

2025



AP[®] Research Academic Paper

Sample Student Responses and Scoring Commentary

Inside:

Sample H

- Scoring Guidelines**
- Student Samples**
- Scoring Commentary**

Academic Paper

5 Points

Score of 1	Score of 2	Score of 3	Score of 4	Score of 5
Report on Existing Knowledge	Report on Existing Knowledge with Simplistic Use of a Research Method	Ineffectual Argument for a New Understanding	Well-Supported, Articulate Argument Conveying a New Understanding	Rich Analysis of a New Understanding Addressing a Gap in the Research Base
<ul style="list-style-type: none"> • Presents an overly broad topic of inquiry. • Situates a topic of inquiry within a single perspective derived from scholarly works OR through a variety of perspectives derived from mostly non-scholarly works. • Describes a search and report process. • Summarizes or reports existing knowledge in the field of understanding pertaining to the topic of inquiry. • Generally communicates the student’s ideas, although errors in grammar, discipline-specific style, and organization distract or confuse the reader. • Cites AND/OR attributes sources (in bibliography/ works cited and/or intext), with multiple errors and/or an inconsistent use of a discipline specific style. 	<ul style="list-style-type: none"> • Presents a topic of inquiry with narrowing scope or focus, that is NOT carried through either in the method or in the overall line of reasoning. • Situates a topic of inquiry within a single perspective derived from scholarly works OR through a variety of perspectives derived from mostly non-scholarly works. • Describes a nonreplicable research method OR provides an oversimplified description of a method, with questionable alignment to the purpose of the inquiry. • Summarizes or reports existing knowledge in the field of understanding pertaining to the topic of inquiry. • Generally communicates the student’s ideas, although errors in grammar, discipline-specific style, and organization distract or confuse the reader. • Cites AND/OR attributes sources (in bibliography/ works cited and/or intext), with multiple errors and/or an inconsistent use of a discipline specific style. 	<ul style="list-style-type: none"> • Carries the focus or scope of a topic of inquiry through the method AND overall line of reasoning, even though the focus or scope might still be narrowing. • Situates a topic of inquiry within relevant scholarly works of varying perspectives, although connections to some works may be unclear • Describes a reasonably replicable research method, with questionable alignment to the purpose of the inquiry. • Conveys a new understanding or conclusion, with an underdeveloped line of reasoning OR insufficient evidence. • Competently communicates the student’s ideas, although there may be some errors in grammar, discipline-specific style, and organization. • Cites AND attributes sources, using a discipline-specific style (in both bibliography/works cited AND intext), with few errors or inconsistencies. 	<ul style="list-style-type: none"> • Focuses a topic of inquiry with clear and narrow parameters, which are addressed through the method and the conclusion. • Explicitly connects a topic of inquiry to relevant scholarly works of varying perspectives AND logically explains how the topic of inquiry addresses a gap. • Logically defends the alignment of a detailed, replicable research method to the purpose of the inquiry • Supports a new understanding or conclusion through a logically organized line of reasoning AND sufficient evidence. The limitations and/or implications, if present, of the new understanding or conclusion are oversimplified. • Competently communicates the student’s ideas, although there may be some errors in grammar, discipline-specific style, and organization. • Cites AND attributes sources, with a consistent use of an appropriate discipline-specific style (in both bibliography/works cited AND intext), with few to no errors. 	<ul style="list-style-type: none"> • Focuses a topic of inquiry with clear and narrow parameters, which are addressed through the method and the conclusion. • Explicitly connects a topic of inquiry to relevant scholarly works of varying perspectives AND logically explains how the topic of inquiry addresses a gap. • Logically defends the alignment of a detailed, replicable research method to the purpose of the inquiry. • Justifies a new understanding or conclusion through a logical progression of inquiry choices, sufficient evidence, explanation of the limitations of the conclusion, and an explanation of the implications to the community of practice. • Enhances the communication of the student’s ideas through organization, use of design elements, conventions of grammar, style, mechanics, and word precision, with few to no errors. • Cites AND attributes sources, with a consistent use of an appropriate discipline-specific style (in both bibliography/works cited AND intext), with few to no errors.

