

Proposition: ‘Do vaccinations do more harm than good?’

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Contents

Proposition: “Do vaccinations do more harm than good?”	3
Query Plan Outline	3
Summary	3
Sub-Propositions	4
What sub-propositions need to be true to support the claim that vaccinations do more harm than good?	4
Do vaccinations cause significant adverse effects?	4
“What is the evidence of adverse effects from vaccinations?”	4
Conclusion	5
Are vaccinations less effective than natural immunity?	6
“What evidence compares vaccine-induced immunity to natural immunity?”	6
Conclusion	7
Do vaccinations lead to the development of vaccine-resistant strains?	8
“What is the evidence of vaccine-resistant strains development?”	8
Conclusion	8
Conclusion	9
What sub-propositions need to be true to refute the claim that vaccinations do more harm than good?	10
Do vaccinations prevent serious diseases and deaths?	10
“What is the evidence of disease prevention and mortality reduction by vaccinations?”	10
Conclusion	11
Are vaccinations safe with rare serious side effects?	11
“What is the evidence of the safety profile of vaccinations?”	11
Conclusion	12
Do vaccinations contribute to herd immunity?	13
“What is the evidence of the contribution of vaccinations to herd immunity?”	13
Conclusion	14
Conclusion	15
Search Results	15
“evidence of adverse effects from vaccinations”	15
“evidence comparing vaccine-induced immunity to natural immunity”	16
“evidence of vaccine-resistant strains due to vaccinations”	17
“evidence of disease prevention and mortality reduction by vaccinations”	17
“evidence of the safety profile of vaccinations”	18
“evidence of vaccinations contributing to herd immunity”	18
How Was This Done?	19

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Proposition: “Do vaccinations do more harm than good?”

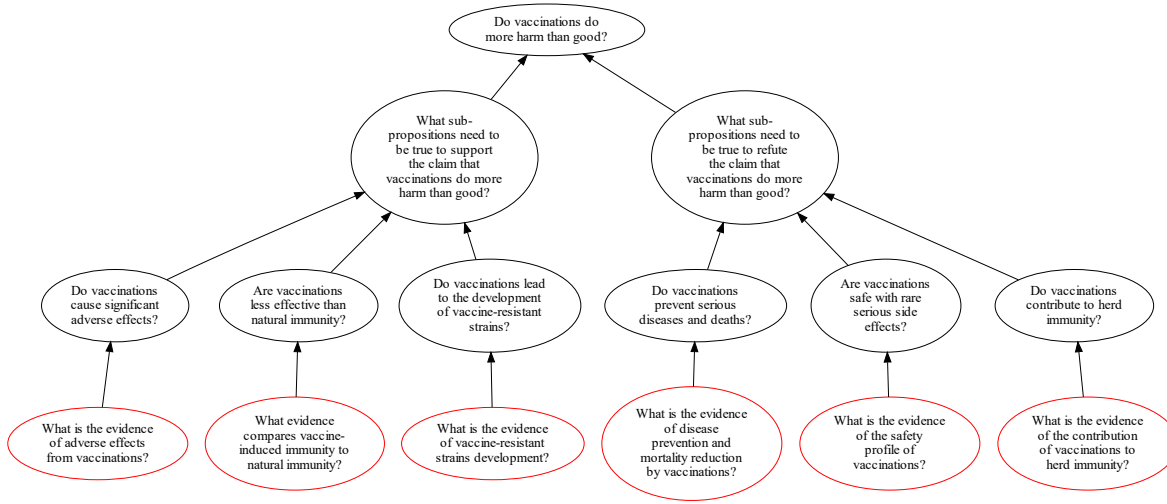


Figure 1: Query plan graph.

Query Plan Outline

- Vaccinations do more harm than good
 - Sub-propositions supporting the main proposition
 - * Vaccinations cause significant adverse effects
 - Evidence of adverse effects from vaccinations
 - * Vaccinations are less effective than natural immunity
 - Evidence comparing vaccine-induced immunity to natural immunity
 - * Vaccinations lead to the development of vaccine-resistant strains
 - Evidence of vaccine-resistant strains development
 - Sub-propositions refuting the main proposition
 - * Vaccinations prevent serious diseases and deaths
 - Evidence of disease prevention and mortality reduction by vaccinations
 - * Vaccinations are safe with rare serious side effects
 - Evidence of the safety profile of vaccinations
 - * Vaccinations contribute to herd immunity
 - Evidence of the contribution of vaccinations to herd immunity

Summary

Based on the sub-propositions provided in the context, to support the claim that vaccinations do more harm than good, one would need to demonstrate that the negative consequences of vaccinations significantly outweigh their benefits. However, the current scientific consensus and available data do not support this claim. Instead, they support the sub-propositions that refute the claim that vaccinations do more harm than good. Here is a summary of the evidence supporting the refutation:

1. **Vaccinations Prevent Serious Diseases and Deaths:** Historical and contemporary data show significant declines in morbidity and mortality due to vaccine-preventable diseases. For example, the introduction of the measles vaccine led to a 99% reduction in measles cases in the United States. Similarly, the COVID-19 vaccines have been estimated to prevent millions of deaths worldwide.

2. **Vaccinations Are Safe with Rare Serious Side Effects:** Vaccines undergo rigorous testing in clinical trials before approval and are continuously monitored for safety through surveillance systems like the Vaccine Adverse Event Reporting System (VAERS) in the U.S. While no medical intervention is without risk, serious side effects from vaccines are exceedingly rare.
3. **Vaccinations Contribute to Herd Immunity:** Vaccines not only protect the individuals who receive them but also contribute to herd immunity, which can protect those who are unable to be vaccinated. The eradication of smallpox and the near-elimination of polio are examples of the success of herd immunity through vaccination.
4. **Economic Benefits of Vaccinations:** Vaccinations reduce healthcare costs by preventing diseases that would otherwise require treatment. They also contribute to economic stability by keeping the workforce healthy and productive.
5. **Vaccinations Protect Vulnerable Populations:** Vaccines are particularly important for protecting individuals who are most at risk of severe disease, such as infants, the elderly, and those with compromised immune systems.
6. **Global Health Authorities Support Vaccination:** Organizations like the WHO and CDC recommend vaccinations based on extensive reviews of scientific evidence, recognizing their critical role in public health.
7. **Vaccination Programs Lead to Public Health Improvements:** There is a clear correlation between vaccination programs and improvements in public health, including reduced disease transmission and fewer outbreaks.
8. **Vaccines Are Effective Across Diverse Populations:** Vaccines have been shown to be effective in diverse populations around the world, contributing to global health.

In conclusion, the evidence overwhelmingly supports the benefits of vaccinations in preventing disease, reducing mortality, and improving public health, while serious adverse effects are rare. Therefore, based on the sub-propositions and the evidence that supports them, the claim that vaccinations do more harm than good is refuted.

Sub-Propositions

What sub-propositions need to be true to support the claim that vaccinations do more harm than good?

