**PULSE EXPERIENTIAL TEAM ASSIGNMENT**

**Team #: 19**

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

*Plaque Attack*
Atherosclerosis: The Villain of the Vessels

**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.]*

Atherosclerosis is a chronic cardiovascular condition characterized by the gradual buildup of fatty plaques within the walls of arteries. It develops when lipids such as cholesterol, along with inflammatory cells and cellular debris, accumulate beneath the inner lining of blood vessels. Over time, this process leads to thickening and hardening of the arteries, reducing blood flow and increasing the risk of serious complications such as heart attack, stroke, and peripheral artery disease.

Atherosclerosis is one of the leading causes of cardiovascular disease worldwide and often progresses silently for years without noticeable symptoms. While it is strongly influenced by modifiable factors like diet, physical activity, smoking, and blood pressure, non-modifiable factors such as age and genetics also play a significant role. Despite its prevalence, it is often misunderstood as simply a “cholesterol problem,” when in reality it is a complex inflammatory disease that involves multiple biological processes.

Designed with public education in mind, our infographic uses a comic book–inspired approach to make the science of atherosclerosis accessible to everyday audiences. By following characters like King Cholesterol, Super Statin, and Mr. Macrophage, readers without a medical background can follow along and learn how the disease develops. Rather than passively presenting information, the design actively engages readers and empowers them to understand their own cardiovascular health, recognize risk factors, and appreciate the value of early prevention and treatment. In a landscape where health literacy remains a significant barrier to disease prevention, tools like this can play a meaningful role in bridging the gap between medical knowledge and public understanding.

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

Atherosclerosis
Inflammation
Cardiovascular Disease (CVD)
Cholesterol
Plaque
Arteries

**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).*

Atherosclerosis

**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*

1. By the end of this assignment, successful students will be able to explain the biological mechanisms underlying atherosclerosis, including the role of LDL cholesterol, endothelial dysfunction, and inflammation in plaque formation and progression.
2. By the end of this assignment, successful students will be able to communicate complex cardiovascular disease concepts to a general audience by translating scientific information into a clear, visually accessible format.

Learning outcomes applicable from lecture: "Explain the pathogenesis of atherosclerosis", "List risk factors for atherosclerosis", "List the major clinical manifestations/sequelae of atherosclerosis"

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

Our team selected atherosclerosis because it is a major contributor to the global burden of cardiovascular disease and closely relates to themes explored in this course, including inflammation, circulation, and chronic illness. As of 2018, approximately 2.6 million Canadian adults aged 20 and over were living with diagnosed ischemic heart disease, the most common manifestation of atherosclerosis, with roughly 20 billion dollars spent annually on its diagnosis, treatment, and management.

The topic is also personally meaningful to our group. One of our group member's fathers was diagnosed with coronary artery disease (CAD) earlier this year, and recently underwent quadruple bypass surgery after several arteries supplying his heart became blocked by atherosclerotic plaque buildup. This experience highlighted the real-life impact of the disease and motivated us to better understand the biological processes behind it.

In terms of assignment format, we chose an infographic as our medium because it helps communicate complex scientific ideas in a clear and engaging way. The development of atherosclerosis occurs through several stages that can be difficult to follow in written descriptions alone. Therefore, we opted for colourful visual diagrams paired with a fun comic-book theme to keep learners engaged as they learn about the disease.

Overall, this format makes the information easier to understand, specifically for audiences without a strong scientific background, and helps highlight the key mechanisms, risk factors, and health impacts of atherosclerosis. By delivering important information in an appealing way, it enhances understanding, retention, and the likelihood that individuals will apply what they learn to their everyday lives.

**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?)*

Our team used several AI and digital tools to support the research and development of our infographic.

During the research phase, we used NotebookLM and Anara to upload, organize, and extract relevant information from scientific articles. Seeing as atherosclerosis research involves dense literature, these tools helped us efficiently identify key concepts while ensuring our content was accurate and well-supported by our sources.

During the writing stage, we used Claude to proofread sections of our assignment, checking for grammar and readability. This was particularly useful when simplifying scientific terminology for a lay audience.

While these tools are not entirely new, they all leveraged AI models that were well-suited to our needs. NotebookLM and Anara were especially valuable because they allowed us to interact directly with our chosen research papers, which is something standard PDF annotators or reference managers cannot do as effectively.

Overall, these tools streamlined our workflow and allowed us to focus more time on the communication aspect of our infographic.

**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?*

Our PULSE experiential assignment is innovative because it combines clear scientific explanations with emerging approaches to disease detection. While many educational materials on atherosclerosis focus only on how plaques form and the associated risk factors, our infographic also highlights new and developing diagnostic strategies that may improve early detection of cardiovascular disease.

Beyond explaining how atherosclerosis develops, our infographic looks ahead by highlighting emerging innovations in prevention and detection, including CRISPR-based gene therapies, advanced molecular imaging, and AI-assisted ECG analysis. By incorporating cutting-edge research alongside foundational concepts, the infographic goes beyond a basic disease overview and positions readers at the forefront of where cardiovascular medicine is heading. This forward-looking section sets our infographic apart, showing that understanding atherosclerosis is not just about the past and present, but about the exciting possibilities that lie ahead.

This element makes our assignment different from many existing educational resources, which often focus only on conventional diagnostic tools such as lipid panels, imaging, or stress testing. By highlighting new diagnostic approaches, our infographic not only explains how atherosclerosis develops but also introduces learners to how new technologies may shape the future of cardiovascular disease detection and prevention.