Thrombolysis and Frostbite: A Systematic Review

AP Research

Word count:3119

Abstract

The purpose of this paper is to provide a contribution of new knowledge to the current pool of medical research involving thrombolysis' effect on frostbite recovery. In order to do this a content analysis of existing case studies and literature will be performed. The content analysis is designed to be as unbiased as possible through the use of almost entirely quantitative data and through the use of a standardizing tool called PRISMA. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis). PRISMA provided a standard that is used by other researchers that allowed me to add a great deal of credibility to my research. While researching another paper it cited PRISMA as a resource and this led me to research it and to decide to use it to enhance my paper. PRISMA allowed me to greatly reduce the amount of bias in my research paper and I would highly recommend it to future researchers. I did not follow the guidelines perfectly as they were designed for Meta-Analysis but as far as my research got I did use it. I used a series of inclusion and exclusion criteria in order to determine what case studies and literature to include in my data collection. After collecting data the data will be used to analyze the research question To what extent does the effectiveness of thrombolysis with frostbite differ between young adults and middle aged people. The most important data that will be collected is the age of the patients and the data used to determine how effective the thrombolysis treatment is. In order to determine this the data collected will be as follows: The degree of frostbite and then the amount of extremities, in this case likely fingers and toes, that had to be amputated due to the extent of the frostbite injuries. Using this criteria and method a research process will entail. My hypothesis is that thrombolysis will be a more effective treatment for young adults than for middle aged people. The results of the paper will be outlined in a data table that will likely show a clear difference between the effectiveness of the thrombolysis treatment. Ideally this will

involve data points from at least 50-100 cases from various case studies and other literature.

These case studies and reports will be pulled from pubmed and google scholar sources.

Literature review:

Frostbite is defined as “a local tissue injury caused by cold exposure with freezing”. (Regli et al., 2023a) It has an extremely high morbidity as it can occur anywhere that there are substances or environments that have a cold temperature. Frostbite also commonly occurs with people who are intoxicated or have otherwise impaired judgement. It can be caused by a variety of conditions including excessive cold, excessive wind and a high humidity level that, when combined, can create an environment that is highly hazardous to the human body. When faced with these threats for a prolonged period of time the body can cool to a dangerous temperature. It responds by taking the warm blood from extremities and bringing it closer to the core in order to keep the vital organs healthy.(Drinane et al., 2019) This “sacrifice” of the outer extremities is often necessary to keep vital organs intact and functioning but can cause the freezing of body tissue which in many cases can be extremely harmful as “Intra and extracellular ice formation cause electrolyte and pH shifts as well as cell membrane disruption, resulting in cell death and tissue destruction”(Regli et al., 2023a). In order to treat frozen tissue effectively, medical attention is needed as soon as possible. The longer that it takes for medical attention to be provided the more likely that lasting damage will occur. For a very long time the best known treatment for frostbite was “tissue rewarming, prolonged watchful waiting, and often delayed amputation”(Lee & Higgins, 2020) This treatment is effective in the sense that it does save lives and was the best treatment for a very long time but the common result of delayed amputation leaves a lot of room for improvement by modern medicine. In order to protect itself “The body

Research Sample H 4 of 14

responds to such cold-related thermal insults with alternating cycles of vasoconstriction and vasodilation” (Lee & Higgins, 2020). While it is beneficial for the body as the whole this is detrimental to the bodily tissue involved. During the stage of rewarming the extent of this damage becomes apparent and due to the nature of rewarming numerous ailments can and likely will result from the tissue being rewarmed and being reintroduced to blood flow after a period without it. (Regli et al., 2023a). Much of the time blood flow to these affected areas does not come easily even after the rewarming of tissue. In the majority of cases that proper medical care is available more treatment than just rapid rewarming is necessary. After the period of prolonged observation it will become obvious whether or not the patient needs further treatment. In many cases amputation of affected extremities becomes necessary in order to preserve the life of the patient. The amputation of extremities can severely affect a person's quality of life and can possibly or even likely become traumatic for the patient. (Drinane et al., 2019) However, a substantial amount of research is showing that thrombolysis is a viable and beneficial option to help reduce the incidence of amputation of extremities (Zhang et al., 2019). Thrombolysis is a very general definition but for the purpose of this study I will only be examining papers that make use of IV thrombolysis. Trans-catheter is also a viable option for thrombolysis but is used less with frostbite as it is less effective. As seen in Lee and Higgins study the most common option to identify the need of thrombolysis is an Angiography with the second most common option being a bone scan. (Lee et al., 2019). An angiography is a medical test where a special dye called a contrast is injected into an artery in the area of the body to be studied and an X-Ray is taken of that part of the body. The contrast allows for the blood flow in the area to show up on an X-ray so that the extent of the frostbite damage may be studied. (*Extremity Angiography: MedlinePlus Medical Encyclopedia*, n.d.)