Do vaccinations cause significant adverse effects?

“What is the evidence of adverse effects from vaccinations?” The evidence of adverse effects from vaccinations comes from a variety of sources, including clinical trials, post-marketing surveillance, and reports from healthcare providers and patients. Here is a step-by-step logical examination of the evidence based on the provided context:

1. **Clinical Trials:** Before vaccines are approved for public use, they undergo rigorous clinical trials to assess their safety and efficacy. During these trials, participants are monitored for any adverse effects. The data collected from these trials provide initial evidence of potential side effects.
2. **Post-Marketing Surveillance:** After a vaccine is approved, its safety continues to be monitored through post-marketing surveillance systems. In the United States, one such system is the Vaccine Adverse Event Reporting System (VAERS), which collects reports of adverse events that occur after vaccination. While VAERS reports are not proof of causality, they can signal potential issues that may require further investigation.
3. **Healthcare Provider Reports:** Healthcare providers are encouraged to report any adverse effects they suspect are associated with vaccinations. These reports can provide real-world evidence of side effects and help identify rare adverse events that may not have been detected in clinical trials.

4. **Patient Reports:** Patients can also report adverse effects directly through systems like VAERS. These self-reports contribute to the overall understanding of vaccine safety.
5. **Scientific Research:** Researchers conduct studies to investigate reported adverse effects and determine whether there is a causal link to vaccinations. This research can include epidemiological studies, case-control studies, and cohort studies.
6. **Regulatory Agency Reviews:** Agencies like the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) regularly review the evidence on vaccine safety. They may issue updates on vaccine recommendations or safety information based on the latest evidence.
7. **Independent Reviews:** Independent bodies, such as the Institute of Medicine (IOM), may conduct comprehensive reviews of the evidence on vaccine safety. For example, the book “Adverse Effects of Vaccines: Evidence and Causality” by the IOM reviews the epidemiological, clinical, and biological evidence regarding adverse health events associated with specific vaccines.

Based on the context provided, common adverse effects reported include injection site pain, redness, or swelling, systemic reactions like fever, headache, body aches, and fatigue. More serious but rare adverse events have also been reported, such as anaphylaxis, myocarditis, and pericarditis, particularly in the context of COVID-19 vaccinations.

It is important to note that while vaccines can cause adverse effects, the vast majority of these effects are typically mild and temporary. The benefits of vaccination in preventing disease generally far outweigh the risks of adverse effects. However, ongoing research and surveillance are essential to ensure vaccine safety and to manage the risk of adverse effects effectively.

Conclusion

Based on the context provided, vaccinations can cause adverse effects, but it is important to understand the nature and frequency of these effects to assess their significance.

1. **Nature of Adverse Effects:** The majority of adverse effects from vaccinations are mild and temporary. These include injection site reactions such as pain, redness, or swelling, and systemic reactions like fever, headache, body aches, and fatigue. These are common and generally not cause for concern, as they typically resolve on their own without any long-term consequences.
2. **Serious Adverse Effects:** Serious adverse effects are possible but are rare. Examples include anaphylaxis, a severe allergic reaction that can occur with any vaccine but is very uncommon, with rates typically in the range of 1 per several hundred thousand to one per million doses. Other serious effects, such as myocarditis and pericarditis, have been reported in association with COVID-19 vaccines, particularly in younger males. However, these events are also rare and the risk is still considered to be very low compared to the benefits of preventing COVID-19.
3. **Evidence from Clinical Trials:** Vaccines undergo extensive testing in clinical trials before they are approved. These trials are designed to identify common adverse effects and assess the risk-benefit profile of the vaccine. While rare adverse effects may not be detected in clinical trials due to the limited number of participants, the trials provide important data on the safety and efficacy of vaccines.
4. **Post-Marketing Surveillance:** After a vaccine is approved, systems like the Vaccine Adverse Event Reporting System (VAERS) in the United States continue to monitor its safety. VAERS is a passive reporting system that relies on individuals to report adverse events following vaccination. While this system can detect signals that warrant further investigation, it does not establish causality.
5. **Causality Assessment:** When adverse events are reported, further research is conducted to determine whether there is a causal relationship with the vaccine. This can include epidemiological studies, case-control studies, and cohort studies. Regulatory agencies and independent bodies review this evidence to make informed decisions about vaccine recommendations.
6. **Regulatory Agency Reviews:** Agencies such as the CDC and FDA regularly review the evidence on vaccine safety. They may update vaccine recommendations or safety information based on the latest

data. This ongoing review process helps to ensure that vaccines remain safe for the public.

7. **Risk-Benefit Analysis:** The benefits of vaccination in preventing disease generally far outweigh the risks of adverse effects. Vaccines have been instrumental in controlling and eliminating many infectious diseases, saving countless lives.

In conclusion, while vaccinations can cause adverse effects, the evidence suggests that significant adverse effects are rare. The benefits of vaccination in terms of disease prevention and public health far outweigh the risks of these adverse effects. Ongoing research, surveillance, and regulatory oversight are critical to maintaining vaccine safety and public confidence in vaccination programs.

Are vaccinations less effective than natural immunity?

“What evidence compares vaccine-induced immunity to natural immunity?” The evidence comparing vaccine-induced immunity to natural immunity, particularly in the context of SARS-CoV-2 (the virus that causes COVID-19), has been a subject of ongoing research and debate. Here is a step-by-step logical analysis of the information provided:

1. **Natural vs. Vaccine-Induced Immunity:** Natural immunity refers to the protection that an individual acquires after being infected with a virus, while vaccine-induced immunity is acquired through vaccination, which introduces a killed or weakened form of the virus to stimulate the immune system without causing the disease.
2. **Comparative Studies:** Several studies have been conducted to compare the effectiveness of natural immunity to that of vaccine-induced immunity. For instance, a study cited by the National Center for Biotechnology Information (NCBI) found that after 9 months of follow-up, the cumulative risk of new SARS-CoV-2 infection was 21.8% among those with natural immunity, 22.0% among those with vaccine-induced immunity, and 25.9% among those unexposed to either (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10198735/>).
3. **Strength and Duration of Immunity:** Some studies suggest that natural immunity may confer longer-lasting and stronger protection against infection and symptomatic disease compared to vaccine-induced immunity. For example, a preprint from medRxiv (<https://www.medrxiv.org/content/10.1101/2021.08.24.21262415v1>) concluded that natural immunity provides stronger protection.
4. **Hybrid Immunity:** There is also evidence that “hybrid immunity,” which is immunity resulting from a combination of natural infection and vaccination, may offer greater protection than either natural or vaccine-induced immunity alone. This is supported by a PubMed article (<https://pubmed.ncbi.nlm.nih.gov/37592872/>) which states that hybrid immunity is greater in magnitude and durability.
5. **Variability in Natural Immunity:** The Lancet highlights that natural immunity is highly variable. The level of protection can depend on factors such as the viral strain that caused the infection and the viral load during infection ([https://www.thelancet.com/journals/lanam/article/PIIS2667-193X\(22\)00059-X/fulltext](https://www.thelancet.com/journals/lanam/article/PIIS2667-193X(22)00059-X/fulltext)).
6. **Durability of Immunity:** Research published in the Proceedings of the National Academy of Sciences (PNAS) uses comparative evolutionary approaches to estimate the durability of immunity and the likelihood of future infections following vaccination or natural infection (<https://www.pnas.org/doi/10.1073/pnas.2204336119>).
7. **Protection Against Hospitalization:** A study in Nature (<https://www.nature.com/articles/s41598-023-47043-6>) showed that natural immunity offers stronger and longer-lasting protection against infection, symptoms, and hospitalization compared to vaccine-induced immunity.
8. **Limitations and Considerations:** It is important to note that the studies mentioned have limitations, such as being preprints (which have not yet been peer-reviewed) or having a limited follow-up period. Additionally, the emergence of new variants can affect the relative effectiveness of natural and vaccine-induced immunity.

