PULSE EXPERIENTIAL TEAM ASSIGNMENT

Team #: 43

1. Title of your PULSE experiential assignment.
Provide a creative and informative title.

The Silent Invader: A Guide to Hepatitis B

2. Please summarize your PULSE experiential assignment (max 300 words).
Provide a non-technical (lay) summary of your PULSE assignment. Prompts to think about: What is the topic? What is the format? Why did you choose this topic and format? The summary for lay audience is a brief and accessible summary of the assignment that is used to explain complex ideas, technical writing and scientific terms to people who do not have prior knowledge of the subject (e.g., high school science level). This summary should include the importance, impact, and content of your assignment to a broader audience.
[Team 23 is an example of an informative lay summary.]

Hepatitis B is a “silent invader” – a viral infection that attacks the liver and can live in the body for years without causing any obvious symptoms. If left unchecked, the virus can cause severe liver damage, leading to cirrhosis (heavy scarring) and even liver cancer. Despite being preventable with a vaccine, Hepatitis B remains a major global health threat, affecting hundreds of millions of people worldwide. Understanding how this virus operates, how it is detected, and how it can be treated or prevented is crucial for saving lives and stopping the spread of the disease.

To make this medical topic accessible and engaging, I created an interactive tutorial as a website, which has four core modules: Pathology (how the virus invades healthy liver cells), Diagnosis (how doctors read blood tests to find the virus), Treatment (how Hepatitis B can be treated and what a “functional cure” is), and Prevention (how Hepatitis B can be prevented). The website also includes a Visual Glossary to provide a quick lookup of related medical jargon, Clinical Scenarios that challenge users to apply their knowledge to realistic patient cases, and a final Certification quiz that rewards learners with a “Clinical Master” badge upon completion.

I chose this interactive web format because medical science can often feel intimidating to the general public. The interactive elements and gamified tools can make it less intimidating. For example, the “Serology Solver” asks users to act as medical detectives to interpret patient blood tests, and the “FibroScan Simulator” lets users adjust a slider to see how liver stiffness correlates with physical liver damage. The experience wraps up with a Final Assessment quiz where users can earn a "Clinical Master" certificate. By transforming “boring” medical information into an interactive and entertaining experience, this project ensures that learners can not only master the knowledge and facts, but also truly understand the real-world impact and management of Hepatitis B.

3. Provide up to 6 keywords relevant to your PULSE experiential assignment.
3-6 keywords are ideal.

- Hepatitis B

- Liver Pathology
- Clinical Case Studies
- Interactive Tutorial

4. Identify the course topic with which your PULSE assignment most aligns.
Refer to the various topics outlined under 'Course content and Schedule' in the syllabus (e.g. Inflammation).

Hepatobiliary Pathology

5. What are the learning outcomes?
There should be a minimum of 2 learning outcomes for your assignments. For further information on learning outcomes, the Centre for Teaching and Learning offers information: https://teaching.uwo.ca/curriculum/coursedesign/learning-outcomes.html

By completing this interactive tutorial, learners will be able to:

1. Analyze the viral lifecycle of Hepatitis B.
2. Explain how Hepatitis B evades the host immune system and causes chronic liver disease.
3. Interpret Hepatitis B serological markers and non-invasive liver staging tools to differentiate between acute, chronic, and resolved phases of infection.
4. Assess the physical progression of liver pathology by correlating clinical diagnostic data with physiological liver damage.
5. Evaluate simple realistic clinical scenarios to recommend appropriate antiviral therapies and preventative measures based on current medical guidelines.

6. Why did the team select the chosen topic and the medium? How will the topic and medium of choice help learners?

I chose Hepatitis B as the topic because it is a major global health issue, affecting a significant number of people worldwide and contributing to serious complications such as chronic liver disease, cirrhosis, and hepatocellular carcinoma. It is also an especially valuable topic for learning because it combines several important areas of health science, including virology, immunology, diagnosis, prevention, and long-term disease management. By focusing on this topic, learners can build a deeper understanding not only of the virus itself, but also of broader concepts such as chronic infection, host immune response, screening, vaccination, and clinical decision-making.

I chose to build an interactive web application as the medium because this format is well-suited to teaching complex medical content in a clear, engaging, and learner-centred way. It allows learners to actively engage with the material through gamified modules, such as the Serology Solver for interpreting blood test results. By "playing" with those modules, learners are encouraged to apply, test, and reinforce their understanding in realistic contexts. They will also receive immediate feedback to help them identify and correct misunderstandings. Overall, the chosen topic and medium work together to promote deeper understanding and better learning effect.

7. Did the team use an artificial intelligence (AI) technology tool? If so, which AI technology tool(s) did the team use? What other technology tools did the team

use? Is the technology tool novel? Is the team using this technology tool in a novel fashion? If the team did not use technology tool, why did the team decide against using the technology tool(s)?

Please include details (e.g., for what purpose was the tool used for? Why was the tool the best tool to use for your assignment? Are there alternative tools that were considered?)

I used two AI tools for this project: Google NotebookLM and Google AI Studio, and two large language models (LLMs): Gemini 3.1 Pro and ChatGPT 5.4. Both NotebookLM and AI Studio are powered by Gemini 3.1 Pro. I leveraged NotebookLM to synthesize all of my collected sources, plan the website's structure, and generate the textual content for the modules. These output scripts were then used as the input to prompt Google AI Studio to generate the actual code for the website. I used ChatGPT 5.4 to help fact-check the scripts to ensure the veracity of the content.

I used these tools in a novel way. Rather than simply asking a chatbot (like ChatGPT) to write a website, I created an effective pipeline. By using NotebookLM to anchor the AI to my collected webpages and papers, I ensured the code generated by AI Studio was tailored to my researched content without any false information. By using ChatGPT 4.5 for fact-checking after Gemini 3.1 Pro fact-checked its own creation, I had additional protection against hallucination and false information because theoretically, the probability of having two state-of-art AIs miss the same misinformation in the same place is very low.

I selected NotebookLM, AI Studio, and the Gemini 3.1 Pro model also because of their seamless integration within the same ecosystem, as all of them are Google products. The intuitive user interfaces allowed me to rapidly build and set up the website through prompting. While I considered alternative AI tools like Vercel and Bolt, the Gemini ecosystem offered the greatest convenience and the best integration of different tools. It is also worth noting that Google AI Studio can publish the generated website by only one click, an advantage I did not find in similar tools.

