# How we used Artificial Intelligence to write a scholarly paper on infant colic

Joyce Miller, DC, PhD<sup>1</sup>, Susanne Williams-Frey, DC, MSc<sup>2</sup>

<sup>1</sup>Minneapolis, MN; Email: yukonmillerjm@gmail.com <sup>2</sup>Private Practice, Ebikon, Switzerland; E-mail: swilliamsfrey@yahoo.com

### ABSTRACT

**Objective:** The purpose of this paper was to investigate answers to basic research questions available on a widely used Artificial Intelligence site. Artificial Intelligence (AI) is machine intelligence which relies upon its ability to detect, identify, process and recall increasing numbers of variables within any specific topic and use it to mimic human intelligence. It is known to have benefits for medical questions. Methods: We asked four basic research questions (topics on which we have previously published) of an Artificial Intelligence site. The answers were presented without any changes or amendments. The site offered a "regenerate" feature if you were unhappy with the first answer and this was utilized once. Results: Four short articles were prepared and downloaded from the AI site in approximately 20 seconds each. Discussion: The short (one page) articles generated logical but not always accurate content, without any apparent clinical decision making or critical reflection. The content was mostly historical and did not include any nuanced answers with clinical perspective. It is reasonable that high school and college instructors might be concerned that students consider using this system to generate classroom paper assignments. It is anticipated that AI will be increasingly used to generate diagnoses from complex data exhibited by patients in a health care setting. Conclusion: The articles generated were basic and did not include any research papers past the year 2018 nor deep and thoughtful discussion as has been done in independent researcher driven papers to answer research questions. It is anticipated that AI will become more sophisticated and increasingly useful and utilized by students and professionals of all types. It needs to be held within our focus so that it can be used wisely and not merely accepted with its limitations.

Key Words: Artificial Intelligence, Infant colic, chiropractic, probiotics, pediatric, infant.

### Introduction

Artificial intelligence is machine intelligence used to generate current and useful answers to human questions.<sup>1</sup> As such, it relies upon its ability to locate, recall, collate, process and remember huge amounts of data to formulate those answers.<sup>1</sup> It is used broadly in most any industry. For example, the Beatles music group recently used AI technology and released a song from 1972 that they had never had time to complete when all four of the musicians were alive. Used in this sense, it can amaze and enhance the human experience. But does it benefit science advancement and decrease human bias or might it increase flawed research because of a lack of critical and differential thinking by the AI?

The goal of this project was to present to the JCCP readership one type of use of Artificial Intelligence (AI), to answer research questions with a short, cogent written thesis. As such, what is presented are the exact questions and the exact results as generated by AI. The entire process took less than two minutes. The human part took a considerable amount of time to copy and paste and evaluate the results.

### Methods

In a Chat AI site (chatGPT, chat.openai.com) questions were typed and the saved results are found herein.

### Results

Question 1. Explain infant colic for a doctor. What is the cause and cure?

### CHATGPT reply

Infant colic, often referred to simply as "colic," is a term used to describe excessive, unexplained crying and fussiness in otherwise healthy and well-fed infants. It is a common concern for parents and can be quite distressing, both for the baby and their caregivers. To explain infant colic to a doctor, it's important to discuss its characteristics, potential causes, and management options.

**Characteristics of Infant Colic:** Infant colic typically presents with the following features:

1. Excessive Crying: Colicky babies often cry for more than three hours a day, at least three days a week, and this may persist for three weeks or longer.

2. **Fussiness:** Infants with colic are often irritable and fussy, especially during the evening hours.

3. **Difficulty Soothing:** Parents may find it challenging to console their colicky baby, as the crying episodes can seem inconsolable.

4. **Symptom Onset:** Colic typically begins within the first few weeks of life and usually resolves by the time the baby is three to four months old.

**Potential Causes of Infant Colic:** The exact cause of infant colic is not well understood, and it may be multifactorial. Several theories have been proposed:

1. **Gastrointestinal Issues:** Some experts believe that colic may be related to gastrointestinal discomfort, such as gas, acid reflux, or an immature digestive system.

2. **Sensory Overload:** Babies may become overwhelmed by sensory stimuli, such as noise, light, or changes in their environment, leading to increased fussiness.

3. **Maternal Diet:** In some cases, a breastfeeding mother's diet (e.g., consumption of certain foods or caffeine) may contribute to colic symptoms in her baby.

4. **Parent-Infant Interaction:** Stress and anxiety in parents, as well as their response to the baby's crying, can play a role in exacerbating colic.

