.01)	386 (0.01)	386 (0.01)	386 (0.01)
Subtotal—HBsAg screening	1 926 636 (31.44)	1 926 636 (20.20)	1 926 636 (17.47)	1 926 636 (46.52)
Recurrent—consumables for the second test	2 773 454 (45.25)	714 219 (17.27)	676 036 (17.07)	-
Recurrent—salaries for the second test	53 287 (0.87)	53 287 (1.29)	15 781 (0.40)	-
Capital for the second test	67 999 (1.11)	67 999 (1.64)	35 (<0.01)	-
Subtotal—second test	2 894 740 (47.23)	835 505 (46.59)	691 853 (48.66)	-
Subtotal	4 821 376 (78.67)	2 762 141 (66.80)	2 618 489 (66.13)	1 926 636 (46.52)
Treatment				
Recurrent—consumables	77 644 (1.27)	135 956 (3.29)	98 159 (2.48)	908 123 (21.93)
Recurrent—salaries	3698 (0.06)	6476 (0.16)	4676 (0.12)	43 256 (1.04)
Subtotal	81 343 (1.33)	142 431 (3.44)	102 835 (2.60)	951 379 (22.97)
Health information system				
Recurrent—consumables	63 219 (1.03)	63 219 (1.53)	63 219 (1.60)	63 219 (1.53)
Recurrent—salaries	18 299 (0.30)	20 058 (0.49)	18 918 (0.48)	28 933 (0.70)
Subtotal	81 518 (1.33)	83 277 (2.01)	82 136 (2.07)	92 152 (2.23)
Subtotal recurrent—consumables	5 071 818 (82.75)	3 071 473 (74.28)	2 997 363 (75.70)	3 134 391 (75.69)
Subtotal recurrent—salaries	870 014 (14.20)	874 893 (21.16)	835 548 (21.10)	870 213 (21.01)
Subtotal capital	187 043 (3.05)	188 867 (4.57)	126 778 (3.20)	136 602 (3.30)
Total	6 128 875 (100.00)	4 135 233 (100.00)	3 959 689 (100.00)	4 141 206 (100.00)

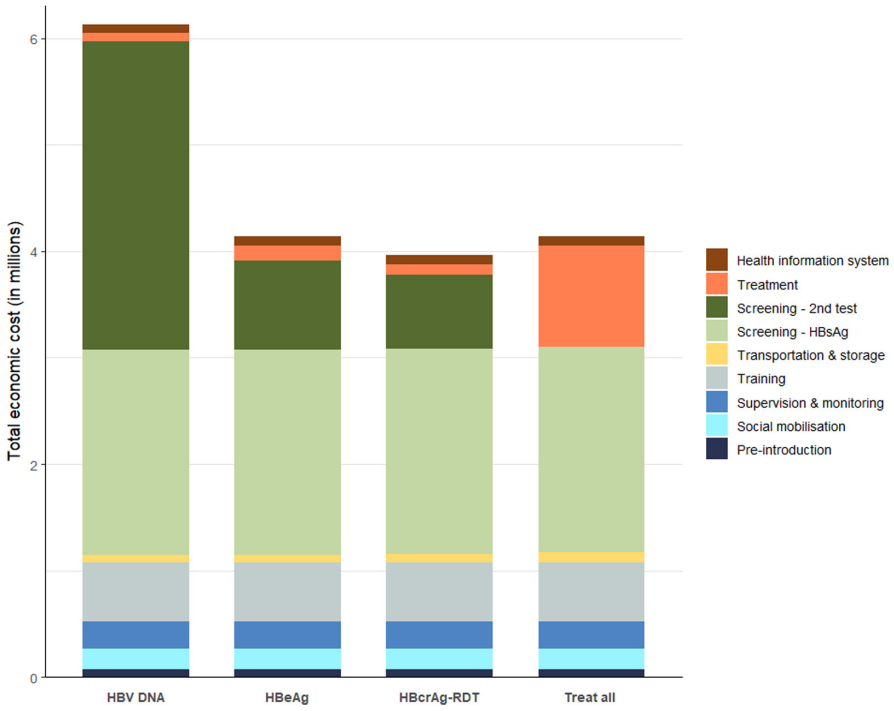

FIGURE 1 Distribution of costs by cost component for each strategy. Costs of integrating hepatitis B screening and antiviral prophylaxis into routine antenatal care in Burkina Faso: Treat All versus targeted strategies.