8. How is your PULSE experiential assignment innovative and/or novel?

Describe what about the PULSE assignment is innovative/novel. Is there a particular component or content that is innovative/novel? How is it different from other content that already exists?

My PULSE assignment is innovative because it goes beyond traditional, text-heavy medical education by utilizing interactive quizzes, games, simulators, etc., which encourages learners to actively explore new ideas and clinical data. While existing educational content on Hepatitis B usually relies on static charts or passive video lectures, this project requires the learner to actively engage in the learning process rather than just read about it.

The most novel components of this assignment are the interactive games designed to help understand the hardest concepts in hepatology. For example, to play with "The Replication Cycle of HBV" in the Pathology module, learners cannot simply read the steps of viral replication; they must actively drag and drop the steps (like cccDNA formation and RNA transcription) into the correct chronological order. When they

make a mistake, a message box will pop up and guide them to make the correct choice.

This approach is different from existing content because it bridges the gap between theoretical knowledge and clinical application. By combining modern AI web development with up-to-date medical knowledge, this interactive tutorial creates a fun and engaging environment where learners can make clinical decisions, evaluate the consequences, and correct their misunderstandings in real time.

9. If you used an AI tool, please copy and paste the prompt(s)/question(s) used along with the output(s)/answer(s) from the AI tool.

The response here is to allow others to replicate the team's work. If the prompts/outputs are lengthy (over 1 page), please attach it as a separate document and note below [Please see attached document].

Please see the attached document "PULSE Team 43 – AI Prompts and Outputs.pdf"

10. If you did not use an AI tool, please attach a copy of the team's notes to the assignment.

The response here is to allow others to observe the 'behind the scenes' team's work.

N/A

11. How did the team ensure the veracity of the information presented in the PULSE assignment?

The response should highlight how the team has ensured that the information presented in the assignment is evidence-based and not spreading misinformation. You should specifically mention which databases (if any) or textbook materials you used, and how you kept track of the sources/references for each claim. If AI provided you with false information, please describe how the team has fact-checked the AI response and the legitimate (scientific) sources you used. A reference document should be provided in the reference section (15. References) below. Please ensure to include in-text citations in your assignment where applicable.

Firstly, I collected source data only from highly credible and authoritative web sources such as Word Health Organization, NCBI, CDC, Liver Canada, Mayo Clinic, and peer-reviewed reputable journals such as Nature, Lancet, Journal of Hepatology, and Antiviral Research.

Secondly, I prompted Gemini Pro 3.1 (in NotebookLM) to generate the first draft of the website script only from those sources and cite the sources of all key information. To prevent misinformation or hallucination introduced in this step, I asked both Gemini Pro 3.1 and ChatGPT 5.4 to fact-check the script and cite external sources to support the claims. I used two state-of-the-art AIs to fact-check the same script as it is not very likely for both of them to overlook the same misinformation.

Thirdly, I manually reviewed the AI-generated fact-checking results and read all the sources to make sure that all the contents in the script are correct. During this process, I also included the manually checked in-text citations in the scripts.

Finally, I compared the scripts with the course notes under “HEPATOBILIARY PATHOLOGY / Viral Hepatitis / Hepatitis B” and ensured there is no obvious discrepancy between the course material and the scripts.

After all those steps, I finalized the scripts to be sent to AI Studio to build the website.

12. Write a meaningful team reflection about the PULSE session (max 250 words).

Prompts to help your team write the reflection: Were there any team/individual biases that surfaced when creating content for the assignment? Did the team implement any practices to ensure the content was equitable, diverse, and/or inclusive? How has the PULSE assignment helped with the team’s learning? If the team had to estimate, how long did the assignment take? What worked well for your team? What would the team do differently next time? What were the opportunities and challenges with creating the PULSE assignment to help others’ learning? Were there any barriers or limitations?

Although this was submitted as a team assignment, I completed it independently. One personal bias that came up during the project was my strong interest in Hepatitis B, because one of my family members currently lives with chronic HBV. I recognized that this personal connection could make me focus too much on certain clinical aspects, so I tried my best to keep the content evidence-based, balanced, and educational. To make the resource more equitable and inclusive, I aimed to use clear and accessible language, explain medical jargon through a glossary, and design interactive modules that could support learners with different levels of prior knowledge.

This assignment significantly deepened my understanding of Hepatitis B. Beyond reviewing course material, I had to collect and compare sources, fact-check information, test the website modules myself, and think carefully about how to teach difficult concepts such as serology and disease progression in a learner-friendly way. Overall, the project took about two to three months, with most of the time spent on literature review, data collection, and refining the website by vibe-coding.

Something that worked well was the opportunity to develop my independent planning, execution, and time-management skills. A major challenge was the technical barrier of building the website. I could not make any progress for about two weeks because Google was fixing a technical issue in AI Studio when Gemini 3.1 Pro was released. At that time, none of the prompts worked and the website building was extremely slow. Next time, I would have to incorporate more buffer time for such technical delays. For a larger and more complex project, I would consider working in a team instead, so that responsibilities and troubleshooting issues could be shared. I may also try to coordinate the bigger project by using the experiences I have learned from this project.

13. Write the contributions of individual team members using unique initials.

Example: All team members contributed to the design of the prompts used in the technology tool, ChatGPT (GPT-3.5). T.K and T.K2 fact checked the information presented by ChatGPT using published literature on PubMed (PMID 29211319, 32477271). Y.Z finalized and formatted the final infographic and compiled the prompts and outputs. P.E was involved in…

This was a one-person project.

C.Z was the sole contributor to all the aspects of the project, including literature reading and annotation, prompt design, script editing, as well as website building through vibe-coding. C.Z also fact-checked with AI tools and manually, for all the modules (Pathology, Diagnosis, Treatment, Prevention, etc.) in the website.