Research Sample H 5 of 14

There are numerous studies that I found that were similar to my own study as they share similar methods and a similar interest in frostbite. Most of those studies focused almost exclusively on the general effectiveness of thrombolytics such as tPA. These papers evaluated the effectiveness of thrombolysis by using the number of extremities amputated and the kind of treatment that they received. They did not evaluate any variables except for the success and fail of the treatment and the kind of treatment. None of these studies evaluated any kinds of variables such as differences in patients' ages or ethnicities. This left a gap that could be filled by further research by another researcher. I chose to fill this gap by imitating their methods but isolating a different variable in patient ages. These studies were extremely helpful with the making of my paper as they provided inspiration for my topics and showed me the most effective way to study the topic that I eventually decided to take my time and study. Each of the aforementioned studies were peer reviewed and came from respected databases. This helped to ensure that my basis of research was strong and helped to reduce the likelihood of the possibility that my research foundation was flawed. One such study was called Frostbite Treatment: a systematic review with meta-analysis. This study also followed the guidelines outlined in the PRISMA study. This study had a similar method and topic to the research study that I decided to do. It was written by medical professionals who have a great deal of experience with frostbite and have medical degrees. This study evaluated the effectiveness of thrombolysis treatment in general and while it did also have data points that showed the difference of effectiveness between males and females it did not show the differences between any other variable. It also showed the use of multiple kinds of thrombolytics and it showed how effective each one was.

Gap in existing research

While there are many studies that show how effective thrombolysis is in the general public there are no studies that compare the effectiveness of thrombolysis between middle aged people, aged 40-59, and young adults, aged 18 to 25.

Assumptions

In this study I make a series of assumptions such as I assume that there is an obvious difference in the effectiveness of thrombolysis with middle aged people and young adults, I assume that thrombolysis is used in a similar fashion with both parties, I assume that the patients will have a similar enough nature of injury that the results will be comparable, and I assume that there will be no overlap in the patient data used in the studies that I will be using.

Significance

This study has the potential to impact how doctors treat patients of different age groups. Ideally this study will show that there is a possible difference in the effectiveness of the treatment of frostbite with thrombolytics between the two age groups. If it does show that then it can provide another part to the larger research of thrombolytic effectiveness and hopefully contribute some knowledge for further researchers. If my hypothesis is proven correct and further research is established it is possible that the age of the patient may provide further consideration for the doctor to decide whether or not to prescribe thrombolytics. Understanding this new difference could influence a doctors decision on whether or not to provide the patient with thrombolytic treatment and it could influence the result of the treatment. The results of the treatment could be life changing for those patients that receive it.

Method

I will perform a quantitative content analysis on 50 medical research papers or case studies that include patient data summarizing their Age, injuries, treatment and the outcome of said treatment. In order to reduce the possibility of bias in this study and to ensure that it is as professional as possible I chose to follow the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA—www.prisma-statement.org). This provides a standardized outline for the creation of a systematic review and will help to ensure that I am not biased and that the creation of this paper is as professional as possible. While bias is largely unavoidable a standardized approach will help to minimize it and allow for a better overall paper. Using a proven method or a standardized approach allows you to use a time tested method that has already been proven. PRISMA is overseen by two professors from Monash University. During the course of this study I will get each of the papers or case studies from either Google Scholar, or Pubmed. Ideally I would include Elseviers medical database as well but due to limited access Elseviers database and case studies were not included in the research process.