For the cost per pregnant woman receiving TDF prophylaxis, sensitivity analysis showed that variations in the proportion of HBsAg-positive pregnant women with a high viral load had the greatest impact in the HBV DNA, HBeAg, and HBcrAg-RDT strategies. In the Treat-All strategy, variations in the HBsAg prevalence had the greatest impact.

4 | DISCUSSION

Our results indicate that the HBcrAg-RDT strategy was the least expensive, costing approximately half as much as the HBV DNA strategy and slightly less than the HBeAg and treat-all strategies. The substantial cost disparity between the HBV DNA strategy and the other strategies primarily arises from the higher unit cost of the HBV DNA test ($40.0), which is approximately four times that of the HBeAg immunoassay ($9.6) or HBcrAg-RDT ($10.0). The HBcrAg-RDT, despite its slightly higher unit cost compared to the HBeAg test, incurred lower consumable costs due to eliminating the need for venepuncture and sample transport to laboratories.

The Treat-All strategy offers the lowest marginal cost per pregnant woman receiving TDF and becomes competitive when the unit price of the cost of TDF decreases. Recent modeling studies have investigated the cost-effectiveness of the Treat-All strategy in sub-Saharan Africa.[9,10] In South Africa, an upper-middle-income country, Mokaya and colleagues[10] found that the Treat-All strategy was cost-effective compared to no HBsAg screening and no TDF prophylaxis, while the HBeAg strategy incurred higher costs and prevented fewer infections than the Treat-All strategy. According to a global model by Nayagam and colleagues,[9] PMTCT strategies based on different eligibility criteria (HBV DNA, HBeAg, or Treat-All) could be cost-effective compared to HepB-BD alone in a few sub-Saharan African countries, but not in Burkina Faso.

In 2022, Burkina Faso allocated $650 million to its health budget. Compared to this national budget, the total economic costs of implementing the HBV PMTCT strategies are expected to be relatively modest, with HBV DNA projected to account for 0.94%, HBeAg for 0.64%, HBcrAg for 0.61%, and the Treat-All strategy for 0.64% of the national health budget. We did not estimate financial costs, which would reflect the actual expenses for additional resources and are more informative for government budgeting. Nevertheless, most of our economic cost estimates should align with the financial costs, except for transportation and storage, for which Burkina Faso's existing capacities should be sufficient.

It is important to note that the current Burkina Faso's healthcare workforce density (0.9 nurses and midwives per 1000 people[18]) falls short of the Sustainable Development Goals' target of 2.3 healthcare workers per 1000 people.[22] Integrating HBV PMTCT into the routine antenatal care without reinforcing the healthcare workforce could severely strain current PHC capacities. The Treat-All strategy would require more healthcare workers ($n = 181$) than the targeted strategies ($n = 125$ for HBV DNA, $n = 127$ for HBeAg, and $n = 119$ for HBcrAg-RDT).

The present study had limitations. First, we could not account for geographical variations in costs, such as midwives' salaries for which we had to rely on the national average salary. Second, the assumption of equipment availability for HBV DNA or HBeAg analysis at the regional level might have overestimated the costs

TABLE 5 Results of the sensitivity analyses.