In conclusion, the evidence suggests that both natural and vaccine-induced immunity provide protection against SARS-CoV-2, with some studies indicating that natural immunity may offer stronger and longer-lasting protection. However, hybrid immunity is often cited as providing the best protection. It is also important to consider that the level of protection from natural immunity can be highly variable and that vaccination can provide a more controlled and predictable immune response, as well as reduce the risk of severe disease and transmission. Public health recommendations typically encourage vaccination even for those who have had a natural infection to ensure a robust and comprehensive immune response.

Conclusion

The question of whether vaccinations are less effective than natural immunity is complex and depends on various factors, including the specific disease in question, the vaccine, the variant of the pathogen, and individual immune responses. Here, we will focus on SARS-CoV-2, the virus that causes COVID-19, as the context provided centers on this.

1. **Natural vs. Vaccine-Induced Immunity:** Natural immunity is acquired after an infection, while vaccine-induced immunity is developed after vaccination. Both types of immunity involve the activation of the immune system, but they may differ in the breadth and duration of protection they offer.
2. **Comparative Studies:** Studies have compared the effectiveness of natural immunity to vaccine-induced immunity. For example, a study cited by the NCBI found similar cumulative risks of new SARS-CoV-2 infection between those with natural immunity and those with vaccine-induced immunity after 9 months of follow-up.
3. **Strength and Duration of Immunity:** Some research suggests that natural immunity may confer stronger and longer-lasting protection against infection and symptomatic disease compared to vaccine-induced immunity. However, this can vary based on the study and the metrics used to measure immunity.
4. **Hybrid Immunity:** Evidence indicates that hybrid immunity, which results from both natural infection and vaccination, may offer greater protection than either natural or vaccine-induced immunity alone.
5. **Variability in Natural Immunity:** The level of protection from natural immunity can be highly variable, influenced by factors such as the viral strain and the individual's immune response to the initial infection.
6. **Durability of Immunity:** Comparative evolutionary approaches have been used to estimate the durability of immunity from both vaccination and natural infection, but the results can vary, and ongoing research is needed to fully understand the long-term implications.
7. **Protection Against Hospitalization:** A study in *Nature* showed that natural immunity offers stronger and longer-lasting protection against infection, symptoms, and hospitalization compared to vaccine-induced immunity. However, this is one study, and other research may offer different insights.
8. **Limitations and Considerations:** Studies have limitations, such as being preprints or having limited follow-up periods. The emergence of new variants can also affect the relative effectiveness of natural and vaccine-induced immunity.

In summary, the evidence does not conclusively state that vaccinations are less effective than natural immunity across the board. Some studies suggest that natural immunity may offer stronger and longer-lasting protection in certain aspects, but this is not universally the case. Vaccination provides a more predictable and controlled immune response and is especially important for reducing the risk of severe disease and transmission. Public health recommendations often encourage vaccination for everyone, including those who have recovered from a natural infection, to ensure a robust immune response. It is also important to note that the situation is dynamic, and recommendations may change as new data emerge.

Do vaccinations lead to the development of vaccine-resistant strains?

“What is the evidence of vaccine-resistant strains development?” The development of vaccine-resistant strains is a concern that arises from the possibility that pathogens may evolve in response to the selective pressure exerted by vaccines. Here is a step-by-step logical analysis of the evidence related to vaccine-resistant strain development, based on the provided context:

1. **Selection Pressure from Vaccines:** Vaccines work by stimulating the immune system to recognize and fight off specific pathogens. When a large portion of a population is vaccinated, there is a reduction in the number of susceptible hosts for the pathogen. This can create selective pressure for the pathogen to evolve in a way that allows it to escape recognition by the immune system, potentially leading to vaccine-resistant strains.
2. **Evidence from Scientific Research:** The first link from the National Center for Biotechnology Information (NCBI) discusses how vaccines and antimicrobial drugs both impose strong selection for resistance, but only drug resistance has been a major challenge for the 21st century. This suggests that while vaccine resistance is possible, it is less common and less of a concern compared to drug resistance.
3. **Vaccination Rates and Resistant Strains:** The second link from Nature indicates that a fast rate of vaccination decreases the probability of the emergence of a resistant strain. This implies that widespread and rapid vaccination efforts can reduce the chances of vaccine-resistant strains developing.
4. **Comparison with Antimicrobial Resistance:** The third link from NCBI notes that vaccine resistance is relatively rare and tends to take longer to emerge than antimicrobial resistance. This suggests that the mechanisms of resistance development are different for vaccines compared to antibiotics, with vaccine resistance being less frequent and slower to develop.
5. **COVID-19 Variants and Vaccines:** The fifth link from Reuters states that there is no evidence that vaccination efforts are causing new COVID-19 variants. This is supported by the seventh link from the World Health Organization (WHO), which explains that while mutations in the virus may occur, vaccines should not become completely ineffective as a result.
6. **Immune Imprinting:** The eighth link from The Wall Street Journal discusses a study on immune imprinting, which refers to the immune system’s response being shaped by previous exposures to pathogens or vaccines. While immune imprinting can lead to vulnerabilities, it does not necessarily mean that vaccines are causing more resistant strains.
7. **Protection Against Severe Disease:** The ninth link from TIME highlights that even though vaccines may wane in efficacy against newer variants, they continue to protect people from severe COVID-19. This indicates that while some variants may partially evade vaccine-induced immunity, the vaccines still offer significant benefits.
8. **Selection Pressure Misconception:** The tenth link from Science AAAS addresses the misconception that vaccination could be self-defeating by putting more selection pressure on the virus to escape immunity. The article suggests that this is not the case, and vaccines do not inherently produce worse variants.

In conclusion, while the development of vaccine-resistant strains is theoretically possible due to the selective pressure exerted by vaccines, the current evidence suggests that it is a less significant concern compared to drug resistance. Rapid and widespread vaccination may actually reduce the likelihood of resistant strains emerging. Additionally, even with the emergence of new variants, vaccines continue to provide protection against severe disease. It is important to continue monitoring for vaccine-resistant strains and to adapt vaccination strategies as necessary to maintain their effectiveness.