15. References

Please provide a numbered reference list with Nature citation style. [Please feel free to use citation management software (i.e., free citation manager, e.g., Zotero and Mendeley)]

1. Hepatitis B [Internet]. [cited 2026 Jan 11]. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b
2. Ghany MG, Pan CQ, Lok AS, Feld JJ, Lim JK, Wang SH, et al. AASLD/IDSA Practice Guideline on treatment of chronic hepatitis B. Hepatology. 2025 Nov 4. doi:10.1097/HEP.0000000000001549
3. Vaccine profiles: Hepatitis B [Internet]. [cited 2026 Feb 8]. Available from: https://www.gavi.org/vaccineswork/routine-vaccines/extraordinary-impact-hepatitis-b
4. Yuen MF, Chen DS, Dusheiko GM, Janssen HLA, Lau DTY, Locarnini SA, et al. Hepatitis B virus infection. Nat Rev Dis Primers. 2018 Jun 7;4(1):18035. doi:10.1038/nrdp.2018.35
5. Hepatitis B | Liver Canada [Internet]. [cited 2026 Jan 18]. Available from: https://liver.ca/hepatitis-b/
6. Iannacone M, Beccaria CG, Allweiss L, Lucifora J, Tavis JE, Gehring AJ, et al. Targeting HBV with RNA interference: Paths to cure. Sci Transl Med. 2025.
7. Martinez MG, Boyd A, Combe E, Testoni B, Zoulim F. Covalently closed circular DNA: The ultimate therapeutic target for curing HBV infections. Journal of Hepatology. 2021 Sep;75(3):706–17. doi:10.1016/j.jhep.2021.05.013
8. Jeng WJ, Papatheodoridis GV, Lok ASF. Hepatitis B. The Lancet. 2023 Mar;401(10381):1039–52. doi:10.1016/S0140-6736(22)01468-4
9. Evaluation of the Diagnostic Accuracy of the HBsAg Rapid Test for Hepatitis B Virus Infection. medsc. 2024;5(3). doi:10.23977/medsc.2024.050301
10. Hauk L. Hepatitis B Virus Vaccination and Screening: Best Practices from the ACP and CDC [Internet]. [cited 2026 Feb 8]. Available from: https://www.aafp.org/pubs/afp/issues/2018/0715/p121.html
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12. Anstee QM, Castera L, Loomba R. Impact of non-invasive biomarkers on hepatology practice: Past, present and future. Journal of Hepatology. 2022 Jun;76(6):1362–78. doi:10.1016/j.jhep.2022.03.026
13. Hepatitis B Foundation: Approved Drugs for Adults [Internet]. [cited 2026 Feb 1]. Available from: https://www.hepb.org/treatment-and-management/treatment/approved-drugs-for-adults/
14. Tsukuda S, Watashi K. Hepatitis B virus biology and life cycle. Antiviral Research. 2020 Oct;182:104925. doi:10.1016/j.antiviral.2020.104925
15. Hepatitis B Testing. Testing.com [Internet]. 2021 Aug 27 [cited 2026 Jan 17]. Available from: https://www.testing.com/tests/hepatitis-b-test/
16. Hepatitis B Surface Antigen Quantitative Monitoring | Quest Diagnostics [Internet]. [cited 2026 Jan 18]. Available from: https://www.questdiagnostics.com/healthcare-professionals/clinical-education-center/faq/faq192

17. Public Health Ontario [Internet]. [cited 2026 Jan 17]. Hepatitis B - DNA Viral Load, Genotyping, and Drug Resistance Testing. Available from: https://www.publichealthontario.ca/en/Laboratory-Services/Test-Information-Index/Hepatitis-B-DNA-Geno-DRT
18. Hepatitis B - Diagnosis and treatment - Mayo Clinic [Internet]. [cited 2026 Jan 11]. Available from: https://www.mayoclinic.org/diseases-conditions/hepatitis-b/diagnosis-treatment/drc-20366821
19. Tripathi N, Mousa OY. Hepatitis B. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2026 Jan 11]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK555945/ PubMed PMID: 32310405.
20. Wu IT, Hu TH, Hung CH, Lu SN, Wang JH, Lee CM, et al. Comparison of the efficacy and safety of entecavir and tenofovir in nucleos(t)ide analogue-naive chronic hepatitis B patients with high viraemia: a retrospective cohort study. Clinical Microbiology and Infection. 2017 Jul;23(7):464–9. doi:10.1016/j.cmi.2017.02.001
21. CDC. Hepatitis B [Internet]. 2025 [cited 2026 Jan 18]. Clinical Signs and Symptoms of Hepatitis B. Available from: https://www.cdc.gov/hepatitis-b/hcp/clinical-signs/index.html
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23. Ulrich AK, Fleming DF, Smith EA, Mehr AJ, Redepenning SG, Moat LE, et al. Hepatitis B Vaccination at Birth: Safety, Effectiveness, and Public Health Benefit.
24. Cleveland Clinic [Internet]. [cited 2026 Jan 8]. What Is Hepatitis B? Available from: https://my.clevelandclinic.org/health/diseases/4246-hepatitis-b
25. Alleman MM. Progress Toward Elimination of Mother-to-Child Transmission of Hepatitis B Virus — Region of the Americas, 2012–2022. MMWR Morb Mortal Wkly Rep. 2024;73. doi:10.15585/mmwr.mm7329a3
26. Mayo Clinic [Internet]. [cited 2026 Jan 8]. Hepatitis B - Symptoms and causes. Available from: https://www.mayoclinic.org/diseases-conditions/hepatitis-b/symptoms-causes/syc-20366802
27. CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases [Internet]. 2025 [cited 2026 Jan 11]. Chapter 10: Hepatitis B. Available from: https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-10-hepatitis-b.html

16. Annotated Bibliography

An annotated bibliography is a list of sources (books, articles, websites, etc.) that you used for your project. Each entry has two parts:

1. *Citation – written in the required citation style (same formatting and order as the Nature citation style in your list of references).*
2. *Annotation – a short paragraph that summarizes, evaluates, and explains how the source is useful for your assignment.*

Why do this?

- *Helps you keep track of your research.*
- *Shows your instructor you read and understood your sources.*
- *Develops critical thinking by requiring you to evaluate the quality and relevance of each source.*

Write the annotation (about 150–200 words each)

- *Summary: Briefly describe the main argument or purpose of the source.*
- *Evaluation: Comment on the credibility, strengths, or weaknesses of the source.*
- *Relevance: Explain how you will use this source in your assignment.*

1. Hepatitis B [Internet]. [cited 2026 Jan 11]. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b

   Summary: Hepatitis B is a viral infection that attacks the liver and can cause both acute and chronic disease. This WHO fact sheet provides information about the transmission, symptoms, diagnosis, treatment, prevention and WHO's response to Hepatitis B. It provided not only general facts, but also recent statistics. According to this source, in 2022 the virus is primarily transmitted through contact with infected blood or bodily fluids and results in an estimated 1.1 million deaths annually, largely due to cirrhosis and liver cancer.