**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].*

**NotebookLM** was used to extract information from uploaded research papers:

- *"Identify the main risk factors for atherosclerosis from the uploaded documents"*
    - **Modifiable risk factors:** high LDL cholesterol, low HDL cholesterol, hypertension, smoking, insulin resistance, obesity, sedentary lifestyles.
    - **Non-modifiable risk factors:** age, male sex, post-menopausal status, genetic predisposition (e.g., familial hypercholesterolemia).
    - **Emerging factors:** elevated lipoprotein(a), chronic inflammatory conditions, gut microbiome metabolites such as TMAO.

- *"Explain how LDL and lipoprotein(a) contribute to plaque formation"*

- LDL particles can penetrate the arterial wall, become oxidized, and trigger an inflammatory response.
- Oxidized LDL attracts immune cells like monocytes, which transform into foam cells, forming fatty streaks.
- Lipoprotein(a) [Lp(a)] is structurally similar to LDL but includes apolipoprotein(a), which promotes additional cholesterol deposition and inflammation, making plaques more prone to progression and rupture.

- *"Highlight key points about endothelial dysfunction and inflammation in atherosclerosis across the papers"*
  - Endothelial dysfunction increases vascular permeability and allows LDL entry into the arterial wall.
  - Dysfunctional endothelium expresses adhesion molecules that recruit immune cells.
  - Chronic inflammation drives smooth muscle cell migration and fibrous cap formation, contributing to plaque stability or vulnerability.
  - Immune cells, including macrophages and T-cells, release enzymes that can degrade the matrix and worsen plaque instability.

- *"List current diagnostic methods for detecting atherosclerosis, including pros and cons found within the papers"*
  - **Blood tests:** lipid panels, HbA1c, hs-CRP; pros: easy, non-invasive; cons: indirect measure, may not show plaque presence.
  - **Imaging:** coronary artery calcium scoring, carotid ultrasound, CT angiography; pros: visualizes plaques, quantifies burden; cons: cost, exposure to radiation in CT.
  - **Functional tests:** exercise stress tests; pros: assess ischemia; cons: may not detect early disease.

    **Emerging:** AI-assisted ECG analysis; pros: detects subtle electrical changes predictive of plaque; cons: still under validation, not widely implemented.

- *"Pull all information on benefits of AI-assisted ECG from these papers"*
  - Detects early and subtle abnormalities in heart electrical activity that may indicate underlying atherosclerotic changes.
  - Provides rapid, automated analysis that can augment clinician interpretation.
  - May allow earlier intervention by identifying cardiovascular risk before conventional signs appear.
  - Can integrate large datasets and recognize complex patterns that are difficult to detect manually.

**Anara** was used for annotating multiple sources (no-prompts were used).

- The tool allowed tagging, highlighting, and grouping key information across papers.

**Claude** was used primarily for proofreading and clarity:

- *"Simplify the third sentence of our paragraph on lipoproteins to make it more suitable for a lay audience"*
    - Original sentence: "Lipoprotein(a) [Lp(a)] is structurally similar to LDL but includes apolipoprotein(a) and oxidized phospholipids (OxPL), which promotes additional cholesterol deposition and inflammation, making plaques more prone to progression and rupture."
    - Edited sentence: "Lipoprotein(a), a type of cholesterol particle similar to LDL, can build up in arteries and cause inflammation, which makes plaques more likely to grow and break."

- *"Proofread this summary paragraph on atherosclerosis to ensure it is readable and there are no errors in grammar"*
    - Original paragraph: "Atherosclerosis is caused by the buildup of fats, cholesterol, and immune cells in the walls of arteries. Over time, this buildup forms plaques that can make the arteries narrower and stiffer, reducing blood flow to the heart, brain, and other parts of the body. If a plaque grows too large or suddenly ruptures, it can block blood flow and cause serious health problems, such as heart attacks or strokes. People with high cholesterol, high blood pressure, diabetes, who smoke, or who live a sedentary lifestyle are at higher risk of developing atherosclerosis. Managing the condition often involves making lifestyle changes, such as eating a healthy diet, exercising regularly, and quitting smoking, as well as taking medications to control cholesterol, blood pressure, or inflammation."
    - Proofread paragraph: "Atherosclerosis occurs when fats, cholesterol particles, and immune cells gradually build up in the walls of arteries, forming plaques. Over time, these plaques can narrow the arteries and reduce the flow of blood to important organs such as the heart and brain. If a plaque suddenly ruptures or blocks the artery completely, it can lead to serious events like heart attacks or strokes. Certain factors increase the risk of developing this condition, including high cholesterol, smoking, high blood pressure, diabetes, and lack of physical activity. Fortunately, atherosclerosis can often be managed or slowed through healthy lifestyle choices—such as regular exercise, a balanced diet, and quitting smoking—along with medications that help control cholesterol and reduce inflammation."

**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.*

**Overview & Statistics**

- Atherosclerosis is the leading global cause of cardiovascular disease (CVD) according to the World Health Organization (WHO), demonstrating its major contribution to morbidity and mortality worldwide.
- Approximately 19.8 million people die each year from CVD-related causes (WHO, 2022).
- In Western populations, about 50% of all deaths have atherosclerotic cardiovascular disease (ASCVD) as an underlying factor (Pahwa et al., 2023).
- An estimated 75% of heart attacks are associated with plaque rupture, highlighting the instability of advanced lesions (Pahwa et al., 2023).
- Around 81% of individuals aged 60+ display some degree of arterial plaque formation, indicating near-ubiquitous prevalence by older age (Viger et al., 2018).
- In Canada, 2.6 million adults aged 20+ were living with diagnosed ischemic heart disease as of 2018 (CCS Guidelines).
- The annual healthcare cost associated with diagnosis, treatment, and management of ASCVD in Canada is approximately $20 billion per year (CCS Guidelines).