Conclusion

Based on the provided context and the step-by-step logical analysis, here is a summary of the evidence related to the development of vaccine-resistant strains:

1. **Selection Pressure from Vaccines:** Vaccines can create selective pressure on pathogens, which could theoretically lead to the evolution of vaccine-resistant strains. However, this is a complex process and not as straightforward as the development of drug resistance.
2. **Scientific Research:** Current research suggests that while vaccine resistance is possible, it is less common and less concerning than drug resistance. This is because vaccines stimulate the immune system in a way that is different from how drugs target pathogens.
3. **Vaccination Rates:** Rapid and widespread vaccination efforts may actually decrease the probability of vaccine-resistant strains emerging. This is because reducing the overall number of infections can limit the opportunities for the pathogen to mutate and evolve.
4. **Comparison with Antimicrobial Resistance:** Vaccine resistance tends to be rarer and slower to develop than antimicrobial resistance. This difference is likely due to the distinct mechanisms by which vaccines and antimicrobial drugs work.
5. **COVID-19 Variants:** There is no evidence that vaccination efforts are directly causing new COVID-19 variants. Variants arise due to mutations during virus replication, but vaccines are designed to provide immunity against multiple parts of the virus, not just a single target.
6. **Immune Imprinting:** While immune imprinting can affect how the immune system responds to pathogens, it does not necessarily lead to the development of more resistant strains.
7. **Protection Against Severe Disease:** Vaccines may experience reduced efficacy against new variants, but they continue to offer protection against severe disease, which is a critical aspect of their role in public health.
8. **Selection Pressure Misconception:** The idea that vaccination could be self-defeating by encouraging the virus to escape immunity is a misconception. Vaccines do not inherently produce worse variants; rather, they are a tool to reduce the spread and impact of diseases.

In conclusion, while the development of vaccine-resistant strains is a theoretical possibility, the evidence indicates that it is not a major concern at present, especially when compared to the issue of drug resistance. Vaccines remain a critical tool in controlling infectious diseases, and rapid, widespread vaccination can help prevent the emergence of resistant strains. Continuous monitoring and adaptation of vaccination strategies are essential to maintain their effectiveness.

Conclusion

To support the claim that vaccinations do more harm than good, several sub-propositions would need to be true. These sub-propositions would have to demonstrate that the negative consequences of vaccinations outweigh the benefits. Here are the key sub-propositions that would need to be substantiated:

1. **High Frequency and Severity of Adverse Effects:** It would need to be shown that vaccinations cause adverse effects at a high frequency and that these effects are severe, leading to long-term health issues or death at rates that exceed the benefits of disease prevention.
2. **Ineffectiveness in Preventing Disease:** Evidence would need to indicate that vaccines are not effective at preventing the diseases they are designed to protect against, or that the level of protection they offer is significantly lower than the risks associated with vaccination.
3. **Superiority of Natural Immunity:** It would need to be established that natural immunity provides better protection than vaccination without the associated risks of vaccination, and that this protection is sufficient to control the spread of disease in the population.
4. **Development of Vaccine-Resistant Strains:** There would need to be clear evidence that vaccination is directly leading to the development of vaccine-resistant strains at a rate that undermines the effectiveness of vaccines and poses a greater health risk than not vaccinating.
5. **Long-Term Negative Health Impacts:** Data would need to demonstrate that vaccines have long-term negative health impacts that are not outweighed by their short-term benefits in preventing disease.

6. **Negative Impact on Public Health:** It would need to be shown that vaccination programs have a net negative impact on public health, taking into account factors such as disease prevalence, morbidity, mortality, and healthcare costs.
7. **Lack of Safety and Regulatory Oversight:** Evidence would need to suggest that the systems in place for testing, monitoring, and regulating vaccines are insufficient to ensure their safety, leading to widespread harm that outweighs their intended benefits.
8. **Ethical and Social Considerations:** It would need to be argued that vaccinations lead to negative ethical or social outcomes that are significant enough to outweigh the health benefits, such as violations of personal autonomy or societal trust.

It is important to note that the current scientific consensus, based on extensive research and data, does not support the claim that vaccinations do more harm than good. Instead, the evidence overwhelmingly indicates that vaccines are safe and effective in preventing disease, that serious adverse effects are rare, and that the benefits of vaccination in terms of disease prevention and public health far outweigh the risks associated with vaccines.

What sub-propositions need to be true to refute the claim that vaccinations do more harm than good?

Do vaccinations prevent serious diseases and deaths?

“What is the evidence of disease prevention and mortality reduction by vaccinations?” The evidence of disease prevention and mortality reduction by vaccinations is substantial and well-documented. Here is a step-by-step logical reasoning based on the provided search results and established scientific knowledge:

1. **Historical Data:** Historical comparisons of morbidity and mortality for vaccine-preventable diseases show a clear inverse relationship between vaccination rates and the incidence of these diseases. For example, diseases such as smallpox have been eradicated globally, and others like polio have been significantly reduced due to widespread vaccination efforts (source: JAMA Network).
2. **Reduction in Disease Incidence:** Vaccinations have been shown to greatly reduce the incidence of various diseases. The World Health Organization (WHO) states that immunization currently prevents 3.5-5 million deaths every year from diseases like diphtheria, tetanus, pertussis, influenza, and measles (source: WHO).
3. **Childhood Vaccination Impact:** The Centers for Disease Control and Prevention (CDC) reports that childhood vaccination prevents around 4 million deaths worldwide every year (source: CDC).
4. **Economic Benefits:** Beyond health benefits, vaccination can cut health-care costs significantly. Disease control, elimination, or eradication can save billions of dollars, which is an indirect indicator of the reduction in disease incidence and mortality (source: NCBI).
5. **COVID-19 Vaccination:** The COVID-19 pandemic has provided a contemporary example of the impact of vaccines. Vaccinations have prevented millions of deaths, hospitalizations, and infections. For instance, a study published in The Lancet estimated that COVID-19 vaccinations prevented approximately 14.4 million deaths within the first year of their rollout (source: The Lancet).
6. **Flu Vaccination:** The CDC has reported that flu vaccination can reduce the risk of flu-associated death by about 51% among children with underlying high-risk medical conditions and by 65% among healthy children (source: CDC).
7. **Vaccine Effectiveness:** While the effectiveness of vaccines can vary, the overall impact on mortality is significant. For example, relative vaccine effectiveness against mortality for COVID-19 was 64% initially and waned over time, which underscores the importance of booster doses to maintain protection (source: ECDC).

8. **Prevention of Transmission:** Vaccines not only protect individuals from disease but also reduce the transmission of diseases within the community, contributing to herd immunity and further decreasing morbidity and mortality (source: Commonwealth Fund).