	HBV DNA strategy	HBeAg strategy	HBcrAg-RDT strategy	Treat-All strategy
95% coverage for HBsAg and second test screening and TDF prophylaxis				
Total incremental economic cost	6 578 671	4 361 191	4 171 253	4 364 513
Cost per pregnant woman screened for HBsAg	8.55	5.67	5.42	5.67
Cost per HBsAg+ pregnant woman	83.81	55.56	53.14	55.60
Cost per pregnant woman screened with a second test	88.22	58.48	55.94	-
Cost per pregnant woman positive at second test	928.64	351.58	465.75	-
Cost per pregnant woman receiving TDF prophylaxis	977.52	370.09	490.27	58.53
80% coverage for HBsAg and second test screening and TDF prophylaxis				
Total incremental economic cost	5 286 522	3 705 865	3 555 602	3 712 441
Cost per pregnant woman screened for HBsAg	8.16	5.72	5.49	5.73
Cost per HBsAg+ pregnant woman	79.98	56.06	53.79	56.16
Cost per pregnant woman screened with a second test	99.97	70.08	67.24	-
Cost per pregnant woman positive at second test	1052.32	421.29	559.85	-
Cost per pregnant woman receiving TDF prophylaxis	1315.40	526.61	699.81	70.20
90% coverage of HBsAg and 100% coverage of the second test and TDF prophylaxis				
Total incremental economic cost	6 463 892	4 256 374	4 064 280	4 248 298
Cost per pregnant woman screened for HBsAg	8.87	5.84	5.57	5.83
Cost per HBsAg+ pregnant woman	86.92	57.24	54.65	57.13
Cost per pregnant woman screened with a second test	86.92	57.24	54.65	-
Cost per pregnant woman positive at second test	914.97	344.09	455.07	-
Cost per pregnant woman receiving TDF prophylaxis	914.97	344.09	455.07	57.13
Prevalence of HBsAg + pregnant women = 8%				
Total incremental economic cost	5 495 327	3 931 686	3 778 517	3 920 884
Cost per pregnant woman screened for HBsAg	7.54	5.39	5.18	5.38
Cost per HBsAg+ pregnant woman	94.22	67.41	64.78	67.23
Cost per pregnant woman screened with a second test	104.69	74.90	71.98	-
Cost per pregnant woman positive at second test	1101.98	450.27	599.35	-
Cost per pregnant woman receiving TDF prophylaxis	1224.43	500.30	665.95	74.69
Prevalence of HBsAg + pregnant women = 12%				
Total incremental economic cost	6 647 266	4 301 804	4 107 921	4 321 470
Cost per pregnant woman screened for HBsAg	9.12	5.90	5.63	5.93
Cost per HBsAg+ pregnant woman	75.98	49.17	46.95	49.40
Cost per pregnant woman screened with a second test	84.42	54.63	52.17	-
Cost per pregnant woman positive at second test	888.66	328.44	434.40	-
Cost per pregnant woman receiving TDF prophylaxis	987.39	364.93	482.67	54.88
Proportion of HBsAg + pregnant women with high viral load = 6%				
Total incremental economic cost	6 096 697	4 111 067	3 934 590	4 141 204
Cost per pregnant woman screened for HBsAg	8.36	5.64	5.40	5.68
Cost per HBsAg+ pregnant woman	81.98	55.28	52.91	55.69
Cost per pregnant woman screened with a secnd test	91.09	61.43	58.79	-
Cost per pregnant woman positive at second test	1518.23	438.57	633.50	-
Cost per pregnant woman receiving TDF prophylaxis	1686.93	487.30	703.89	61.88
Proportion of HBsAg + pregnant women with high viral load = 15%				
Total incremental economic cost	6 179 441	4 173 207	3 999 131	4 141 209
Cost per pregnant woman screened for HBsAg	8.48	5.72	5.49	5.68

TABLE 5 (Continued)