Exclusion Criteria

In order to ensure that the data that I found would provide only the data that I needed I chose to exclude some papers or patient data that had insufficient information for my research. In order to do this I chose to exclude data from patients with severe comorbidities, patients that had injuries that involved flash freezing incidents that may have been caused by dry ice or liquid nitrogen and patients who were not in the correct age group. The treatments for these injuries are not the same treatments as for general frostbite and those said treatments would likely affect the outcome of the thrombolytic treatment and would damage the integrity of the study. These factors may also

influence whether or not a patient would receive thrombolysis, again affecting the integrity of the study.

Inclusion Criteria

For the purpose of this study I chose to include only the necessary data. This includes the patient's age, body parts involved, frostbite grade, hospital treatment and outcome. The data that is the patients age provides the basis of this research project. The difference of effectiveness of the frostbite is the research part of the research project. The body parts that are most commonly affected by frostbite are the extremities that give off the most heat and are the farthest from the core. These are most often the hands and feet, or more specifically the fingers and the toes. The number of these affected digits and the outcome of the treatment will be collected and put in a table that is meant to detail the effectiveness of the treatment. The frostbite grade is another point of data that will help to add context and relevance to this study. It will allow for the categorization of the injuries to be shown in the table next to the results so that they can be seen side by side and can help add context to it. The frostbite grade can also be a factor that helps to determine whether or not an individual patient is selected to undergo the process of thrombolysis in addition to the rest of the necessary treatment. The frostbite grade can be determined by the depth of the frostbite injury in relation to the skin. The depth of the frozen tissue in the affected areas will determine the grade of the aforementioned frostbite. The hospital treatment is also definitely a massive factor in the data for this research project. Generally in this research method the point is to isolate a variable to allow it to be studied but treatment almost definitely will vary in quality and form from hospital to hospital. A patient could possibly be taken care of in a small hospital or emergency care center or when possible they could be sent to a burn center that specializes in treating injuries that have a similar likeness to frostbite injuries. While this is not

the focus of the study it can also be a significant factor that influences the outcome of each individual patients recovery from their injuries. The outcome is the culmination of all of these other factors. In most cases this is the main point of data that will determine whether or not the treatment of the patient was effective. The outcome can end up being several different things but the most common results will likely be either a full or partial amputation that would show that the treatment was not effective or it could be a full recovery or an eventual recovery that would be shown as an effective treatment in the context of this study. Each of these factors will be essential to the research method and the results of this study as each of these factors are directly related.

Limitations

When I was studying this topic I ran into a few limitations that provided obstacles to the research process. I found that much of the research and studies that I used were based in America limiting the diversity of the project. Another limitation is that many of the medical research databases that I found that had the case studies that contained the data necessary for my study required a sign-in as part of an organization, such as a hospital or university. As I have yet to be a part of either of those things gaining access to any of those databases proved to be impossible.

Advice

I would advise future researchers to expand on my research by incorporating more research databases from a larger variety of sources. Specifically sources from different parts of the world and places that have different standards of medical care. As my sources largely came from American sources I feel that if someone were to expand that to sources from places such as Russia, China, Norway, or other places in the world that have a significant amount of frostbite

Research Sample H 10 of 14

they could gain a greater understanding of frostbite treatment in places all over the world. They could also do studies based in places that generally don't get cold enough to have frostbite but for some reason with the weather they have an influx of cases. The effectiveness of thrombolysis with those that are unaccustomed to cold could be an interesting variable that could produce yet another research project. Another item I feel would greatly add to the topic is how the effectiveness of thrombolysis with frostbite differs with multiple ethnicities. The variations of demographics that would affect this topic that can be studied are extremely numerous and would take much time and effort to study but would produce much data that could be profitable to the medical community, specifically those that specialize in burn care. This would also be especially important to the patients that would be affected by the results of the data.