**Management and Treatment Options:** There is no onesize-fits-all cure for infant colic, and management strategies often focus on soothing the baby and providing support to the parents. Recommendations for managing colic include:

1. **Feeding:** Ensure that the baby is feeding well and consider trying different feeding techniques, such as smaller, more frequent meals.

2. **Burping:** Burp the baby frequently during and after feedings to release gas and reduce discomfort.

3. **Comfort Measures:** Use gentle rocking, swaddling, or a pacifier to provide comfort and soothe the baby.

4. Environmental Changes: Create a calm and quiet environment to reduce sensory stimuli during fussy periods.

5. **Parental Support:** Offer support and reassurance to parents, as coping with a colicky baby can be stressful.

6. **Dietary Changes (if breastfeeding):** If breastfeeding, the mother may try eliminating certain foods from her diet to see if it affects the baby's symptoms.

In most cases, colic gradually improves on its own as the baby grows and matures. It is essential for healthcare providers to rule out any underlying medical conditions that could be causing the symptoms. If colic persists or is causing significant distress to the baby or parents, healthcare professionals may recommend further evaluation and potential interventions.

It's important to emphasize to parents that infant colic is a temporary phase, and with patience and support, it typically resolves as the baby gets older. Encourage parents to reach out to their healthcare provider for guidance and reassurance during this challenging time.

### A regeneration was requested: CHATGPT reply:

Infant colic is a common but poorly understood condition characterized by excessive, inconsolable crying and fussiness in otherwise healthy and well-fed infants. It typically occurs in the first few months of life, peaking around six weeks of age and often resolving by the time the baby is three to four months old.

### Symptoms:

1. **Crying spells:** Colicky infants often cry for more than three hours a day, three days a week, for at least three weeks.

2. **Predictability:** Colic tends to occur at the same time each day, often in the late afternoon or evening.

3. **Posture changes:** During crying episodes, infants may clench their fists, arch their backs, and pull their knees toward their chest.

### **Possible Causes:**

1. **Gastrointestinal issues:** Some believe that colic may be related to gastrointestinal discomfort, such as gas or indigestion. However, the evidence supporting this is not conclusive.

2. **Maternal diet:** In breastfeeding infants, certain components of the mother's diet, such as cow's milk or certain foods, may trigger colic symptoms.

3. **Overstimulation or sensitivity:** Some infants may be more sensitive to stimuli, such as light, noise, or changes in environment, leading to colic-like symptoms.

### Cure/Treatment:

1. **Time:** Colic often resolves on its own as the baby grows older, usually by the time they reach three to four months of age.

2. **Comfort measures:** Parents can try various comfort measures to soothe a colicky baby, such as holding, rocking, swaddling, or using pacifiers.

3. **Feeding adjustments:** If the baby is breastfed, the mother may try adjusting her diet, eliminating potential trigger foods. For formula-fed babies, a switch to a different formula may be considered.

4. **Probiotics:** Some studies suggest that probiotics might be helpful in reducing colic symptoms, though the evidence is not yet conclusive.

It's important to note that while colic is distressing for both infants and parents, it is generally a self-limiting condition. If a parent is concerned about their baby's excessive crying or suspects an underlying issue, it is crucial to consult with a pediatrician. The doctor can evaluate the baby's health, provide guidance on managing colic, and rule out any other potential medical issues.

# Question 2: What treatment has the best evidence to reduce infant colic? Give me the scientific information so that I can find it on the internet.

### CHATGPT reply

Infant colic is a common condition characterized by

excessive crying and fussiness in otherwise healthy infants, typically starting around the second week of life and resolving by the fourth or fifth month. While its exact cause remains unclear, several treatments have been explored to alleviate colic symptoms, with varying degrees of success. Based on current scientific evidence, three approaches stand out as effective in reducing infant colic:

1. **Probiotics:** Numerous studies have investigated the use of probiotics, specifically strains of Lactobacillus and Bifidobacterium, to alleviate colic symptoms. One study published in the journal "Pediatrics" in 2018 (PMID: 29358284) found that probiotics reduced crying time in colicky infants. Probiotics are believed to positively influence gut flora, potentially addressing underlying gastrointestinal issues associated with colic.

2. **Reduced Lactose Formula:** Some infants with colic may have trouble digesting lactose, a sugar found in milk. Utilizing lactose-free or reduced-lactose formula has shown promise in improving colic symptoms. A study published in "JAMA Pediatrics" in 2016 (PMID: 27893896) found that switching to a hydrolyzed formula resulted in decreased crying and fussiness among colicky infants.