**Pathophysiology** (References: Sakakura et al., 2013; Libby et al., 2016)

*Step 1*: Endothelial Dysfunction

- Initiated by hemodynamic shear stress, cigarette smoking, and hyperlipidemia.
- Leads to increased vascular permeability, upregulation of adhesion molecules (e.g., VCAM-1), and oxidative modification of LDL into oxLDL.

*Step 2*: Lipid Accumulation & Inflammation

- oxLDL promotes monocyte adhesion and migration into the vessel wall.
- Monocytes differentiate into macrophages, which engulf oxLDL → formation of foam cells.
- Aggregation of foam cells produces fatty streaks, the earliest visible atherosclerotic lesion.

*Step 3*: Chronic Inflammatory Response

- Sustained by macrophage and T-cell recruitment.
- Cytokine and growth factor release aggravates vascular injury and drives plaque progression.

*Step 4*: Smooth Muscle Cell Activation

- Smooth muscle cells (SMCs) migrate to the intima, proliferate, and secrete extracellular matrix components (collagen, elastin).
- Formation of a fibrous cap leads to arterial wall thickening and reduced elasticity.

*Step 5*: Plaque Progression & Instability
- Development of a lipid-rich necrotic core beneath the fibrous cap.
- Matrix degradation weakens the cap and exposes thrombogenic materials.
- Results in thrombus formation and potential for acute vascular occlusion (e.g., myocardial infarction, stroke).

**Risk Factors** (References: Fruchart et al., 2004; Kannel, 1998; van Oostrom et al., 2004)
- Modifiable factors:
  - High LDL cholesterol, low HDL cholesterol
  - Elevated blood glucose or diabetes mellitus
  - Hypertension
  - Cigarette smoking
  - Obesity and physical inactivity
- Non-modifiable factors:
  - Advanced age
  - Biological sex (higher male risk pre-menopause, female risk rises post-menopause)
  - Genetic predisposition
- Other contributing factors:
  - Elevated lipoprotein(a) levels
  - Chronic systemic inflammation

**Clinical Manifestations** (References: George & Johnson, 2010; Liu et al., 2025)
- Often asymptomatic until there is significant arterial narrowing or plaque rupture.
- **Coronary arteries**: Stable angina, acute coronary syndrome, myocardial infarction, dyspnea, fatigue.
- **Carotid/cerebral arteries**: Transient ischemic attacks, ischemic stroke, dizziness, speech disturbances.
- **Peripheral arteries**: Intermittent claudication, pain during walking, reduced pulses, critical limb ischemia.
- **Renal arteries**: Secondary hypertension, progressive renal insufficiency.

**Diagnostic Approaches** (References: Poznyak et al., 2023; Meng et al., 2022)
- Blood tests:
  - Lipid panel
  - Fasting glucose

        - C-reactive protein (CRP) for inflammatory assessment
    - Electrocardiogram (ECG) detects ischemic changes, abnormal rhythms, and myocardial injury.
    - Exercise stress test evaluates heart function under physical exertion or pharmacologic stress.
    - Coronary angiogram uses contrast dye and catheter to identify arterial narrowing or occlusions.
    - Echocardiogram uses ultrasound to visualize heart structure, function, and blood flow patterns.

**Treatment & Management** (References: Lewis, 2009; Jamkhande et al., 2014; CCS Guidelines)

- Lifestyle modifications:
    - Regular aerobic exercise
    - Adoption of a Mediterranean diet
    - Glycemic control in diabetics
    - Complete smoking cessation
- Medications:
    - Statins lower LDL-C and stabilize plaque.
    - Ezetimibe inhibits intestinal cholesterol absorption.
    - PCSK9 inhibitors reduce LDL-C significantly in high-risk patients.
    - Acetylsalicylic acid (ASA) prevents platelet aggregation and thrombus formation.
- Interventional procedures:
    - Percutaneous coronary intervention (PCI/angioplasty) to restore blood flow.
    - Coronary artery bypass graft (CABG) for multi-vessel disease.

**Emerging & Future Directions** (References: Walker et al., 2021; Meng et al., 2022; Martínez-Sellés & Marina-Breysse, 2023)

- Gene editing (CRISPR–PCSK9) opens the potential to permanently reduce LDL-C and slow ASCVD progression.
- Advanced molecular imaging uses nanoparticles and targeted tracers to detect vulnerable plaques early.
- AI-assisted ECG analysis can identify subtle electromechanical changes, enhancing risk prediction and early detection of ASCVD.

**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.*

Our team ensured the accuracy and reliability of the information in our assignment by relying primarily on peer-reviewed scientific literature and the course textbook as sources. We used databases such as PubMed and Google Scholar, as well as the Robbins & Kumar Pathology textbook to ensure the information contained in our infographic is accurate. Additionally, when using AI tools, we carefully reviewed the outputs to verify that the information was consistent with our primary sources.

Any claims generated by AI were cross-checked against the original research papers or textbooks. For example, when NotebookLM summarized the role of lipoprotein(a) or AI-assisted ECGs, we confirmed the details by reading the original articles before including them in our infographic. To add, we chose to use NotebookLM because it is not a generative AI, meaning all of the information it puts out comes directly from the uploaded sources. This helped us prevent AI hallucinations and misleading outputs.

In addition, we sought peer feedback from individuals in our Medical Science 4931G class to ensure our information was accurate and easy to understand. Lastly, to keep track of sources, we maintained a shared reference document and annotated papers in Anara. This approach helped us reduce the risk of spreading misinformation and ensured that our infographic contained up-to-date knowledge.