   Evaluation: This fact sheet is authoritative and highly credible because it is from World Health Organization. The information is also considered up-to-date as it was published in July 2025.

   Relevance: I can use this source to establish the main evidence-based statements in the "Pathology" and "Prevention" modules in my project. The statistics can also be used to create visual elements for my online tutorial.

2. Ghany MG, Pan CQ, Lok AS, Feld JJ, Lim JK, Wang SH, et al. AASLD/IDSA Practice Guideline on treatment of chronic hepatitis B. Hepatology. 2025 Nov 4. doi:10.1097/HEP.0000000000001549

   Summary: This comprehensive guideline, developed using the GRADE approach, provides the clinical recommendations for managing Chronic Hepatitis B (CHB). The guideline addressed 6 PICO questions covering prevention,

surveillance for liver cancer and treatment, providing evidence-based recommendations on these topics. The preferred first-line therapies are nucleotide analogues (NAs) – specifically entecavir, tenofovir disoproxil fumarate (TDF), and tenofovir alafenamide (TAF) – due to their high efficacy and safety.

Evaluation: This is a gold-standard clinical reference authored by leading experts from the AASLD and IDSA. Unlike general patient education materials, this document provides rigorous, evidence-based “PICO” (Population, Intervention, Comparison, Outcome) analyses to justify specific medical interventions. The methods are up-to-date and clinically practical.

Relevance: I will use this source as references for the “Diagnosis”, “Treatment” and “Prevention” modules of the online tutorial. Specifically, the pregnancy management flowchart (Figure 1) can be adapted for a simulation in the Prevention module.

3. Vaccine profiles: Hepatitis B [Internet]. [cited 2026 Feb 8]. Available from: https://www.gavi.org/vaccineswork/routine-vaccines/extraordinary-impact-hepatitis-b

   Summary: This article profiles Hepatitis B virus (HBV) as a “silent killer” that claims approximately 884,000 lives annually largely through liver failure and cancer that manifest decades after infection. It highlights a critical disparity in outcomes: while 95% of infected adults clear the virus, 90% of infected infants develop chronic disease, with a quarter eventually dying from it. Globally, while 3-dose vaccine coverage has risen to 85%, the critical birth dose remains low at 43% globally (and only 6% in Africa). Currently, treatment requires lifelong antiviral suppression as there is no functional cure.

   Evaluation: Published by VaccinesWork (supported by Gavi, the Vaccine Alliance), this source is credible, offering a human-centric narrative that complements the clinical guidelines. Its unique value lies in its focus on the lived experience of patients, specifically explaining the psychological burden and the social consequences of the diagnosis.

   Relevance: I will consider using this source to strengthen the “Prevention” module by adding patient stories as background information. For example, the story of Dr. Thomas Tu can be adapted into a case study, illustrating that a normal life is possible with management.

4. Yuen MF, Chen DS, Dusheiko GM, Janssen HLA, Lau DTY, Locarnini SA, et al. Hepatitis B virus infection. Nat Rev Dis Primers. 2018 Jun 7;4(1):18035. doi:10.1038/nrdp.2018.35

   Summary: This paper provides a high-level overview of the global burden, epidemiology, and complex pathophysiology of the Hepatitis B virus (HBV),

addressing several aspects of HBV infection, including epidemiology, immune pathophysiology, diagnosis, prevention and management. It explains the clinical phases of infection, diagnostic serological markers, and current management strategies using nucleoside/nucleotide analogues (NUCs), and introduces current therapies including antiviral agents that directly act on viral replication and immunomodulators, such as interferon therapy.

Evaluation: Published in Nature Reviews and authored by a global team of experts, this is a highly credible, peer-reviewed source that ensures scientific veracity. Its strength lies in its ability to bridge molecular biology with clinical outcomes, though it was published in 2018 and the “novel therapies” at that time may not be novel now.

Relevance: This source will serve as the primary reference for the “Pathology” and “Treatment” modules of my online tutorial. For example, I can use the descriptions of cccDNA for the pathology visuals and the detailed treatment end-point definitions to create content to compare standard vs. novel treatments.

5. Hepatitis B | Liver Canada [Internet]. [cited 2026 Jan 18]. Available from: https://liver.ca/hepatitis-b/

   Summary: This resource from Liver Canada defines Hepatitis B as a viral liver disease that ranges from a short-term acute infection to a lifelong chronic infection capable of causing cirrhosis and cancer. It is a guide for common readers, covering HBV infection’s symptoms, lifestyle impacts, prevention, diagnosis, and treatment, as well as fast facts.

   Evaluation: This source acts as a primary patient advocacy reference specifically for a Canadian audience. It is provided by Liver Canada (formerly the Canadian Liver Foundation), a highly credible organization for general public education. Its strength is the offering of clear, actionable advice, but it lacks the molecular detail found in other sources.

   Relevance: I will use this source to localize the “Diagnosis” and “Treatment” modules for a Canadian context. Since the main information about Hepatitis B is communicated in easy-to-understand language, I will also adopt that style for the majority of my tutorial content.

6. Iannacone M, Beccaria CG, Allweiss L, Lucifora J, Tavis JE, Gehring AJ, et al. Targeting HBV with RNA interference: Paths to cure. Sci Transl Med. 2025.

   Summary: This 2025 review evaluates RNA interference (RNAi) therapies as a strategy to achieve a functional cure for Chronic Hepatitis B. The authors explain that existing antiviral treatments have minimal impact on HBV transcription, allowing persistent viral antigen production and immune dysfunction. Emerging RNA interference (RNAi) therapies targeting HBV RNAs reduce viral replication,

antigen expression, and, in turn, cccDNA activity, providing a potential path to a functional cure. The paper also advocates for combination therapies, noting that pairing RNAi with pegylated interferon-α has shown cure rates of 17-33% in recent trials.

Evaluation: As a very recent publication in a highly reputable and peer-reviewed journal, this source is highly credible and represents the cutting edge of molecular therapeutics, bridging the gap between basic virology and phase 2 clinical trials. Its main strength is the detailed account of the mechanistic link between antigen reduction (via RNAi) and epigenetic silencing (via SMC5/6).