	HBV DNA strategy	HBeAg strategy	HBcrAg-RDT strategy	Treat-All strategy
Cost per HBsAg+ pregnant woman	83.10	56.12	53.78	55.69
Cost per pregnant woman screened with a second test	92.33	62.35	59.75	-
Cost per pregnant woman positive at second test	615.54	300.28	366.58	-
Cost per pregnant woman receiving TDF prophylaxis	683.93	333.65	407.32	61.88
Price of all screening tests increased by 25%				
Total incremental economic cost	7 206 189	4 697 738	4 528 633	4 541 141
Cost per pregnant woman screened for HBsAg	9.88	6.44	6.21	6.23
Cost per HBsAg+ pregnant woman	96.90	63.17	60.90	61.07
Cost per pregnant woman screened with a second test	107.67	67.66	70.19	-
Cost per pregnant woman positive at second test	1133.38	421.96	563.40	-
Cost per pregnant woman receiving TDF prophylaxis	1259.32	468.85	626.00	67.85
Price of all screening tests decreased by 25%				
Total incremental economic cost	5 051 560	3 572 727	3 390 746	3 741 272
Cost per pregnant woman screened for HBsAg	6.93	4.90	4.65	5.13
Cost per HBsAg+ pregnant woman	67.93	48.04	45.60	50.31
Cost per pregnant woman screened with a 2nd test	75.48	53.38	50.66	-
Cost per pregnant woman positive at second test	794.51	320.91	421.84	-
Cost per pregnant woman receiving TDF prophylaxis	882.78	356.57	468.71	55.90
25% price increase for HBsAg screening test				
Total incremental economic cost	6 528 809	4 535 167	4 359 624	4 541 141
Cost per pregnant woman screened for HBsAg	8.96	6.22	5.98	6.23
Cost per HBsAg+ pregnant woman	87.80	60.99	58.63	61.07
Cost per pregnant woman screened with a second test	97.55	67.76	65.14	-
Cost per pregnant woman positive at second test	1026.85	407.36	542.38	-
Cost per pregnant woman receiving TDF prophylaxis	1140.94	452.62	602.64	67.85
25% price decrease for HBsAg screening test				
Total incremental economic cost	5 728 940	3 735 298	3 559 755	3 741 272
Cost per pregnant woman screened for HBsAg	7.86	5.12	4.88	5.13
Cost per HBsAg+ pregnant woman	77.04	50.23	47.87	50.31
Cost per pregnant woman screened with a second test	85.60	55.81	53.19	-
Cost per pregnant woman positive at second test	901.04	335.51	442.87	-
Cost per pregnant woman receiving TDF prophylaxis	1001.16	372.79	492.07	55.90
25% price increase for second test				
Total incremental economic cost	6 806 255	4 297 804	4 128 698	4 141 206
Cost per pregnant woman screened for HBsAg	9.34	5.90	5.66	5.68
Cost per HBsAg+ pregnant woman	91.53	57.79	55.52	55.69
Cost per pregnant woman screened with a second test	101.70	64.22	61.69	-
Cost per pregnant woman positive at second test	1070.48	386.04	513.65	-
Cost per pregnant woman receiving TDF prophylaxis	1189.43	428.93	570.72	61.88
25% price decrease for second test				
Total incremental economic cost	5 451 495	3 972 661	3 790 680	4 141 206
Cost per pregnant woman screened for HBsAg	7.48	5.45	5.20	5.68
Cost per HBsAg+ pregnant woman	73.31	53.42	50.97	55.69
Cost per pregnant woman screened with a second test	81.45	59.36	56.64	-
Cost per pregnant woman positive at second test	857.41	356.83	471.59	-

(Continues)

TABLE 5 (Continued)

	HBV DNA strategy	HBeAg strategy	HBcrAg-RDT strategy	Treat-All strategy
Cost per pregnant woman receiving TDF prophylaxis	952.67	396.48	523.99	61.88
25% increase in TDF price				
Total incremental economic cost	6 148 286	4 169 221	3 984 229	4 368 237
Cost per pregnant woman screened for HBsAg	8.43	5.72	5.46	5.99
Cost per HBsAg+ pregnant woman	82.68	56.07	53.58	58.74
Cost per pregnant woman screened with a second test	91.86	62.29	59.53	-
Cost per pregnant woman positive at second test	967.00	374.49	495.67	-
Cost per pregnant woman receiving TDF prophylaxis	1074.44	416.10	550.75	65.27
25% decrease in TDF price				
Total incremental economic cost	6 109 464	4 101 244	3 935 149	3 914 176
Cost per pregnant woman screened for HBsAg	8.38	5.63	5.40	5.37
Cost per HBsAg+ pregnant woman	82.16	55.15	52.92	52.64
Cost per pregnant woman screened with a second test	91.28	61.28	58.80	-
Cost per pregnant woman positive at second test	960.89	368.38	489.57	-
Cost per pregnant woman receiving TDF prophylaxis	1067.66	409.32	543.96	58.48
Eligible pregnant women receive four 30-tablet packs of TDF (until 1 month postpartum)				
Total incremental economic cost	6 155 975	4 182 685	3 993 949	4 458 149
Cost per pregnant woman screened for HBsAg	8.44	5.74	5.48	6.11
Cost per HBsAg+ pregnant woman	82.78	56.25	53.71	59.95
Cost per pregnant woman screened with a second test	91.98	62.50	59.68	-
Cost per pregnant woman positive at second test	968.21	375.70	496.88	-
Cost per pregnant woman receiving TDF prophylaxis	1075.79	417.44	552.09	66.61