**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?*

As fourth-year students, creating this infographic felt like a meaningful way to bring together much of what we have learned throughout our degree. It ended up being one of the most valuable parts of the course because it pushed us to think beyond just understanding atherosclerosis and made us focus on how to explain it clearly to someone without a science background.

Before this assignment, atherosclerosis felt familiar from lectures, but putting it into our own words exposed gaps in our understanding. We realized quickly that if we could not explain something simply, we did not fully understand it ourselves. Removing jargon forced us to slow down, rethink the process step by step, and be more precise in how we explained concepts like plaque formation, inflammation, and treatment. In that sense, the project helped us move from memorizing content to actually understanding it. We spent around 35 hours on the assignment over a few months, and that time felt necessary for both learning the material and refining how we communicated it.

Dividing the work based on our strengths was a key reason the project went smoothly. One of us focused more on research and writing, while the other focused on design and layout, while ensuring continuous communication, and exchanging updates throughout. This made the process more efficient and helped maintain a clear direction. The comic book approach also worked better than we expected. Using characters like King Cholesterol, Super Statin, and Mr. Macrophage gave us a consistent way to connect different sections and made it easier to turn abstract processes into something more concrete and memorable.

At the same time, there are things we would change. We started designing earlier than we should have, which meant we had to go back and reorganize sections once our understanding became clearer. If we were to do it again, we would spend more time planning the structure and flow before moving into the visual side. We also think getting even more feedback early on in the process, especially from someone outside of science, would have helped us better judge whether our explanations were actually clear.

One of the biggest challenges was deciding how much detail to include. We often had to choose between adding more information and keeping the infographic readable. Finding that balance took more time than we expected, especially when trying to stay accurate without overwhelming the reader. The design aspect was also a learning curve, since neither of us has formal design experience, but working through that together made the final product stronger.

Overall, this assignment felt meaningful because it resulted in something that could be useful beyond the classroom. It reinforced that understanding science is only part of the goal, and being able to communicate it clearly is just as important.

We hope that this infographic can continue to be used by future students as a clear and engaging way to understand atherosclerosis, and as an example of how complex scientific ideas can be communicated in a way that is both accurate and accessible.

– Zarrah Ling & Viktoria Brkic

**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…*

- Design of the prompts used in all 3 AI tools (NotebookLM, Claude, and Anara) V.B. Z.L.
- Researching atherosclerosis (definition, importance, prevalence) V.B. Z.L.
- Breaking down disease progression V.B.
- Simplifying the pathophysiology of atherosclerosis Z.L.
- Identifying key sections for the infographic V.B. Z.L.
- Writing the "What is atherosclerosis?" overview V.B.
- Summarizing risk factors (modifiable vs non-modifiable) V.B.
- Explaining symptoms and major complications Z.L.
- Researching and describing diagnostic methods V.B.
- Summarizing treatment and prevention strategies Z.L.
- Developing the comic book concept and theme V.B. Z.L.
- Creating characters (King Cholesterol, Super Statin, Mr. Macrophage) V.B.
- Editing, reviewing, and formatting the final infographic for submission V.B. Z.L.
- Writing the (lay) summary V.B.
- Formatting references and annotated bibliography Z.L.

**14. Other comments (Optional)**

*Any comments the team would like to let the coordinator and/or TAs know.*

Thank you and we hope you enjoy our infographic :)

**15. References**

Please provide a numbered reference list with Nature citation style.

(1) Cardiovascular diseases (cvds). *World Health Organization* Available at: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-%28cvds%29#:~:text=Key%20facts,38%25%20were%20caused%20by%20CVDs. (Accessed: 6th April 2026)

(2) Pahwa, R. Atherosclerosis. *StatPearls [Internet].* (2023). Available at: https://www.ncbi.nlm.nih.gov/books/NBK507799/. (Accessed: 6th April 2026)

(3) Ihle-Hansen, H. *et al.* Prevalence of carotid plaque in a 63- to 65-year-Old Norwegian cohort from the general population: The Ace (Akershus Cardiac Examination) 1950 study. *Journal of the American Heart Association* **7,** (2018).

(4) Wang, H. & Patterson, C. *Atherosclerosis: Risks, mechanisms, therapies*. (Wiley Blackwell, 2015).

(5) Sakakura, K. *et al.* Pathophysiology of atherosclerosis plaque progression. *Heart, Lung and Circulation* **22,** 399–411 (2013).

(6) Fruchart, J.-C., Nierman, M. C., Stroes, E. S., Kastelein, J. J. & Duriez, P. New risk factors for atherosclerosis and patient risk assessment. *Circulation* **109,** (2004).

(7) Kannel, W. B. Overview of atherosclerosis. *Clinical Therapeutics* **20,** (1998).

(8) Poznyak, A. V., Sukhorukov, V. N., Eremin, I. I., Nadelyaeva, I. I. & Orekhov, A. N. Diagnostics of atherosclerosis: Overview of the existing methods. *Frontiers in Cardiovascular Medicine* **10,** (2023).

(9) Meng, H. *et al.* New progress in early diagnosis of atherosclerosis. *International Journal of Molecular Sciences* **23,** 8939 (2022).

(10) Lewis, S. J. Prevention and treatment of atherosclerosis: A practitioner's guide for 2008. *The American Journal of Medicine* **122,** (2009).

(11) Jamkhande, P. G. *et al.* Therapeutic approaches to drug targets in atherosclerosis. *Saudi Pharmaceutical Journal* **22,** 179–190 (2014).