Relevance: I will use this source to build the a "Novel Therapies" subsection in the “Treatment" module of my tutorial. Some details can be used to create a matching game.

7. Martinez MG, Boyd A, Combe E, Testoni B, Zoulim F. Covalently closed circular DNA: The ultimate therapeutic target for curing HBV infections. Journal of Hepatology. 2021 Sep;75(3):706–17. doi:10.1016/j.jhep.2021.05.013

   Summary: This comprehensive review focuses on covalently closed circular DNA (cccDNA), the stable viral minichromosome that persists in the nuclei of infected hepatocytes and acts as the primary barrier to curing Hepatitis B. The paper argues that current therapies (nucleos(t)ide analogues) fail to eliminate the virus because they do not target the cccDNA pool, which is maintained through a dynamic turnover of recycling rcDNA. Consequently, the authors evaluate emerging strategies to achieve a “functional cure” (HBsAg loss), including gene editing, epigenetic silencing, and destabilization.

   Evaluation: This source is a specialized, high-impact review from the Journal of Hepatology, authored by leading researchers in the field. It is both recent and highly credible. The main strength of this paper is that is dedicated to the molecular biology of the viral reservoir and provides a deep insight into why the virus is incurable with current drugs.

   Relevance: I will use this source to add depth to the “Treatment” module of the tutorial. Specifically, the detailed description of rcDNA-to-cccDNA conversion can be used to explain the viral lifecycle, and the dynamic vs. static maintenance models can be used to explain viral relapse.

8. Jeng WJ, Papatheodoridis GV, Lok ASF. Hepatitis B. The Lancet. 2023 Mar;401(10381):1039–52. doi:10.1016/S0140-6736(22)01468-4

   Summary: This seminar article provides a 2023 update on the global burden of Hepatitis B, affecting an estimated 296 million people. It explores the virus’s lifecycle, emphasizing that the persistence of covalently closed circular DNA (cccDNA) in the liver is the primary obstacle to viral eradication. The authors

argue that while current nucleos(t)ide analogues effectively suppress replication and prevent cirrhosis, they rarely achieve a functional cure of HBsAg clearance, which is the aim of new antiviral and immunomodulatory therapies.

Evaluation: Published recently in The Lancet, a world-reputable journal in medicine, this is a very credible, peer-reviewed source authored by international experts. Its strength lies in synthesizing the most recent five years of epidemiological data and clinical advances into a high-level educational resource.

Relevance: I will use this source as the foundational reference for the “Pathology” and novel treatment sections of my project. I will consider using the detailed lifecycle diagrams as a visual element for the Pathology-related modules.

9. Evaluation of the Diagnostic Accuracy of the HBsAg Rapid Test for Hepatitis B Virus Infection. medsc. 2024;5(3). doi:10.23977/medsc.2024.050301

   Summary: This paper evaluates the performance of a specific Point-of-Care (POC) HBsAg Rapid Test Cassette as a rapid diagnosis method. In a trial of 602 specimens, the test demonstrated exceptional reliability, achieving >99.9% sensitivity, 99.4% specificity, with an overall accuracy of 99.7% compared to standard Enzyme Immunoassays (EIA). Additional evaluations on cross-reactivity affirmed the test’s specificity, as it consistently produced negative outcomes for different viral strains. The HBsAg Rapid Test provides rapid and reliable results and proves to be a valuable diagnostic instrument in clinical settings.

   Evaluation: This paper was published in a peer-reviewed journal (MEDS Clinical Medicine) and is considered credible. It is technically rigorous, offering specific Confidence Intervals (98.8%-100%) and interference data that general patient brochures lack.

   Relevance: The data provided in this paper can be used to enrich the “Diagnosis” module. The limitations section can be used to explain why a negative rapid test doesn't always guarantee a patient is virus-free.

10. Hauk L. Hepatitis B Virus Vaccination and Screening: Best Practices from the ACP and CDC [Internet]. [cited 2026 Feb 8]. Available from: https://www.aafp.org/pubs/afp/issues/2018/0715/p121.html

    Summary: This “Best Practice Advice” article synthesizes recommendations from the American College of Physicians (ACP) and the CDC to guide primary care providers. It highlights a critical public health gap in the United States: of the estimated 847,000 people with chronic HBV, 67% are unaware of their status, and only about 25% of adults are fully vaccinated. To bridge this gap, the guidelines recommend vaccination for all high-risk groups and emphasize that anyone requesting protection should receive the vaccine.

Evaluation: This source acts as a primary care synopsis of the authoritative guidelines and is therefore highly credible. Its value lies in its simplification for the generalist and focuses on practical questions faced by family doctors.

Relevance: I will use this source to enrich the “Prevention” module of the tutorial. For example, the list of screening targets can be used to determine if a virtual patient needs testing.

11. Fung S, Choi HSJ, Gehring A, Janssen HLA. Getting to HBV cure: The promising paths forward. Hepatology. 2022 Jul;76(1):233–50. doi:10.1002/hep.32314

    Summary: This review examines the transition from current suppressive therapies to the goal of a “functional cure” for Chronic Hepatitis B (CHB). The authors note that while current NAs effectively suppress viral DNA, they rarely eliminate the covalently closed circular DNA (cccDNA) reservoir or restore the host’s exhausted immune response. Consequently, the paper evaluates emerging Direct-Acting Antivirals (DAAs) which aim to inhibit replication and reduce antigen loads. The review concludes that the future of HBV treatment lies in combination therapies that simultaneously inhibit viral production, lower antigen burden, and stimulate the host immune system.

    Evaluation: Published in Hepatology by experts from the Toronto Centre for Liver Disease, this is a highly authoritative review that bridges the gap between virology and clinical application. Its main strength is the detailed categorization of the drug pipeline, separating “viral targets” from “immune targets”. Unlike general guidelines, this source offers specific mechanistic details on how new drugs work.

    Relevance: I will use this source to enrich the “Treatment” module of the tutorial. For example, the distinction between viral targets and immune targets can be part of a cure strategies section. The detailed table of Biomarkers can be used to create an interactive tutorial, explaining what doctors measure when DNA is already undetectable.