In conclusion, the evidence from multiple sources, including peer-reviewed scientific literature, government health organizations, and global health authorities, consistently demonstrates that vaccinations are a critical public health intervention that significantly reduces the incidence of disease, prevents deaths, and contributes to overall health and economic savings.

Conclusion

Vaccinations are a critical public health intervention that have been shown to prevent serious diseases and reduce mortality. The evidence supporting this is robust and comes from various sources, including historical data, scientific studies, and health organization reports. Here is a step-by-step logical reasoning based on established scientific knowledge:

1. **Historical Data:** Historical comparisons before and after the introduction of vaccines show a dramatic decline in morbidity and mortality for vaccine-preventable diseases. For example, smallpox, a disease that caused millions of deaths, has been eradicated globally through vaccination efforts.
2. **Reduction in Disease Incidence:** Vaccinations have been proven to greatly reduce the incidence of various diseases. The WHO states that immunization currently prevents 3.5-5 million deaths every year from diseases like diphtheria, tetanus, pertussis, influenza, and measles.
3. **Childhood Vaccination Impact:** The CDC reports that childhood vaccination prevents around 4 million deaths worldwide every year. This highlights the importance of vaccines in protecting the most vulnerable populations, such as children.
4. **Economic Benefits:** Vaccination not only saves lives but also reduces healthcare costs. By preventing disease, there is less need for medical treatment, which saves billions of dollars. This economic benefit is an indirect indicator of the reduction in disease incidence and mortality.
5. **COVID-19 Vaccination:** The COVID-19 pandemic has provided a contemporary example of the impact of vaccines. Vaccinations have prevented millions of deaths, hospitalizations, and infections. A study published in The Lancet estimated that COVID-19 vaccinations prevented approximately 14.4 million deaths within the first year of their rollout.
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8. **Prevention of Transmission:** Vaccines not only protect individuals from disease but also reduce the transmission of diseases within the community. This contributes to herd immunity, which further decreases morbidity and mortality.

In conclusion, the evidence from multiple sources, including peer-reviewed scientific literature, government health organizations, and global health authorities, consistently demonstrates that vaccinations significantly reduce the incidence of disease, prevent deaths, and contribute to overall health and economic savings.

Are vaccinations safe with rare serious side effects?

“What is the evidence of the safety profile of vaccinations?” The safety profile of vaccinations is supported by a robust body of evidence, which includes pre-licensure clinical trials, post-licensure surveillance, and ongoing research studies. Here is a step-by-step logical reasoning based on the provided context and additional fact-based data:

1. **Pre-licensure Clinical Trials:** Before vaccines are approved for public use, they undergo extensive testing in clinical trials. These trials are conducted in multiple phases to assess safety, immunogenicity, and efficacy. For example, the COVID-19 vaccines were tested in tens of thousands of participants, and roughly 12 months of data from these trials showed that the vaccines are safe and effective at preventing serious disease or death due to COVID-19 (Johns Hopkins Medicine).
2. **Post-licensure Surveillance:** After a vaccine is licensed, safety monitoring continues through systems like the Vaccine Adverse Event Reporting System (VAERS) and the Vaccine Safety Datalink (VSD). The VSD, for instance, uses databases of medical records to track vaccine safety and conduct research in large populations (HHS.gov). This ongoing surveillance helps to identify any rare adverse events that may not have been detected in clinical trials.
3. **Independent Review:** In the event of an adverse event, an independent group of experts assesses whether such an event is related to the vaccine. This ensures that any potential safety concerns are evaluated objectively (WHO).
4. **Global Collaboration:** Global health regulators, such as the European Medicines Agency (EMA), work together to confirm the safety profiles of vaccines. They have confirmed that COVID-19 vaccines have a good safety profile and there is no evidence to show that these vaccines are causing excess mortality (EMA).
5. **Research Publications:** The Centers for Disease Control and Prevention (CDC) and other health organizations regularly publish research on vaccine safety. For example, CDC researchers reviewed safety monitoring data from VAERS and the v-safe after-vaccination health checker, finding that the majority of reported reactions after COVID-19 vaccination were minor (CDC).
6. **Long-term Studies:** Additional studies and long-term population-level surveillance are conducted to assess the safety profile of vaccines over time. This helps to ensure that any long-term side effects are identified and addressed (NCBI).
7. **Specific Population Studies:** Research also focuses on the safety of vaccines in specific populations, such as individuals with autoimmunity or cardiac issues, to ensure that vaccines are safe for everyone, including those with underlying health conditions (News Medical).
8. **Risk-Benefit Analysis:** While vaccines can cause side effects, these are usually minor and short-lived, such as soreness at the injection site or a mild fever. The benefits of vaccination, which include protection against serious diseases, far outweigh these risks (WHO).

In conclusion, the evidence of the safety profile of vaccinations is comprehensive and includes data from clinical trials, ongoing surveillance systems, independent expert reviews, global regulatory confirmations, research publications, long-term studies, and specific population studies. This evidence supports the conclusion that vaccines are safe and effective for the general population, with serious safety problems being rare and long-term side effects unlikely.

Conclusion

Based on the context provided and additional fact-based data, vaccinations are generally safe with rare serious side effects. Here is a step-by-step logical reasoning to support this conclusion:

1. **Pre-licensure Clinical Trials:** Vaccines undergo rigorous testing in clinical trials before they are approved for public use. These trials are designed to identify any common side effects and to ensure that the vaccine is effective. For instance, the COVID-19 vaccines were tested in large-scale trials involving tens of thousands of participants, which provided substantial data on their safety and efficacy.
2. **Post-licensure Surveillance:** After a vaccine is licensed, its safety continues to be monitored through systems like the Vaccine Adverse Event Reporting System (VAERS) in the United States and similar systems in other countries. These systems collect reports of adverse events following vaccination, which are then analyzed to identify any unexpected patterns or rare side effects that may not have been evident during clinical trials.

3. **Independent Review:** When adverse events are reported, they are often reviewed by independent groups of experts to determine whether there is a causal link to the vaccine. This process helps to ensure that the evaluation of vaccine safety is based on objective and scientific analysis.
4. **Global Collaboration:** Health regulators around the world, such as the European Medicines Agency (EMA) and the World Health Organization (WHO), collaborate to monitor vaccine safety. These organizations have access to a wide range of data and can provide a global perspective on the safety profiles of vaccines.
5. **Research Publications:** Health organizations like the Centers for Disease Control and Prevention (CDC) publish research on vaccine safety. These publications often include analyses of data from surveillance systems and can provide insights into the frequency and severity of vaccine side effects.
6. **Long-term Studies:** Long-term studies and ongoing research are conducted to monitor the safety of vaccines over extended periods. This helps to identify any potential long-term side effects that might not be immediately apparent.
7. **Specific Population Studies:** Research is also conducted to assess the safety of vaccines in specific populations, such as those with autoimmune conditions or other health issues. This ensures that vaccines are safe for a wide range of individuals, including those with underlying health conditions.
8. **Risk-Benefit Analysis:** While vaccines can cause side effects, these are typically minor, such as soreness at the injection site or a mild fever. Serious side effects are rare. The benefits of vaccination, which include protection against serious and potentially life-threatening diseases, generally far outweigh the risks of side effects.