3. **Behavioral Interventions:** Techniques aimed at soothing and comforting colicky infants have proven beneficial. A study in the "Journal of Pediatric Health Care" in 2017 (PMID: 28162843) highlights the effectiveness of infant massage and swaddling in reducing colic-related crying. These interventions promote relaxation and comfort, potentially mitigating colic-related distress.

It is important to note that the response to treatments can vary among infants, and what works for one may not work for another. Therefore, it's advisable for parents to consult with a healthcare professional before implementing any treatment strategy for infant colic. Additionally, ongoing research may lead to new insights and treatment options, so staying up-to-date with the latest scientific literature is essential in managing infant colic effectively.

### Question 3: What is the evidence that manual therapy improves infant colic? Give me the scientific information so that I can find it on the internet.

# CHATGPT reply

Manual therapy, such as chiropractic or osteopathic manipulation, has been explored as a potential treatment for infant colic. However, the evidence supporting its effectiveness remains limited and controversial. Here, we'll discuss the available scientific literature on this topic.

**Description:** Manual therapy for infant colic involves the use of hands-on techniques to manipulate the infant's spine

or musculoskeletal system with the aim of improving colic symptoms. These therapies are typically administered by licensed healthcare providers, such as chiropractors or osteopaths, and are intended to correct any perceived musculoskeletal issues in the infant.

**Explanation:** While some parents report positive outcomes after manual therapy sessions for colicky infants, the scientific evidence supporting these claims is inconclusive, and there are concerns about the safety of such interventions.

Here are three scientific articles that provide insight into this topic:

1. Article 1: Miller JE, Newell D, Bolton JE. (2012) Efficacy of chiropractic manual therapy on infant colic: a pragmatic single-blind, randomized controlled trial. In this study published in the "Journal of Manipulative and Physiological Therapeutics" (PMID: 22489942), chiropractic manual therapy was assessed for its effect on infant colic. While the study reported some reduction in crying time, the results were not statistically significant, and the authors emphasized the need for further research.

2. Article 2: Olafsdottir E, Forshei S, Fluge G, Markestad T. (2001) Randomized controlled trial of infantile colic treated with chiropractic spinal manipulation. Published in the journal "Archives of Disease in Childhood" (PMID: 11788714), this study also investigated chiropractic manipulation as a treatment for infant colic. The findings suggested a slight improvement in colic symptoms among treated infants, but the study's design had limitations, and the overall evidence remained inconclusive.

3. **Article 3:** Gotink RA, Chu P, Busschbach JJ, et al. (2015) Standardised manual therapy for the treatment of infant colic: a systematic review. This systematic review, published in "European Journal of Pediatrics" (PMID: 26055212), analyzed existing studies on manual therapy for infant colic. The review concluded that while some studies reported positive effects, the overall quality of evidence was low, and further research with rigorous methodologies was needed to draw definitive conclusions.

In summary, while there are studies that suggest a potential benefit of manual therapy for infant colic, the evidence remains limited, and concerns about safety and the lack of consistent results call for caution. Parents should consult with healthcare professionals and consider alternative evidence-based treatments for infant colic, such as the ones mentioned in the previous response, before pursuing manual therapy as an option.

### Question 4: What is the evidence that probiotics are helpful for infant colic? Give me the scientific information so that I can find it on the internet.

## CHATGPT reply

Probiotics have gained attention as a potential treatment for infant colic due to their potential to modulate the gut microbiota, which may play a role in colic symptoms. Here, we'll discuss the scientific evidence regarding the effectiveness of probiotics in alleviating infant colic.

**Description:** Probiotics are live microorganisms, typically bacteria or yeast, that are believed to confer health benefits when consumed in adequate amounts. In the context of infant colic, they are administered to infants with the aim of promoting a balanced gut microbiome and reducing gastrointestinal discomfort, which is thought to contribute to colic symptoms.

**Explanation:** Several scientific studies have investigated the use of probiotics for infant colic, but the results have been mixed. Here are three key scientific articles that shed light on this topic:

1. Article 1: Savino F, Pelle E, Palumeri E, et al. (2013) Lactobacillus reuteri (American Type Culture Collection Strain 55730) versus simethicone in the treatment of infantile colic: a prospective randomized study. Published in the journal "Pediatrics" (PMID: 23589877), this study compared the effectiveness of Lactobacillus reuteri (DSM 17938) to simethicone, a commonly used over-the-counter colic remedy. The study found that the probiotic group experienced a greater reduction in crying time, suggesting a potential benefit for L. reuteri in treating colic.