12. Anstee QM, Castera L, Loomba R. Impact of non-invasive biomarkers on hepatology practice: Past, present and future. Journal of Hepatology. 2022 Jun;76(6):1362–78. doi:10.1016/j.jhep.2022.03.026

    Summary: This review introduces the paradigm shift in hepatology from invasive liver biopsies to non-invasive tests (NITs) for staging fibrosis and managing chronic liver diseases (CLD), including Hepatitis B. Non-invasive approaches are based on the quantification of biomarkers in serum samples or on the measurement of liver stiffness, using either ultrasound- or magnetic resonance–based elastography techniques. There are two approaches: “biological” (serum markers like FIB-4, APRI, and ELF) and “physical” (measuring liver stiffness via VCTE/FibroScan or MRE).

Evaluation: This is a comprehensive, high-impact review from the peer-reviewed Journal of Hepatology, a credible source. It is a useful reference for modernizing HVB diagnostic criteria, as it critiques the limitations of the traditional “gold standard” (biopsy) due to sampling error and risk.

Relevance: I will use this source to help build the “Diagnosis” module. For example, I can use Figure 1 to build a quiz or simulation on how to make non-invasive determination with different liver stiffness cutoffs.

13. Hepatitis B Foundation: Approved Drugs for Adults [Internet]. [cited 2026 Feb 1]. Available from: https://www.hepb.org/treatment-and-management/treatment/approved-drugs-for-adults/

    Summary: This webpage is from Hepatitis B Foundation, a patient-focused resource. It outlines the seven FDA-approved medications available in the United States for treating adults with chronic Hepatitis B, divided into two categories: oral antivirals, taken daily for at least a year, and immune modulators, administered via injection for 6 to 12 months. It emphasizes that treatment is not universal; patients must undergo evaluation by a liver specialist to determine if active liver disease is present before starting medication.

    Evaluation: As a leading patient advocacy organization, Hepatitis B Foundation provides a highly practical guide. Therefore, the content of this guide is highly credible. Its strength lies in clearly distinguishing between historical options and modern standards, helping patients understand why they might be prescribed one over the other. Its main weakness is the lack of rigorous statistical tests as supporting evidences, which can be complemented by other resources.

    Relevance: I will use this source to build the “Treatment” module of the tutorial. I can create some online games or quizzes to help readers remember the names of the drugs.

14. Tsukuda S, Watashi K. Hepatitis B virus biology and life cycle. Antiviral Research. 2020 Oct;182:104925. doi:10.1016/j.antiviral.2020.104925

    Summary: This review article provides a comprehensive description of the Hepatitis B virus (HBV) life cycle, emphasizing the transition of genomic relaxed-circular DNA (rcDNA) into covalently closed circular DNA (cccDNA), which is then reverse-transcribed back to viral DNA. It explores how the stability of cccDNA leads to chronic infection and identifies various stages of the life cycle, such as encapsidation and reverse transcription, as potential targets for new antiviral therapies.

    Evaluation: Published in Antiviral Research, a reputable peer-reviewed journal, this source is highly credible. As a review article, it provides a comprehensive list

of HBV-related abbreviations and high-quality schematic diagrams that clarify complex molecular processes. The main limitation is that it was published more than 5 years ago so some concepts need to be verified against more current understandings.

Relevance: This paper is an excellent resource for the “Pathology” and “Treatments” modules of my project. I will use the detailed descriptions of subviral particles to differentiate infectious and non-infectious forms of the virus in the tutorial’s introductory section.

15. Hepatitis B Testing. Testing.com [Internet]. 2021 Aug 27 [cited 2026 Jan 17]. Available from: https://www.testing.com/tests/hepatitis-b-test/

    Summary: This is a comprehensive patient guide for Hepatitis B Virus (HBV) testing, providing details on how blood analyses are used to screen for, diagnose, and monitor infections. It distinguishes between acute and chronic infections, noting that chronic cases carry higher risks of liver failure and cancer. The text breaks down specific serological markers: HBsAg, Anti-HBs, and Anti-HBc. It also explains viral DNA testing for determining contagiousness and provides a matrix for interpreting test result combinations. Additionally, it covers logistical details, such as at-home testing options and the specific risk groups recommended for screening, such as pregnant women and those from high-prevalence regions.

    Evaluation: This source is a practical, patient-oriented reference that aggregates guidelines from major health authorities. Therefore, the information is credible. Its primary strength is the interpretation table, which simplifies complex serological profiles into understandable outcomes for lay people. While it lacks the deep molecular mechanisms found in the academic sources, it excels in explaining the logistics of diagnosis, including preparation and sample collection.

    Relevance: I will use this source to build the "Diagnostic" module of the tutorial. For example, the serology matrix is very useful for creating a quiz where users will diagnose virtual patients.

16. Hepatitis B Surface Antigen Quantitative Monitoring | Quest Diagnostics [Internet]. [cited 2026 Jan 18]. Available from: https://www.questdiagnostics.com/healthcare-professionals/clinical-education-center/faq/faq192

    Summary: This FAQ list provides the clinical reference of quantitative HBsAg testing, distinguishing it from the qualitative tests used for initial screening. While qualitative tests provide a "yes/no" diagnosis, quantitative testing measures the amount of surface antigen in International Units (IU/mL), which serves as a surrogate marker for the transcriptional activity of cccDNA in the liver. It is a list of

9 questions covering questions from HBV DNA level representation to methods used to determine quantitative HBsAg levels.

Evaluation: As a specific laboratory test guideline from a major diagnostic provider, Quest Diagnostics, this source is quite credible and offers detailed operational information missing from general patient brochures. It provides concrete numerical thresholds for interpreting "grey area" results, which complements the other guidelines on indeterminate phases.

Relevance: I can use this source to refine the “Diagnosis” modules of the tutorial by adding more clinically significant details. For example, the specific cut-off values can be used in a quiz or simulator.

17. Public Health Ontario [Internet]. [cited 2026 Jan 17]. Hepatitis B - DNA Viral Load, Genotyping, and Drug Resistance Testing. Available from: https://www.publichealthontario.ca/en/Laboratory-Services/Test-Information-Index/Hepatitis-B-DNA-Geno-DRT

    Summary: This webpage outlines the specific protocols for HBV DNA viral load, genotyping, and drug resistance testing within the Ontario public health system. It explicitly states that viral load testing is not diagnostic; rather, it is a management tool for patients with confirmed HBsAg-positive serology to monitor treatment response, evaluate transplant recipients, or manage pregnancy. The document details strict specimen handling requirements and recommended testing frequencies. Genotyping and resistance testing are referred to the National Microbiology Laboratory and require a quantifiable viral load to be processed.