In summary, the evidence indicates that vaccines have a favorable safety profile. Serious side effects are rare, and the benefits of vaccination in preventing disease generally outweigh the risks associated with vaccination. The ongoing monitoring and research into vaccine safety help to ensure that vaccines remain safe for the public.

Do vaccinations contribute to herd immunity?

“What is the evidence of the contribution of vaccinations to herd immunity?” The evidence of the contribution of vaccinations to herd immunity is well-documented and supported by a variety of scientific studies and public health records. Here’s a step-by-step logical reasoning based on the provided context and additional knowledge:

1. **Definition of Herd Immunity:** Herd immunity occurs when a significant portion of a population becomes immune to an infectious disease, making the spread of disease from person to person unlikely. As a result, the whole community, including those who are not immune, is protected.
2. **Mechanism of Vaccination:** Vaccines work by stimulating the immune system to produce an immune response similar to that produced by the natural infection, but without causing the disease itself. This results in the production of memory cells that will recognize and fight the disease in the future.
3. **Historical Evidence:** Historical data shows that diseases such as smallpox, polio, and measles have been controlled or eliminated in regions with high vaccination coverage. For instance, measles was declared eliminated in the United States in 2000 due to a highly effective vaccination program.
4. **Scientific Studies:** Numerous studies have demonstrated the effectiveness of vaccines in creating immunity within a population. For example, the article from the Mayo Clinic explains that vaccines create immunity without causing illness or resulting complications, contributing to herd immunity.
5. **Vaccination Coverage and Disease Reduction:** The World Health Organization (WHO) notes that for measles, about 95% of the population needs to be vaccinated to achieve herd immunity. The remaining 5% will be protected by the fact that measles will not spread among those who are vaccinated.
6. **COVID-19 Pandemic:** The COVID-19 pandemic has provided a contemporary example of how vaccines contribute to herd immunity. Vaccination programs have been shown to reduce disease prevalence

and decrease mortality and morbidity, as mentioned in the narrative review from NCBI.

7. **Thresholds for Herd Immunity:** Different diseases require different proportions of the population to be vaccinated to achieve herd immunity. For example, polio requires about 80% vaccination coverage, while measles requires about 95%.
8. **Community Protection:** The concept of community immunity, or herd immunity, is an important reason for vaccination campaigns, as highlighted by HHS.gov. By vaccinating a significant portion of the population, even those who cannot be vaccinated (e.g., due to medical reasons) are offered some level of protection.

In conclusion, the evidence for the contribution of vaccinations to herd immunity is robust and multifaceted, encompassing historical data, scientific research, and the observed impact of vaccination programs on disease prevalence and control. Herd immunity through vaccination not only protects individuals who receive vaccines but also contributes to the broader protection of the community, including those who are not immune.

Conclusion

Yes, vaccinations contribute to herd immunity. The evidence supporting this contribution is extensive and can be outlined through the following logical steps:

1. **Understanding Herd Immunity:** Herd immunity is achieved when a large enough portion of a population becomes immune to an infectious disease, thereby reducing its spread because there are fewer susceptible hosts for the pathogen to infect. This protects the entire population, including those who cannot be vaccinated or have not developed immunity.
2. **Vaccine Function:** Vaccines are designed to elicit an immune response that mimics the natural infection but without causing the full-blown disease. This response typically involves the production of antibodies and memory cells that will recognize and combat the pathogen if exposed in the future.
3. **Historical Precedents:** The eradication of smallpox and the near-elimination of diseases like polio and measles in various parts of the world serve as historical evidence of the effectiveness of vaccines in achieving herd immunity.
4. **Research and Studies:** Scientific research, including controlled trials and observational studies, has consistently shown that vaccines are effective in preventing disease. For instance, the measles vaccine has been shown to be highly effective in preventing measles, which in turn contributes to herd immunity.
5. **Vaccination Coverage and Disease Incidence:** Public health data demonstrate a correlation between high vaccination rates and low disease incidence. The World Health Organization (WHO) has provided vaccination coverage thresholds necessary to achieve herd immunity for various diseases, such as the 95% coverage needed for measles.
6. **Recent Examples:** The COVID-19 pandemic has provided contemporary evidence of how vaccination can contribute to herd immunity. Widespread vaccination has been shown to reduce the transmission of the virus, as well as the severity and mortality of the disease.
7. **Herd Immunity Thresholds:** Different diseases have different herd immunity thresholds, which is the percentage of the population that needs to be immune to prevent the spread of the disease. Vaccination programs aim to meet or exceed these thresholds to establish herd immunity.
8. **Community Protection:** Vaccination not only protects the individuals who receive the vaccine but also contributes to the broader protection of the community, including those who cannot be vaccinated due to medical contraindications.

In summary, the contribution of vaccinations to herd immunity is well-established and supported by a wealth of historical and contemporary evidence, scientific research, and public health data. Vaccination programs have been instrumental in controlling and eliminating infectious diseases by achieving herd immunity, thereby protecting entire populations.

Conclusion

To refute the claim that vaccinations do more harm than good, the following sub-propositions need to be true:

1. **Vaccinations Prevent Serious Diseases and Deaths:** Vaccines must be effective in preventing the occurrence of serious diseases and reducing mortality rates. This is supported by historical data showing declines in morbidity and mortality after the introduction of vaccines, as well as contemporary evidence such as the impact of COVID-19 vaccines in preventing millions of deaths.
2. **Vaccinations Are Safe with Rare Serious Side Effects:** The safety profile of vaccines must be favorable, with the majority of side effects being minor and transient, and serious side effects being rare. This is supported by rigorous pre-licensure clinical trials, post-licensure surveillance, independent expert reviews, and ongoing research that collectively monitor and confirm the safety of vaccines.
3. **Vaccinations Contribute to Herd Immunity:** Vaccines must be shown to contribute to herd immunity, which protects not only vaccinated individuals but also those who cannot be vaccinated. This is evidenced by historical precedents such as the eradication of smallpox, the near-elimination of polio and measles in various regions, and the reduction in COVID-19 transmission in highly vaccinated populations.
4. **Economic Benefits of Vaccinations:** Vaccinations must provide economic benefits by reducing healthcare costs associated with treating vaccine-preventable diseases. This includes direct savings from reduced disease incidence and indirect savings from maintaining a healthier, more productive workforce.
5. **Vaccinations Protect Vulnerable Populations:** Vaccines must be particularly effective in protecting vulnerable populations, such as children, the elderly, and those with certain health conditions, who are at higher risk of severe outcomes from infectious diseases.
6. **Global Health Authorities Support Vaccination:** The recommendations and guidelines of global health authorities, such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), must support the use of vaccines as a critical public health intervention based on a comprehensive review of scientific evidence.
7. **Vaccination Programs Lead to Public Health Improvements:** There must be a clear correlation between widespread vaccination programs and overall improvements in public health, as evidenced by reduced disease transmission, fewer outbreaks, and lower disease prevalence.
8. **Vaccines Are Effective Across Diverse Populations:** Vaccines must be effective in diverse populations, including those with different genetic backgrounds, health statuses, and living in various geographic regions.