Abbreviation: TDF, tenofovir disoproxil fumarate.

associated with transporting blood samples. In Burkina Faso, some districts now have access to automated HBV DNA assays, such as GeneXpert. Third, there are no real-world data in Burkina Faso on the feasibility and acceptability of the different strategies to select women for TDF prophylaxis. A recent study in Uganda described the care cascade for HBV PMTCT based on the HBV DNA strategy.[23] While all pregnant women enrolled in the study accepted HBsAg screening, and 93% of HBsAg-positive women accepted HBV DNA testing, only 73% returned for their results due to the long turnaround time from sample collection to receipt of HBV DNA results (median: 46 days). The use of strategies with same-day initiation of TDF prophylaxis, such as HBcrAg-RDT or Treat All, could potentially overcome this challenge. However, it is uncertain whether a similar proportion of women would adhere to TDF prophylaxis once they fully understand its risks and benefits, compared to situations where communication might be more challenging under the Treat-All strategy. Finally, our study did not account for Burkina Faso's ongoing security crisis, which may affect the cost and coverage of the interventions.

Our cost estimation indicates that the economic costs required to integrate HBV PMTCT into routine antenatal care are likely to be modest in relation to Burkina Faso's total annual health budget. Conducting a cost-effectiveness and budget impact analysis is crucial to provide more robust guidance to the country in selecting the optimal strategy. This study provides robust data for such analyses, not only for Burkina Faso, but also for other highly HBV-endemic countries considering adopting similar strategies.

AUTHOR CONTRIBUTIONS

Andréa Gosset led the study design, data collection, analysis, and drafting of the manuscript. Seydou Drabo contributed to study design and data collection. Patrizia Carrieri and Sylvie Boyer contributed to study design. Abdoul Tiendrebeogo, Jeanne Perpétue Vincent, Yasuhito Tanaka, Roger Sombié, Haoua Tall, Dramane Kania contributed to data collection. Yusuke Shimakawa contributed to study design, data collection, analysis, and drafting of the manuscript. All authors reviewed and approved the final version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

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DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in this article.