(12) Liu, L., Wang, Z., Ma, L. & Wu, S. Recent insights into the pathophysiology and implications for surgery in atherosclerosis. *Journal of Cardiothoracic Surgery* **20,** (2025).

(13) Martínez-Sellés, M. & Marina-Breysse, M. Current and future use of artificial intelligence in Electrocardiography. *Journal of Cardiovascular Development and Disease* **10,** 175 (2023).

(14) Walker, H. E. *et al.* CRISPR gene editing in lipid disorders and atherosclerosis: Mechanisms and opportunities. *Metabolites* **11,** 857 (2021).

(15) Libby, P., Bornfeldt, K. E. & Tall, A. R. Atherosclerosis. *Circulation Research* **118,** 531–534 (2016).

(16) George, S. J. & Johnson, J. *Atherosclerosis: Molecular and cellular mechanisms*. (Wiley-VCH, 2010).

(17) *2021 Canadian Cardiovascular Society Guidelines for the management of Dyslipidemia for the prevention of cardiovascular disease in adults - canadian journal of cardiology* Available at: https://onlinecjc.ca/article/S0828-282X(21)00165-3/fulltext. (Accessed: 6th April 2026)

(18) van Oostrom, A. J., van Wijk, J. P. & Cabezas, M. C. Lipaemia, inflammation and atherosclerosis. *Drugs* **64,** 19–41 (2004).

(19) Arteriosclerosis / atherosclerosis. *Mayo Clinic* (2024). Available at: https://www.mayoclinic.org/diseases-conditions/arteriosclerosis-atherosclerosis/diagnosis-treatment/drc-20350575. (Accessed: 6th April 2026)

## 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. Cardiovascular diseases (cvds). *World Health Organization* Available at: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-%28cvds%29#:~:text=Key%20facts,38%25%20were%20caused%20by%20CVDs. (Accessed: 6th April 2026)**

**Annotation:**
This fact sheet from the Word Health Organization, accessed digitally, provides global statistics on cardiovascular disease, including prevalence, mortality rates, and key risk factors. Its purpose is to inform public health awareness and policy. As a publication from a leading international health organization, it is highly credible and widely trusted. A major strength is its clarity, accessibility, and reliability. A major weakness of this source is that it does not provide detailed mechanistic explanations or much elaboration on the the information provided and so interpreting and understanding required additional external sources. This source was used in the overview section of the infographic to support claims about the global burden of atherosclerosis and cardiovascular disease. It ensured that the infographic was grounded in real-world epidemiological data, and was used to exemplify the global burden of the disease. Overall, this was a strong reliable source which reinforced the significance and relevance of the topic.

**2. Pahwa, R. Atherosclerosis. *StatPearls [Internet].* (2023). Available at: https://www.ncbi.nlm.nih.gov/books/NBK507799/. (Accessed: 6th April 2026)**

**Annotation:**
This StatPearls article, published through the U.S. National Library of Medicine (NIH/NCBI Bookshelf), provides a comprehensive, clinically oriented overview of atherosclerosis, including its etiology, epidemiology, pathophysiology, diagnostic evaluation, and management. It emphasizes atherosclerosis as a chronic inflammatory, lipid-driven disease and outlines its role as a leading cause of cardiovascular morbidity and mortality worldwide. As a government-hosted, peer-reviewed educational resource written by medical experts and regularly updated, it is highly credible and authoritative. A key strength is its clear, structured organization into sections such as risk factors, disease progression, and treatment, making complex information highly accessible and easy to navigate. Additionally, the article is extensively referenced, allowing for verification and deeper exploration of key concepts, while requiring minimal external interpretation. This source was used across multiple sections of the infographic to ensure consistency and accuracy in explanations, particularly in integrating information across pathophysiology, diagnosis, and treatment. It also supported the inclusion of epidemiological context in the overview. Overall, this source significantly strengthened the coherence, clarity, and scientific reliability of the infographic.

**3. Ihle-Hansen, H. *et al.* Prevalence of carotid plaque in a 63- to 65-year-Old Norwegian cohort from the general population: The Ace (Akershus Cardiac Examination) 1950 study. *Journal of the American Heart Association* 7, (2018).**

**Annotation:**
This population-based cohort study investigates the prevalence of carotid atherosclerotic plaque and carotid intima-media thickness (cIMT) in adults aged 63-65 years from the general Norwegian population using ultrasound imaging. It demonstrates that atherosclerosis is highly prevalent even in relatively healthy, community-dwelling individuals, with findings showing that 87% of participants had detectable carotid plaque, despite a relatively low proportion having diagnosed cardiovascular disease. As a peer-reviewed article published in the *Journal of the American Heart Association*, it is a highly credible and methodologically rigorous source, strengthened by its large sample size and standardized imaging protocols. A key strength is its use of real-world epidemiological data, which provides strong external validity; however, its limitation lies in its focus on a specific age group and population, which may affect generalizability. This source was used directly in the infographic's overview and clinical relevance sections to support the striking statistic that atherosclerosis is extremely common in older adults, even in asymptomatic individuals. It reinforced the importance of early screening and risk factor management. Overall, this source added strong quantitative evidence and significantly enhanced the real-world relevance and impact of the infographic.