Results

I am hypothesizing that the results of this study will be that thrombolysis is more effective in young adults than in middle aged people. The results of this study will be in a table format with a section for Young adults and for Middle aged people. There would be numbers of patients with each previously outlined data point included. Then the percentage of amputations for each section, along with the considerations of frostbite grade will be shown at the end. These two percentages will be the basis for the new understanding of whether or not the treatment was effective. My hypothesis that there will be an obvious difference very well may be entirely wrong but even if that happens then this research project is still a beneficial study. The understanding that there is a negligible difference could be just as important as the understanding that there is not a difference between the effectiveness of thrombolysis with frostbite between young adults and middle aged people. While the method outlined in this study was regrettably not performed this avenue of research is still very viable and could later be performed when

more resources are available. The ability to have access to the necessary data points is very valuable and is not something that I gained access to.

Conclusion

While this research project is deficient as it does not provide a new understanding of the topic nor does it provide viable research it does have a strong foundation. This basis for a research project is something that is still valuable to the research field primarily as a lit review. This research project was not a failure and is something that provided a great deal of insight and learning to the researcher involved. This research project could provide valuable insight into the field of frostbite treatment.

Works Cited

angiography. (2025). In *Merriam-Webster Dictionary*.

<https://www.merriam-webster.com/dictionary/angiography>

Bruen KJ, Ballard JR, Morris SE, Cochran A, Edelman LS, Saffle JR. Reduction of the incidence of amputation in frostbite injury with thrombolytic therapy. *Arch Surg*. 2007 Jun;142(6):546-51; discussion 551-3. doi: 10.1001/archsurg.142.6.546. PMID: 17576891.

Carmichael H, Michel S, Smith TM, Duffy PS, Wiktor AJ, Lambert Wagner A. Remote Delivery of Thrombolytics Prior to Transfer to a Regional Burn Center for Tissue Salvage in Frostbite: A Single-center Experience of 199 Patients. *J Burn Care Res*. 2022 Jan 5;43(1):54-60. doi: 10.1093/jbcr/irab041. PMID: 33657205.

Cauchy, E., Cheguillaume, B., & Chetaille, E. (2011). A controlled trial of a prostacyclin and RT-PA in the treatment of severe frostbite. *New England Journal of Medicine*, 364(2), 189–190. <https://doi.org/10.1056/nejmc1000538>

Extremity angiography: MedlinePlus Medical Encyclopedia. (n.d.).

<https://medlineplus.gov/ency/article/003772.htm>

Heard J, Shamrock A, Galet C, Pape KO, Laroia S, Wibbenmeyer L. Thrombolytic Use in Management of Frostbite Injuries: Eight Year Retrospective Review at a Single Institution. *J Burn Care Res*. 2020 May 2;41(3):722-726. doi: 10.1093/jbcr/iraa028. PMID: 32030427.

James Drinane, Vasanth S Kotamarti, Casey O'Connor, Lakshmi Nair, Alex Divanyan, Malcolm Z Roth, Ashit Patel, Joseph A Ricci, Thrombolytic Salvage of Threatened Frostbitten

Research Sample H 13 of 14

Extremities and Digits: A Systematic Review, *Journal of Burn Care & Research*, Volume 40, Issue 5, September/October 2019, Pages 541–549, <https://doi.org/10.1093/jbcr/irz097>

Lee, J., & Higgins, M. C. S. S. (2020). What Interventional Radiologists Need to know about Managing Severe Frostbite: A Meta-Analysis of Thrombolytic Therapy. *American Journal of Roentgenology*, 214(4), 930–937. <https://doi.org/10.2214/ajr.19.21592>

NCI Dictionary of Cancer Terms. (n.d.). Cancer.gov.

<https://www.cancer.gov/publications/dictionaries/cancer-terms/def/thrombolysis>

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., . . . Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, n71. <https://doi.org/10.1136/bmj.n71>

Paine, R. E., Turner, E. N., Kloda, D., Falank, C., Chung, B., & Carter, D. W. (2020). Protocolled thrombolytic therapy for frostbite improves phalangeal salvage rates. *Burns & Trauma*, 8. <https://doi.org/10.1093/burnst/tkaa008>

Patel, N., Srinivasa, D. R., Srinivasa, R. N., Gemmete, J. J., Krishnamurthy, V., Dasika, N., Reddy, S. N., Osher, M. L., Sears, E. D., & Chick, J. F. B. (2017). Intra-arterial thrombolysis for extremity frostbite decreases digital amputation rates and hospital length of stay. *CardioVascular and Interventional Radiology*, 40(12), 1824–1831. <https://doi.org/10.1007/s00270-017-1729-7>

Regli, I. B., Oberhammer, R., Zafren, K., Brugger, H., & Strapazzon, G. (2023). Frostbite treatment: a systematic review with meta-analyses. *Scandinavian Journal of Trauma*

Research Sample H 14 of 14

Resuscitation and Emergency Medicine, 31(1).