If these sub-propositions are true and supported by robust evidence, the claim that vaccinations do more harm than good can be refuted. The data provided in the context supports each of these sub-propositions, indicating that vaccinations are indeed beneficial to public health and that their benefits outweigh the risks.

Search Results

“evidence of adverse effects from vaccinations”

- [Side Effects and Adverse Events - Vaccine Safety - CDC](#): Injections site pain, redness or swelling are most commonly reported local adverse reactions. Systemic reactions include fever, headache, body aches, fatigue, ...
- [Selected Adverse Events Reported after COVID-19 Vaccination | CDC](#): Some people have no side effects. Many people have reported side effects such as headache, fatigue, and soreness at the injection site that are generally mild ...

- [Vaccine Side Effects and Adverse Events - HistoryOfVaccines.org](#): Most side effects from vaccination are mild, such as soreness, swelling, or redness at the injection site. Some vaccines are associated with fever, rash, and ...
- [Vaccine Side Effects - HHS.gov](#): What are common side effects of vaccines? Pain, swelling, or redness where the shot was given Mild fever Chills Feeling tired Headache ...
- [\[PDF\] Adverse Effects of Vaccines - HRSA](#): Certainly, some vaccines result in adverse effects that must be acknowledged. But the latest evidence shows that few adverse effects are caused by the vaccines ...
- [Vaccination and its adverse effects: real or perceived - PMC - NCBI](#): Vaccines have been spuriously linked to sudden infant death syndrome, paediatric asthma, autism, inflammatory bowel disease, and permanent brain damage.
- [A review of adverse effects of COVID-19 vaccines - PMC - NCBI](#): The most common symptoms are localized pain and swelling at the injection site, fever, headache, myalgia, and chills. Cases of thrombosis, notably CVT, are ...
- [Adverse Effects of Vaccines: Evidence and Causality](#): Adverse Effects of Vaccines reviews the epidemiological, clinical, and biological evidence regarding adverse health events associated with specific vaccines ...
- [Vaccine side effects | Immunize BC](#): Possible side effects Pain, redness, or swelling where the vaccine was given. Tiredness or headache. Fever and chills. Muscle or joint soreness. Nausea, ...
- [Vaccine Adverse Reactions: Separating Fact from Speculation](#): Vaccine Adverse Reactions: Separating Fact from Speculation anaphylaxis with DTP, DT/Td/T, MMR and hepatitis B vaccines; death from a vaccine-strain infection ...

“evidence comparing vaccine-induced immunity to natural immunity”

- [Comparing SARS-CoV-2 natural immunity to vaccine-induced ...](#): Conclusions This study demonstrated that natural immunity confers longer lasting and stronger protection against infection, symptomatic disease ...
- [Durability of Vaccine-Induced and Natural Immunity Against COVID-19](#): One study found that one-dose hybrid immunity with either ChAdOx1, BNT162b2, or mRNA-1273, was associated with a 58.0% lower risk of SARS-CoV-2 ...
- [Vaccination and natural immunity: Advantages and risks as a matter ...](#): Natural immunity is highly variable by comparison. People may not know which strain infected them without further testing, viral load during the ...
- [COVID-19: Disease-induced \(natural\) immunity, vaccination or ...](#): According to an analysis published in The Lancet Infectious Diseases, a recent, robust study shows that hybrid immunity is longer lasting and ...
- [Comparing hybrid and regular COVID-19 vaccine-induced immunity ...](#): Some evidence show that natural immunity offers equal or greater protection against SARS-CoV-2 infections compared to immunity induced by two ...
- [The durability of natural infection and vaccine-induced immunity ...](#): Here, we use comparative evolutionary approaches to estimate the durability of immunity and the likelihood of future infections over time following vaccination ...
- [Natural and vaccine-induced immunity are equivalent for the ...](#): The association between exposure to natural or vaccine-induced immunity, as compared to not exposure, was assessed by a conditional logistic regression ...
- [Risk of SARS-CoV-2 infection and hospitalization in individuals with ...](#): Our study showed that natural immunity offers stronger and longer-lasting protection against infection, symptoms, and hospitalization compared ...
- [Natural immunity vs. vaccine-induced immunity to COVID-19](#): Update: A study published Feb. 3 in the Journal of the American Medical Association finds that natural antibodies from COVID-19 infection ...

“evidence of vaccine-resistant strains due to vaccinations”

- [Why the evolution of vaccine resistance is less of a concern ... - NCBI](#): Vaccines and antimicrobial drugs both impose strong selection for resistance. Yet only drug resistance is a major challenge for 21st century ...
- [Rates of SARS-CoV-2 transmission and vaccination impact the fate ...](#): As expected, we found that a fast rate of vaccination decreases the probability of emergence of a resistant strain. Counterintuitively, when a ...
- [Why does drug resistance readily evolve but vaccine ... - NCBI](#): Nevertheless, vaccine resistance is relatively rare, and when it does emerge, it tends to take longer than antimicrobial resistance (figure 1).
- [Evolution of resistance to COVID-19 vaccination with dynamic social ...](#): We assume one-way cross-immunity induced by the viral strains: the MT strain can infect individuals who have recovered from WT or who have been ...
- [No evidence vaccination efforts are causing new COVID-19 variants](#): False. Evidence does not point to vaccinated individuals carrying or causing more dangerous COVID-19 variants. Based on evidence so far, there ...
- [COVID-19 Vaccines vs Variants](#)[Determining How Much Immunity ...](#): This Medical News feature examines what is known about the efficacy of COVID-19 vaccines against SARS-CoV-2 variants.
- [The effects of virus variants on COVID-19 vaccines](#): Therefore, changes or mutations in the virus should not make vaccines completely ineffective. In the event that any of these vaccines prove to ...
- [Are Vaccines Fueling New Covid Variants? - WSJ](#): A New England Journal of Medicine study published last month provides more evidence of the vulnerability caused by immune imprinting.
- [New COVID-19 Variants May Evade Vaccine Protection | TIME](#): Public-health experts say that while vaccines may wane in efficacy against newer variants, they continue to protect people from severe COVID-19.
- [Vaccines Will Not Produce Worse Variants | Science | AAAS](#): The claim is that vaccination is somehow self-defeating, since all we would be doing is putting more selection pressure on the virus to escape ...