**4. Wang, H. & Patterson, C. *Atherosclerosis: Risks, mechanisms, therapies*. (Wiley Blackwell, 2015).**

**Annotation:**
This textbook provides a comprehensive and in-depth examination of atherosclerosis, integrating risk factors, molecular and cellular mechanisms, and therapeutic approaches to explain disease development and progression. It emphasizes how both modifiable and non-modifiable risk factors, such as hypertension, hyperlipidemia, and diabetes, contribute to the gradual buildup of plaques in medium- to large-sized arteries, ultimately leading to vessel narrowing and reduced blood flow. It also highlights how plaque destabilization increases the risk of major clinical outcomes, including myocardial infarction, stroke, and peripheral artery disease. Published by Wiley Blackwell and edited by experts in the field, this source is highly credible and academically rigorous. A key strength is its comprehensive scope and integration of basic science with clinical implications; additionally, incorporating a textbook diversifies our sources beyond journal articles and online materials, strengthening the overall reliability of the project. This source was used directly in the infographic's overview and complications sections to describe plaque progression and associated risks. It also informed the risk factors and treatment sections by linking mechanisms to interventions. Overall, this source enhanced both the scientific depth and source diversity of the infographic, reinforcing its credibility and coherence.

**5. Sakakura, K. *et al.* Pathophysiology of atherosclerosis plaque progression. *Heart, Lung and Circulation* 22, 399–411 (2013).**

**Annotation:**
This review article provides a detailed and mechanistic explanation of atherosclerotic plaque progression, tracing the transition from early pathologic intimal thickening to advanced fibroatheroma and ultimately plaque rupture. It emphasizes key cellular and molecular processes, including macrophage infiltration, lipid accumulation, formation of a necrotic core, and degradation of the fibrous cap by matrix metalloproteinases, which together contribute to plaque instability and thrombosis. Published in *Heart, Lung and Circulation* and indexed on PubMed, it is a credible, peer-reviewed source supported by pathological and histological evidence. A major strength is its clear, stepwise description of disease progression at a molecular and structural level, allowing for a deeper understanding of how microscopic changes translate into clinical events such as myocardial infarction. However, its technical language may require simplification for broader audiences. This source was central to the pathophysiology section of the infographic, where it was used to accurately outline the mechanistic stages of atherosclerosis development, from lipid deposition to plaque rupture. It directly informed both the written content and visual progression diagram. Overall, this source significantly strengthened the scientific depth, accuracy, and explanatory clarity of the infographic.

**6. Fruchart, J.-C., Nierman, M. C., Stroes, E. S., Kastelein, J. J. & Duriez, P. New risk factors for atherosclerosis and patient risk assessment. *Circulation* 109, (2004).**

**Annotation:**
This review article examines both traditional and emerging cardiovascular risk factors involved in the development of atherosclerosis, with a particular focus on how these factors interact to improve individual risk prediction. It discusses established lipid and non-lipid contributors alongside newer biomarkers such as lipoprotein(a), homocysteine, and inflammatory markers, highlighting their growing importance in clinical risk assessment. Published in *Circulation*, a leading, peer-reviewed cardiology journal, the source is highly credible and grounded in strong clinical and epidemiological evidence. A major strength is its synthesis of both classical and evolving concepts, providing a more nuanced understanding of risk beyond conventional models. However, as it is an older publication, some emerging risk factors may not reflect the most current research developments. This source was used to broaden the conceptual scope of the project by incorporating evidence that extends beyond traditional risk frameworks, ensuring a more comprehensive and evidence-based approach to understanding disease etiology. It was particularly useful in supporting the inclusion of less commonly emphasized contributors to atherosclerosis in our infographics risk factors section. Overall, this source enhanced the depth and academic rigor of the project by integrating both established and emerging perspectives on cardiovascular risk.

**7. Kannel, W. B. Overview of atherosclerosis. *Clinical Therapeutics* 20, (1998).**

**Annotation:**
This article provides a broad overview of atherosclerotic cardiovascular disease, emphasizing its significant contribution to mortality, its systemic nature across multiple vascular territories, and the importance of prevention through risk factor modification. It discusses how atherosclerosis manifests clinically in the heart, brain, and peripheral arteries, and highlights the value of multivariate risk assessment and preventive strategies such as antiplatelet therapy. As a peer-reviewed publication in *Clinical Therapeutics*, the source is credible and reflects the scientific understanding of its time. However, a major limitation is its age (1998), which significantly reduces its relevance for current epidemiological data, economic burden estimates, and modern treatment approaches, particularly given advances in lipid-lowering therapies, imaging, and risk stratification. Additionally, some statistics and clinical perspectives may no longer align with contemporary guidelines. Despite these limitations, a key strength is its clear articulation of the systemic and preventative framework of atherosclerosis, which remains conceptually valid. This source was used primarily as a foundational reference during early stages of research to build a general understanding of disease scope and prevention, rather than for specific data inclusion. Overall, while outdated, it provided useful conceptual grounding that was later refined with more current, evidence-based sources.

**8. Poznyak, A. V., Sukhorukov, V. N., Eremin, I. I., Nadelyaeva, I. I. & Orekhov, A. N. Diagnostics of atherosclerosis: Overview of the existing methods. *Frontiers in Cardiovascular Medicine* 10, (2023).**

**Annotation:**
This source is a recent peer-reviewed review article published in *Frontiers in Cardiovascular Medicine*, providing a comprehensive synthesis of current diagnostic approaches. It emphasizes both structural and functional imaging methods, ranging from traditional techniques like angiography to advanced modalities, and molecular imaging. Its value lies in integrating these approaches within a single framework, allowing for a broad understanding of how atherosclerosis is detected across different stages of disease progression. The article is highly credible, given its publication in a reputable, peer-reviewed journal and its reliance on extensive citations from clinical and experimental studies. Its recency ensures that the information reflects current clinical practices and technological advancements, which is critical in the rapidly evolving field of cardiovascular imaging. A key strength is the depth of detail, particularly in explaining the mechanisms, advantages, and limitations of each diagnostic technique. This made it possible to select the most clinically relevant and widely used methods for the infographic. The technical nature of the article is a limitation, as it is written for a scientific audience, requiring careful interpretation to extract concepts suitable for a broader audience. Overall, the article served in ensuring the diagnostic section was accurate, evidence-based, and aligned with modern clinical understanding.