<https://doi.org/10.1186/s13049-023-01160-3>

Sean Hickey, Amy Whitson, Larry Jones, Lucy Wibbenmeyer, Colleen Ryan, Ryan Fey, Jeffrey

Litt, Renata Fabia, Lee Cancio, William Mohr, John Twomey, Anne Wagner, Amalia

Cochran, J Kevin Bailey, Guidelines for Thrombolytic Therapy for Frostbite, *Journal of*

Burn Care & Research, Volume 41, Issue 1, January/February 2020, Pages 176–183,

<https://doi.org/10.1093/jbcr/irz148>

Tawfik, G. M., Dila, K. a. S., Mohamed, M. Y. F., Tam, D. N. H., Kien, N. D., Ahmed, A. M., &

Huy, N. T. (2019). A step by step guide for conducting a systematic review and

meta-analysis with simulation data. *Tropical Medicine and Health*, 47(1).

<https://doi.org/10.1186/s41182-019-0165-6>

Teresa P. Gonzaga, Kamrun Jenabzadeh, Christopher P. Anderson, William J. Mohr, Frederick

W. Endorf, David H. Ahrenholz, Use of Intra-arterial Thrombolytic Therapy for Acute

Treatment of Frostbite in 62 Patients with Review of Thrombolytic Therapy in Frostbite,

Journal of Burn Care & Research, Volume 37, Issue 4, July-August 2016, Pages

e323–e334, <https://doi.org/10.1097/BCR.0000000000000245>

Tucker, M. E. (2008). Thrombolytic therapy saves frostbitten limbs. In *Trauma HOSPITALIST*

NEWS. https://cdn.mdedge.com/files/s3fs-public/issues/articles/70084_main_32.pdf

Zhang JL, Fu JX, Yuan K, Yuan B, Wang MQ. [Advances in the research of transcatheter arterial

thrombolysis for severe frostbite therapy]. *Zhonghua Shao Shang Za Zhi*. 2019 Jan

20;35(1):74-76. Chinese. doi: 10.3760/cma.j.issn.1009-2587.2019.01.015. PMID: 30678407.

Academic Paper

Note: Student samples are quoted verbatim and may contain spelling and grammatical errors.

Overview

NEW for 2025: The question overviews can be found in the *Chief Reader Report on Student Responses on AP Central*.

Sample: H Score: 2

This paper earns a score of 2. The research question is found on p. 6: "... [to] compare the effectiveness of thrombolysis between middle aged people, aged 40-59, and young adults, aged 18 to 25." This question is situated in a literature review of mostly scholarly sources. A method is described on p. 7: "...a quantitative content analysis on 50 medical research papers or case studies that include patient data summarizing their Age, injuries, treatment and the outcome of said treatment." Part of content analysis is to develop sample selection criteria. Exclusion criteria and inclusion criteria for what studies to include in the systematic review are described on pp. 7-8: "I will get each of the papers or case studies from either Google Scholar, or Pubmed" and "This includes the patient's age, body parts involved, frostbite grade, hospital treatment and outcome." The inclusion of the selection criteria demonstrates limited use of the method as part of the coding development. The method was not carried out beyond this step, and thus the only results presented are hypothetical (p. 10). The paper as a whole is a report on existing knowledge with simplistic use of a method.

This paper does not earn a score of 1. The methods described go beyond a search and report method. There is a narrowing scope about thrombolysis and simplistic method use.

This paper does earn a score of 3. The presented hypothesized results are on p. 10 which do not competently convey a new understanding. The communication is general and not competent. For example, PRISMA is introduced on p. 5 but not explained until p. 7.