ORCID

Andréa Gosset https://orcid.org/0000-0003-0743-2458

REFERENCES

1. Polaris Observatory Collaborators. Global prevalence, cascade of care, and prophylaxis coverage of hepatitis B in 2022: a modelling study. *Lancet Gastroenterol Hepatol*. 2023;8(10):879-907. doi:10.1016/S2468-1253(23)00197-8
2. Edmunds WJ, Medley GF, Nokes DJ, Hall AJ, Whittle HC. The influence of age on the development of the hepatitis B carrier state. *Proc Biol Sci*. 1993;253(1337):197-201. doi:10.1098/rspb.1993.0102
3. Shimakawa Y, Yan H-J, Tsuchiya N, Bottomley C, Hall AJ. Association of early age at establishment of chronic hepatitis B infection with persistent viral replication, liver cirrhosis and hepatocellular carcinoma: a systematic review. *PLoS One*. 2013;8(7):e69430. doi:10.1371/journal.pone.0069430
4. Shimakawa Y, Veillon P, Birguel J, et al. Residual risk of mother-to-child transmission of hepatitis B virus infection despite timely birth-dose vaccination in Cameroon (ANRS 12303): a single-centre, longitudinal observational study. *Lancet Glob Health*. 2022;10(4):e521-e529. doi:10.1016/S2214-109X(22)00026-2
5. *Prevention of Mother-to-Child Transmission of Hepatitis B Virus: Guidelines on Antiviral Prophylaxis in Pregnancy*. World Health Organization; 2020.
6. Boucheron P, Lu Y, Yoshida K, et al. Accuracy of HBeAg to identify pregnant women at risk of transmitting hepatitis B virus to their neonates: a systematic review and meta-analysis. *Lancet Infect Dis*. 2021;21(1):85-96. doi:10.1016/S1473-3099(20)30593-4
7. Shimakawa Y, Ndow G, Kaneko A, et al. Rapid point-of-care test for hepatitis B Core-related antigen to diagnose high viral load in resource-limited settings. *Clin Gastroenterol Hepatol*. 2022;21(7):1943-1946.e2. doi:10.1016/j.cgh.2022.05.026
8. Vincent JP, Segeral O, Kone A, et al. Evaluation of hepatitis b core-related antigen rapid test (HBcrAg-RDT) to identify HBV-infected women eligible for peripartum antiviral prophylaxis in resource-limited countries. *J Hepatol*. 2023;78:S897-S898.
9. Nayagam S, de Villiers MJ, Shimakawa Y, et al. Impact and cost-effectiveness of hepatitis B virus prophylaxis in pregnancy: a dynamic simulation modelling study. *Lancet Gastroenterol Hepatol*. 2023;8(7):635-645. doi:10.1016/S2468-1253(23)00074-2
10. Mokaya J, Burn EAO, Tamandjou CR, et al. Modelling cost-effectiveness of tenofovir for prevention of mother to child transmission of hepatitis B virus (HBV) infection in South Africa. *BMC Public Health*. 2019;19:829. doi:10.1186/s12889-019-7095-4
11. Meda N, Tuaillon E, Kania D, et al. Hepatitis B and C virus seroprevalence, Burkina Faso: a cross-sectional study. *Bull World Health Organ*. 2018;96(11):750-759. doi:10.2471/BLT.18.208603
12. Ministère de la Santé et de l'Hygiène Publique du Burkina Faso. Plan de l'élimination de la transmission mère-enfant du VIH, de la syphilis et de l'hépatite B 2021–2025. 2021.
13. Zoungrana-Yameogo WN, Romba I, Samadoulougou S, et al. Dépistage du VIH et traitement chez la femme enceinte au Burkina Faso à l'ère de la stratégie universelle « Test and Treat ». *Sante Publique*. 2022;34(HS1):19b. doi:10.3917/spub.220.0019b
14. Tall H, Adam P, Tiendrebeogo ASE, et al. Impact of introducing hepatitis B birth dose vaccines into the infant immunization program in Burkina Faso: study protocol for a stepped wedge cluster randomized trial (NéoVac study). *Vaccine*. 2021;9(6):583. doi:10.3390/vaccines9060583
15. Gosset A, Diallo MY, Betsem E, et al. Cost-effectiveness of adding a birth dose of hepatitis B vaccine in the Dafra district of the Hauts-Bassins region in Burkina Faso (NéoVac study). *Vaccine*. 2021;39(33):4659-4670. doi:10.1016/j.vaccine.2021.06.059
16. Drummond M. Methods for the economic evaluation of health care programmes. *Oxford Medical Publications*. 4th ed. Oxford University Press; 2015.
17. World Health Organisation. Making choices in health: WHO guide to cost-effectiveness analysis. 2003. Accessed July 17, 2018. http://apps.who.int/iris/handle/10665/42699
18. World Bank Open Data. World bank open data. Accessed August 28, 2023. https://data.worldbank.org
19. United Nations. Population division of the department of economic and social affairs, World population prospects 2022. https://population.un.org/wpp/Download/Standard/CSV/
20. Lingani M, Akita T, Ouoba S, et al. High prevalence of hepatitis B infections in Burkina Faso (1996-2017): a systematic review with meta-analysis of epidemiological studies. *BMC Public Health*. 2018;18(1):551. doi:10.1186/s12889-018-5432-7
21. Guingané AN, Kaboré R, Shimakawa Y, et al. Screening for hepatitis B in partners and children of women positive for surface antigen, Burkina Faso. *Bull World Health Organ*. 2022;100(4):256-267. doi:10.2471/BLT.21.287015
22. World Health Organization. Health workforce requirements for universal health coverage and the Sustainable Development Goals. (Human Resources for Health Observer, 17). Geneva: World Health Organization, 2016. Accessed February 28, 2023. https://apps.who.int/iris/handle/10665/250330
23. Thahir S, Muhindo E, Turigye B, et al. Implementation of hepatitis B screening into routine antenatal care to prevent mother-to-child transmission in rural Western Uganda. *Open Forum Infect Dis*. 2023;10(9):ofad452. doi:10.1093/ofid/ofad452

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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