**9. Meng, H. *et al.* New progress in early diagnosis of atherosclerosis. *International Journal of Molecular Sciences* 23, 8939 (2022).**

**Annotation:**
This article explores recent advancements in the early detection of atherosclerosis, focusing on novel biomarkers, imaging technologies, and molecular techniques that enable earlier diagnosis. It emphasizes the importance of identifying disease before significant plaque buildup occurs to improve patient outcomes. As a recent peer-reviewed source, it is highly credible and reflects current research trends. A major strength is its focus on innovation in early detection, although some technologies discussed are not yet widely implemented in clinical practice. This was important in adding an innovative aspect to our infographic. This source was used in the screening and early detection section of the infographic to highlight emerging diagnostic approaches and reinforce the importance of early intervention. It helped ensure that the infographic addressed not only current practices but also future directions in diagnosis. Overall, this source enhanced the forward-looking aspect of the infographic by emphasizing the role of early detection in preventing disease progression.

**10. Lewis, S. J. Prevention and treatment of atherosclerosis: A practitioner's guide for 2008. *The American Journal of Medicine* 122, (2009).**

**Annotation:**
This article provides a clinically focused overview of strategies for preventing and managing atherosclerosis, emphasizing lifestyle modification, risk factor control, and pharmacological interventions. It highlights the importance of early prevention and long-term management in reducing cardiovascular disease risk, more specifically emphasizing lifestyle modifications and the first line treatment in atherosclerosis. Published in a reputable medical journal, it is a credible source, though somewhat dated and lacking newer therapeutic approaches. A major strength is its practical, clinician-oriented perspective, which makes it highly applicable to real-world healthcare settings. This source was easy to read and navigate, and provided graphs to aid in the visualization of data, allowing for easier interpretation. This source was used to inform the lifestyle and prevention section of the infographic, supporting recommendations such as smoking cessation, exercise, and dietary changes. It also reinforced the importance of combining lifestyle interventions with medication. Overall, this source enhanced the applicability and clarity of the infographic by emphasizing realistic and evidence-based prevention strategies.

**11. Jamkhande, P. G. *et al.* Therapeutic approaches to drug targets in atherosclerosis. *Saudi Pharmaceutical Journal* 22, 179–190 (2014).**

**Annotation:**
This review article examines pharmacological strategies for targeting atherosclerosis, focusing on drugs that regulate lipid metabolism, inflammation, and endothelial function. It outlines the

mechanisms of commonly used therapies, including statins and emerging drug targets, and explains how these interventions reduce plaque progression and cardiovascular risk. As a peer-reviewed publication, it is a credible and scientifically grounded source, although its publication date means it does not include the most recent therapeutic developments. A key strength is its detailed explanation of drug mechanisms, which enhances understanding beyond simple treatment descriptions. This source was used in the medication section of the infographic to support accurate explanations of how treatments such as statins and antiplatelet agents function at a molecular level. It also helped ensure that the infographic linked pharmacological interventions to underlying disease mechanisms. Overall, this source strengthened the scientific depth of the treatment section by providing mechanistic justification for commonly used therapies.

**12. Liu, L., Wang, Z., Ma, L. & Wu, S. Recent insights into the pathophysiology and implications for surgery in atherosclerosis. *Journal of Cardiothoracic Surgery* 20, (2025).**

**Annotation:**
This recent article provides updated insights into the pathophysiology of atherosclerosis and its implications for surgical intervention, with a focus on inflammation, plaque stability, and treatment outcomes. As a current peer-reviewed publication, it is highly credible and reflects the latest advancements in cardiovascular research. A key strength is its integration of molecular mechanisms with clinical and surgical considerations, although it may assume prior medical knowledge. The journal article was very well laid out, provided images to reinforce understanding, and persistently used external sources to strengthen ideas and provide alternative explanations for more difficult to grasp concepts. This source was used to inform the advanced disease and intervention sections of the infographic, particularly in explaining when invasive treatments such as angioplasty or bypass surgery may be necessary. It helped ensure that the infographic reflected modern understanding of disease progression and management. Overall, this source enhanced the clinical depth and accuracy of the infographic by incorporating up-to-date research findings.

**13. Martínez-Sellés, M. & Marina-Breysse, M. Current and future use of artificial intelligence in Electrocardiography. *Journal of Cardiovascular Development and Disease* 10, 175 (2023).**

**Annotation:**
This article explores the current and future applications of artificial intelligence in electrocardiography, focusing on how AI can enhance the detection of cardiovascular abnormalities and improve diagnostic accuracy. It highlights the ability of machine learning algorithms to identify subtle patterns that may not be visible through traditional ECG interpretation. As a recent peer-reviewed publication, it is highly credible and reflects cutting-edge developments in cardiovascular diagnostics, although its focus is broader than

atherosclerosis alone. A key strength is its forward-looking perspective, emphasizing innovation and technological advancement in medicine. This source was used in the diagnostic section of the infographic to support the inclusion of AI-assisted ECG as an emerging tool for early detection of cardiovascular disease. It allowed us to incorporate modern diagnostic approaches alongside traditional methods, ensuring the infographic remained current and relevant. Overall, this source strengthened the infographic by highlighting how evolving technologies may improve early diagnosis and patient outcomes in cardiovascular disease.