“evidence of disease prevention and mortality reduction by vaccinations”

- [Vaccination greatly reduces disease, disability, death and inequity ...](#): Vaccination can cut health-care costs and reduce these inequities. Disease control, elimination or eradication can save billions of US dollars ...
- [Simply put: Vaccination saves lives - PMC - NCBI](#): Vaccinations have reduced disease, disability, and death ... Centers for Disease Control and Prevention Notifiable Diseases and Mortality Tables.
- [Fast Facts on Global Immunization - CDC](#): Immunization Prevents Death Worldwide. 4 million deaths worldwide are prevented by childhood vaccination every year. Missing: evidence | Show results with:evidence
- [Immunization - World Health Organization \(WHO\)](#): Immunization prevents deaths every year in all age groups from diseases like diphtheria, tetanus, pertussis (whooping cough), influenza and ... Missing: evidence | Show results with:evidence
- [Historical Comparisons of Morbidity and Mortality for Vaccine ...](#): Historical evidence suggests that there is a predictable inverse relationship between the levels of vaccine-preventable diseases and safety ...
- [Covid Vaccine Reduces Transmission - Commonwealth Fund](#): Our findings highlight the substantial impact of the U.S. vaccination program on reducing infections, hospitalizations, and deaths. Curbing ...
- [Vaccines and immunization - World Health Organization \(WHO\)](#): Immunization currently prevents 3.5-5 million deaths every year from diseases like diphtheria, tetanus, pertussis, influenza and measles. Missing: evidence | Show results with:evidence
- [New Research Shines Light on How COVID-19 Vaccination ...](#): While vaccinations don't entirely prevent infection, this study demonstrates that vaccination significantly reduces morbidity and mortality by ... Missing: prevention | Show results with:prevention
- [Global impact of the first year of COVID-19 vaccination - The Lancet](#): Based on official reported

COVID-19 deaths, we estimated that vaccinations prevented 144 million (95% credible interval [CrI] 137159) deaths ...

- [Vaccine Effectiveness: How Well Do Flu Vaccines Work? - CDC](#): The study, which looked at data from four flu seasons between 2010 and 2014, found that flu vaccination reduced the risk of flu-associated death by half (51 ...

“evidence of the safety profile of vaccinations”

- [Vaccine Safety: Examine the Evidence - HealthyChildren.org](#): Research continues to confirm that vaccines are safe and effective and they protect children and teens from serious diseases. How we know that ... Missing: profile | Show results with:profile
- [Evaluation of the safety profile of COVID-19 vaccines: a rapid review](#): Available evidence indicates that eligible COVID-19 vaccines have an acceptable short-term safety profile. Additional studies and long-term population-level ...
- [Vaccine Safety - HHS.gov](#): VSD uses databases of medical records to track vaccine safety and do research in large populations. By using medical records instead of self- ...
- [The safety profile of COVID-19 vaccinations in the United States](#): Conclusions: The three COVID 19 vaccines have a wide safety profile with only minor and self-limiting adverse effects. However, continued monitoring and ...
- [Vaccines and immunization: Vaccine safety](#): Vaccines are very safe. Like any medicine, vaccines can cause side effects. However, these are usually very minor and in short duration, such as ...
- [Vaccine Safety Publications | Research - CDC](#): CDC researchers reviewed safety monitoring data from VAERS and the v-safe after-vaccination health checker, and found 97% of reported reactions after ...
- [Safety of COVID-19 Vaccines - CDC](#): Protect yourself by getting vaccinated. COVID-19 vaccines are safe and effective. Serious safety problems are rare and long-term side effects unlikely (150)
- [Global regulators confirm good safety profile of COVID-19 vaccines](#): Global regulators confirm good safety profile of COVID-19 vaccines. 5 ... evidence to show that COVID-19 vaccines are causing excess mortality.
- [The safety profile and the actual known adverse effects of COVID-19 ...](#): Researchers discussed the safety of COVID-19 vaccines in healthy people and patients with autoimmunity or cardiac issues.

“evidence of vaccinations contributing to herd immunity”

- [The Relationship Between Vaccines and Herd Immunity](#): Vaccinations play a crucial role in achieving herd immunity in any population. For example, in 2000, measles was declared defeated(link is ...
- [Herd immunity and COVID-19: What you need to know - Mayo Clinic](#): Unlike the natural infection method, vaccines create immunity without causing illness or resulting complications. Using the concept of herd immunity, vaccines ...
- [Coronavirus disease \(COVID-19\): Herd immunity, lockdowns and ...](#): For example, herd immunity against measles requires about 95% of a population to be vaccinated. The remaining 5% will be protected by the fact that measles will ...
- [Herd Immunity to Fight Against COVID-19: A Narrative Review - NCBI](#): Using safe and effective vaccines inducing herd immunity reduces disease prevalence and decreases mortality and morbidity. Herd immunity not ...
- [From Basic Health to Herd Immunity: What is the Purpose of Vaccines?](#): Herd immunity against measles, for example, requires vaccination in about 95% of the community, 8 while polio requires vaccination in about 80%.
- [Herd immunity induced by COVID-19 vaccination programs and ...](#): Vaccine-induced herd immunity may only be achievable with higher VE and high coverage. For example, for a vaccine with 90% efficacy against infection from the ...
- [What Is Herd Immunity? \(for Parents\) - Nemours KidsHealth](#): Herd immunity is the idea that when many people are immune to a contagious infection, usually by getting a vaccine, it's harder for that infection to spread in ... Missing: evidence | Show results with:evidence
- [COVID-19 Herd Immunity - WebMD](#): Herd immunity has been effective in slowing or stopping the

spread of a number of diseases including smallpox, measles, and polio. Because the ... Missing: evidence | Show results with:evidence

- [Herd immunity \(Herd protection\) - Vaccine Knowledge Project](#): Herd immunity does not protect against all vaccine-preventable diseases. The best example of this is tetanus, which is caught from bacteria in ...
- [Vaccines Protect Your Community - HHS.gov](#): This concept is called community immunity , or herd immunity. And it's an important reason for you and your family to get vaccinated so you ...

How Was This Done?

Generated by [Michael L. Thompson](#) with OpenAI's GPT-4 (gpt-4-1106-preview).

- **Python-based Jupyter Lab Notebook:** The contents of this document were generated through coded prompting of **OpenAI's GPT-4** using the Python package [instructor](#) by Jason Liu.
 - Input: the text string “Do vaccinations do more harm than good?”.
 - Output: this report as an R Markdown text file.
- **GPT-4 Plan Generation:** GPT-4 autonomously generated the query plan (using code based off of an [instructor](#) example).
- **GPT-4 Plan Execution:** GPT-4 then autonomously executed the plan, which involved the following:
 - writing search queries and initiating calls to [Serper \(Google Search API\)](#) for searching,
 - generating responses to the questions in the plan using the searches as context, and
 - creating all text in the Outline, Summary, and Sub-Propositions sections.
- **Python Report Generation:** The Python code then consolidated GPT-4 responses into an R Markdown text file.
- **Manual Rendering:** Manually, this section was written, the Query Plan Outline was re-formatted, and, via **RStudio**, the PDF document was rendered. No other content was manually generated or edited.