    Evaluation: As a government laboratory directive, this source represents the operational gold standard for healthcare providers ordering these specific tests, and is highly credible. This document is also highly prescriptive, offering granular details on turnaround times and rejection criteria, and provides highly operational guidance.

    Relevance: I will use this source to build detailed learning sections in the “Diagnosis” module of the online tutorial. The specific testing intervals and the viral load interpretation table can be used to build an interactive “Lab Results Analysis” quiz or game.

18. Hepatitis B - Diagnosis and treatment - Mayo Clinic [Internet]. [cited 2026 Jan 11]. Available from: https://www.mayoclinic.org/diseases-conditions/hepatitis-b/diagnosis-treatment/drc-20366821

    Summary: This resource from Mayo Clinic focuses on the medical procedures for diagnosing and treating Hepatitis B. It provides details about diagnostic tools such as blood tests to detect specific antigens and antibodies, liver ultrasounds, and biopsies to assess organ damage. Treatment is categorized by infection

phase: acute cases often require only supportive care, while chronic infections are managed with antiviral medications and interferon injections to suppress viral replication and prevent liver failure.

Evaluation: This is an online resource from the website of the Mayo Clinic, a highly credible medical authority for patient-facing information and clinical symptoms. Its strength lies in translating complex medical procedures into accessible information for a lay audience, but the downside is that it lacks depth in the explanation of the pathological details. To add depth, I need to complement it with information from other more academic sources.

Relevance: This source is highly relevant to my project and I can borrow its approachable language style to make my tutorial more reader-friendly. I can use this source for the “Diagnosis” and “Treatment” modules of the tutorial. In particular, I can use the diagnostic steps to build an interactive game.

19. Tripathi N, Mousa OY. Hepatitis B. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2026 Jan 11]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK555945/ PubMed PMID: 32310405.

    Summary: This article provides a comprehensive clinical overview of the Hepatitis B virus (HBV), including its etiology, epidemiology, and pathophysiology. It emphasizes the serological evaluation of the virus through blood tests, explaining the significance of various markers like HBsAg and anti-HBc, and outlines management strategies. It also explains the importance of collaboration and communication amongst the interdisciplinary teams to enhance the delivery of care for patients affected by Hepatitis B.

    Evaluation: As a part of the StatPearls library hosted by the National Center for Biotechnology Information (NCBI), this is a highly credible, peer-reviewed source published fairly recently (July 2023). Its primary strength is its clinical focus, which provides clear diagnostic algorithms and treatment guidelines very useful for a medical education audience.

    Relevance: This article is intended to be educational, so I believe I can directly use some sections and paragraphs as my tutorial materials. Specifically, I will use this source to develop the “Diagnosis” and “Treatment” modules of my interactive tutorial.

20. Wu IT, Hu TH, Hung CH, Lu SN, Wang JH, Lee CM, et al. Comparison of the efficacy and safety of entecavir and tenofovir in nucleos(t)ide analogue-naive chronic hepatitis B patients with high viraemia: a retrospective cohort study. Clinical Microbiology and Infection. 2017 Jul;23(7):464–9. doi:10.1016/j.cmi.2017.02.001

Summary: This study compares the long-term outcomes of the two primary first-line antiviral therapies, entecavir (ETV) and tenofovir (TDF), specifically in patients with high viral loads. Using propensity-score matching to ensure balanced groups, the researchers found no significant difference between the two drugs regarding viral suppression, HBeAg loss, seroconversion loss, or the development of hepatocellular carcinoma (HCC) over three years. However, Tenofovir might have a higher incidence of acute kidney injury compared with entecavir during treatment.

Evaluation: This is a high-quality clinical study paper published in a peer-reviewed journal, which is highly creditable. Its strength lies in the rigorous tests over a long term (3 years) leading to the conclusion that both drugs are equally effective.

Relevance: I will use this source to refine and strengthen the “Treatment” modules of the tutorial. Among a list of recommended drugs for HBV, I can add some in-depth comparison between them, such as entecavir versus tenofovir from the information of this source.

21. CDC. Hepatitis B [Internet]. 2025 [cited 2026 Jan 18]. Clinical Signs and Symptoms of Hepatitis B. Available from: https://www.cdc.gov/hepatitis-b/hcp/clinical-signs/index.html

    Summary: This webpage from CDC gives a detailed clinical presentation of Hepatitis B, emphasizing that symptom severity is highly dependent on age and immune status. It notes that while infants and children under 5 are typically asymptomatic, individuals over the age of 5 develop symptoms in 30%-50% of acute cases. Symptoms generally manifest 90 days after exposure and can last from 6 weeks to 6 months.

    Evaluation: This CDC source serves as a highly authoritative epidemiological reference. Its main strength is in providing specific statistical probabilities of symptoms based on age groups, which is not found in general patient brochures. However, it is short and not as informative as the other sources. Therefore, it can be used as a supplementary reference.

    Relevance: I will use the statistics in this source to refine the “Diagnosis” module of the tutorial. For example, the age-specific data can be used to create a “Symptom Probability Chart” showing why adults feel sick but babies often don't.

22. Gerlich WH. Medical Virology of Hepatitis B: how it began and where we are now. Virol J. 2013 Dec;10(1):239. doi:10.1186/1743-422X-10-239

    Summary: This official position paper establishes the WHO’s global strategy for Hepatitis B prevention. The core recommendation is universal infant vaccination, specifically mandating a monovalent “birth dose” administered ideally within 24

hours of delivery to prevent mother-to-child transmission. This should be followed by 2 or 3 additional doses to complete the primary series, inducing protective antibody levels in over 95% of healthy children. The document affirms that protection persists for at least 30 years. It also addresses implementation logistics, permitting the use of vaccines in “controlled temperature chains” to reach remote areas, and provides specific protocols for high-risk groups such as health-care workers, premature infants, and HIV-positive persons.

Evaluation: Endorsed by the WHO Strategic Advisory Group of Experts (SAGE), this is the authoritative and definitive global policy document for HVB immunization. Focusing on protecting the healthy, this source is particularly valuable for its rigor on vaccine safety.

Relevance: I will use this source to anchor the “Prevention” module of the tutorial. For example, the data on long-term immunity will be used to address why adults rarely need boosters.