**14. Walker, H. E. *et al.* CRISPR gene editing in lipid disorders and atherosclerosis: Mechanisms and opportunities. *Metabolites* 11, 857 (2021).**

**Annotation:**
This article investigates the potential of CRISPR gene editing as a therapeutic strategy for lipid disorders and atherosclerosis, focusing on targeting genes involved in cholesterol metabolism to reduce cardiovascular risk. It outlines both the biological mechanisms of gene editing and its future clinical applications. As a peer-reviewed publication, it is highly credible and represents cutting-edge research, although many of the therapies discussed are still experimental and not yet widely implemented. A major strength is its emphasis on innovative and long-term treatment possibilities. This source helped our infographic maintain an innovative component and added a way to keep our target audience engaged by mentioning AI, a current widely discussed topic. This source was used in the future treatments section of the infographic to introduce gene editing as a potential approach for permanently reducing LDL cholesterol levels. It helped expand the scope of the infographic beyond traditional therapies, demonstrating how treatment strategies may evolve in the future. Overall, this source enhanced the infographic by incorporating emerging scientific advancements and encouraging consideration of next-generation cardiovascular therapies.

**15. Libby, P., Bornfeldt, K. E. & Tall, A. R. Atherosclerosis. *Circulation Research* 118, 531–534 (2016).**

**Annotation:**
This article, published in Circulation Research, provides a short but informative overview of the role of inflammation and immune system activity in the development and progression of atherosclerosis. Specifically, it offers a brief explanation of how plaque instability can lead to acute cardiovascular events like myocardial infarction and stroke, helping to connect the underlying biology to real clinical outcomes. Since it is published in a high-impact, peer-reviewed journal, it remains highly credible and is widely cited in the field of cardiovascular research. While it does a great job explaining the key pathophysiological processes, the article is quite short, so it doesn't go into the depth found in some other sources. That being said, this source was really helpful in making sure the link between biological processes and clinical

outcomes was accurate, and it strengthened our infographic by adding both scientific clarity and clinical relevance.

**16. George, S. J. & Johnson, J. *Atherosclerosis: Molecular and cellular mechanisms*. (Wiley-VCH, 2010).**

**Annotation:**
This reading provided us with a comprehensive overview of the molecular and cellular mechanisms that drive atherosclerosis, with its main focus being on endothelial dysfunction, lipid accumulation, inflammatory signaling, and immune cell interactions. Specifically those that contribute to plaque formation and progression. This reading is a scholarly text published by Wiley-VCH and authored by experts in vascular biology, meaning it is a highly credible source for information on atherosclerosis. One key limitation however, is that it was published in 2010, therefore it does not include the most recent therapeutic advancements or emerging technologies. Seeing as it is very well written and edited, a key strength is that it uses very detailed and systematic explanations of mechanisms behind atherosclerosis, which allowed us to develop a strong foundation. Overall, this source strengthened the credibility of our infographic by ensuring all our biological explanations and diagrams were well-supported by experts in the field.

**17. *2021 Canadian Cardiovascular Society Guidelines for the management of Dyslipidemia for the prevention of cardiovascular disease in adults - canadian journal of cardiology* Available at: https://onlinecjc.ca/article/S0828-282X(21)00165-3/fulltext. (Accessed: 6th April 2026)**

**Annotation:**
This article provides evidence-based recommendations and guidelines for the management of dyslipidemia to reduce CVD risk. It touches on lifestyle interventions as well as pharmacological treatments such as statins, ezetimibe, and PCSK9 inhibitors. Seeing as it was developed by a national professional organization, it is highly credible and widely used in clinical practice across Canada. Its strengths include providing clear, actionable recommendations, but its use of highly technical language limits accessibility, requiring simplification for lay audiences. Although its information was covered in other articles, it helped bridge our understanding of treatments and interventions, and tied together what we learned in class with other primary research. Additionally, it helped us understand how large medical organizations communicate information to the scientific community, and helped us better target a general audience.

**18. van Oostrom, A. J., van Wijk, J. P. & Cabezas, M. C. Lipaemia, inflammation and atherosclerosis. *Drugs* 64, 19–41 (2004).**

**Annotation:**
This article examines the relationship between lipid metabolism, inflammation, and the development of atherosclerosis, focusing on how elevated lipid levels contribute to vascular inflammation and plaque formation. As a peer-reviewed source, it is credible, although somewhat older and lacking information on recent research developments. This article was used to further our understanding of the pathophysiology of ASCVD and to ensure all of our other sources were accurate. Although its information is redundant and covered in other articles, it helped ensure that the biological mechanisms underlying lipid accumulation were well represented. Therefore, this source contributed to our foundational understanding of atherosclerosis and helped strengthen the scientific accuracy of our infographic.

**19. Arteriosclerosis / atherosclerosis. *Mayo Clinic* (2024). Available at: https://www.mayoclinic.org/diseases-conditions/arteriosclerosis-atherosclerosis/diagnosis-treatment/drc-20350575. (Accessed: 6th April 2026)**

**Annotation:**
This source is published by Mayo Clinic, a highly reputable medical institution, making it a reliable source for general medical information, although it is designed for patient education rather than in-depth scientific analysis. It provides a patient-friendly overview of atherosclerosis, including symptoms, diagnosis, and treatment options. In terms of strengths and weaknesses, a key strength is its clarity and accessibility, as it explains complex concepts in a way that is easy to understand, while a limitation is its lack of depth compared to primary research articles. This source was used for background information and a general understanding of the topic. It also helped us understand how scientific information should be presented for a lay audience and acted as a reference for complexity and reach.