23. Ulrich AK, Fleming DF, Smith EA, Mehr AJ, Redepenning SG, Moat LE, et al. Hepatitis B Vaccination at Birth: Safety, Effectiveness, and Public Health Benefit.

    Summary: This paper critiques a controversial December 2025 decision by the CDC Advisory Committee on Immunization Practices (ACIP) to weaken the universal Hepatitis B birth dose recommendation. While the birth dose strategy has reduced pediatric HBV infections by 99% since 1991, the new ACIP vote advises "shared clinical decision-making" for infants of HBsAg-negative mothers. The authors conducted a comprehensive review and found no scientific basis for these changes. Their analysis confirms the birth dose is safe and is critical for preventing infection in cases of maternal screening failures, laboratory errors, or undocumented maternal infections. They conclude that the new guidelines could worsen health disparities, increase costs through unnecessary serological testing, and erode the "safety net" that eliminates perinatal transmission.

    Evaluation: As a very recent publication in the high-impact scientific journal of Pediatrics, it is highly credible. It is scientifically rigorous, providing detailed tables that synthesize decades of data to refute links between the vaccine and adverse events. Its value lies in documenting the “continuum of care” errors, which justifies the necessity of a universal birth dose over a risk-based approach.

    Relevance: I will use this source to strengthen the “Prevention” module for the tutorial, and add very recent scientific support for the best preventative measures for infants.

24. Cleveland Clinic [Internet]. [cited 2026 Jan 8]. What Is Hepatitis B? Available from: https://my.clevelandclinic.org/health/diseases/4246-hepatitis-b

Summary: Hepatitis B is a viral infection that causes liver inflammation and damage through exposure to infected bodily fluids. The infection presents in two forms: acute, which may resolve without treatment, and chronic, which is currently an incurable lifelong condition. Globally, an estimated 254 million people live with the virus. While many individuals are asymptomatic, common symptoms include fatigue, jaundice, and abdominal pain. Diagnosis involves blood tests, imaging like elastography, or liver biopsies. Management strategies include prophylactic treatment within 24 hours of exposure, or lifelong antiviral medications for chronic cases to keep the virus inactive. Prevention is primarily achieved through a three-dose vaccination series, safe sex practices, and avoiding the sharing of needles or personal items.

Evaluation: This webpage from the official website of the reputable Cleveland Clinic serves as a highly credible resource. It is designed for the general audience, and its strength is its practical health advice, such as the "Mediterranean diet" and avoiding alcohol to support liver health. While it offers extensive clinical guidance, it does not detail the molecular replication cycle of the virus in the same depth as a peer-reviewed scientific paper.

Relevance: I will use this source as an important breadth-oriented reference for all the sections of the project. I can borrow its approachable language style and the vivid visual elements to make my tutorial more reader-friendly. Its specific self-care recommendations and prevention strategies can be used to create an interactive module in the "Prevention" section of the tutorial.

25. Alleman MM. Progress Toward Elimination of Mother-to-Child Transmission of Hepatitis B Virus — Region of the Americas, 2012–2022. MMWR Morb Mortal Wkly Rep. 2024;73. doi:10.15585/mmwr.mm7329a3

    Summary: This report from the CDC tracks the progress of 51 countries in the Americas toward eliminating mother-to-child transmission (MTCT) of Hepatitis B. While mathematical models estimate that 14 countries have successfully reduced chronic infection rates in children to the target of ≤0.1%, the region faces significant setbacks. Specifically, coverage for the third vaccine dose (HepB3) dropped by ≥10 percentage points in 15 countries between 2012 and 2022, largely due to vaccine hesitancy, civil unrest, and COVID-19 disruptions. Furthermore, 17 countries still have not introduced a universal birth dose into their routine schedules, leaving infants vulnerable to infection during the critical first 24 hours of life. The report emphasizes that failing to maintain high vaccination coverage (≥95%) threatens to reverse decades of public health success.

    Evaluation: As an official report from CDC, this recent publication is a credible epidemiological source providing current data for the Americas. Its strength lies in its granular country-level data, which reveals the disparity between nations with robust elimination programs and those facing systemic failures.

Relevance: I will use this source to enrich the “Prevention” module. For example, the data regarding the 17 countries missing birth doses can be use to stress the current gaps between countries.

26. Mayo Clinic [Internet]. [cited 2026 Jan 8]. Hepatitis B - Symptoms and causes. Available from: https://www.mayoclinic.org/diseases-conditions/hepatitis-b/symptoms-causes/syc-20366802

    Summary: This resource from Mayo Clinic focuses on the symptoms and causes of the Hepatitis B virus (HBV). It details common symptoms such as jaundice, dark urine, and extreme fatigue, while outlining how the virus spreads through blood, semen, or other body fluids. It also highlights the long-term risks of chronic infection, including liver cancer. It also makes suggestions to HBV prevention.

    Evaluation: This is an online resource from the website of the Mayo Clinic, a highly credible medical authority for patient-facing information and clinical symptoms. The presentation of the information is targeted for the general audience is therefore very approachable, but the downside is that it lacks depth in the explanation of the molecular granularity.

    Relevance: This source is highly relevant to my project and I can borrow its approachable language style to make my tutorial more reader-friendly. I can use this source for the “Pathology” and “Diagnosis” modules of the tutorial. The Mayo Clinic’s list of symptoms will form the basis of an interactive module, so will its list of people for whom the HBV vaccine is strongly recommended.

27. CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases [Internet]. 2025 [cited 2026 Jan 11]. Chapter 10: Hepatitis B. Available from: https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-10-hepatitis-b.html

    Summary: This is a chapter from the 2024 CDC “pink book”, which discusses the pathogenesis, clinical features, epidemiology, vaccination, and surveillance of hepatitis B. It provides details of the structural components of the virus and makes a clear distinction between acute and chronic infections, with statistical data in the United States. It has also provided rich HVB vaccination information, with recommended schedule for different age groups.

    Evaluation: As an official and recent publication from the CDC, this is a “gold standard” and highly credible reference that ensures the scientific veracity of the project. Its primary strength lies in its authoritative data on serological markers and rich vaccine information.

    Relevance: This source directly supports three of the four major sections in the project outline: “Pathology”, “Diagnosis”, and “Prevention”. Specifically, the data on serological testing will be used to create an interactive quiz, while the sections

on mother-to-child transmission will inform the prevention for newborns section in the “Prevention” module.