2. Article 2: Sung V, Hiscock H, Tang MLK, et al. (2014) Treating infant colic with the probiotic Lactobacillus reuteri: double-blind, placebo-controlled randomized trial. This study, published in the journal "Pediatrics" (PMID: 25070305), conducted a randomized controlled trial to assess the effectiveness of Lactobacillus reuteri DSM 17938 in treating infant colic. The results indicated that infants receiving the probiotic had a significant reduction in crying and fussiness compared to the placebo group.

3. Article 3: Szajewska H, Gyrczuk E, Horvath A. (2013) Lactobacillus reuteri DSM 17938 for the management of infantile colic in breastfed infants: a randomized, double-blind, placebo-controlled trial. Published in the journal "Journal of Pediatrics" (PMID: 23796741), this study focused on breastfed infants and found that Lactobacillus reuteri DSM 17938 reduced the daily crying time and improved colic symptoms compared to the placebo group.

While these studies suggest a potential benefit of probiotics, it's essential to note that the effectiveness of specific probiotic strains may vary, and further research is needed to confirm these findings. Probiotics appear to be a promising option for some infants with colic, but consulting with a healthcare professional before starting probiotic treatment for a colicky infant is crucial to ensure it is appropriate and safe for the individual child.

### Discussion

Crying is the baby's first attempt at communication. Crying in the infant is an important survival skill as it elicits caring behaviors in the parents that insure survival of the infant.<sup>2</sup> Numerous studies and levels of research have not successfully identified specific reasons for the onset of infant colic, or excessive crying within the first two weeks of life, although some familial social conditions may be related.<sup>3,4</sup> As such the ideas promoted in the AI articles are much too certain of the given etiologies. For example, although it may seem that an experienced mother might be helpful, a key risk factor for infant colic is whether or not it has occurred in the family previously.<sup>3,4</sup> The associations with infant colic as discussed with AI are not commonly repeated in up-to-date research articles, but are common in the older literature, suggesting a simplistic and incomplete approach to answer the research questions. Current research does NOT suggest that maternal diet or cow's milk protein intolerance are causes for infant colic. To put it simply, if these are the causes, then there is a known reason for the crying, and by definition, the cause of the crying is not attributable to infant colic.<sup>5</sup> Further, AI seems to have confused lactose free formulas with hydrolyzed formulas (which hydrolyze the protein in milk, not the sugar) and in a nutshell, neither of these are related to infant colic.<sup>5</sup>

Put simply, there are no randomized controlled trials that support the two treatments, reduced lactose formula and behavioral interventions that AI has called efficacious. The levels of evidence required to meet the standard of effectiveness for AI appears to be low.

There are also considerable disputes that colic resolves automatically at three or four months of age as solidly stated by the AI articles, or that it does not include negative side effects.<sup>6-9</sup> The regenerated version did not fare better holding on to the ideas that colic comes from GI upset or maternal diet. Both these claims are unsupported by the research literature. However, there was mention of probiotics as a potential therapy and this is credible, but only in babies who are breastfed.<sup>10-12</sup> The latter factor was not included in the AI article and would be helpful to being able to help specific colicky infants with probiotics. Both the original and regenerative request brought up the utility of probiotics, but neither noted that probiotics are only beneficial for breastfed babies. This is key to understanding how probiotics might be beneficial. In short, they do not critically reflect on the literature or use the most relevant literature or even interpret it correctly.

Two examples of interpretation difficulties were the use of the Miller et al. 2012 study and the Olafsdottir et al. 2001 randomized trials of manual therapy for infant colic. AI stated that the change in crying time in the Miller study was not statistically significant (not true),<sup>13</sup> and that the Olafsdottier<sup>14</sup> study found "slight improvement in colic symptoms among treated infants, but the study's design had limitations." In fact, the Olafsdottier study found no statistically significant difference between treated and untreated infants and has been repeatedly lauded for an excellent study design with good parent blinding.<sup>14</sup> Such basic misinterpretation of the actual study findings puts all of their findings at risk. Missing out on more current trials is an important limitation to the AI review of the science to maintain accuracy as well as current relevance.

Out of the nine given references, not one had a correct PMID Number and therefore resulted in finding scientific articles that did not support the stated facts. For example, the PMID number for the research paper given for the 2nd question rendered a result for a paper<sup>15</sup> with a completely different subject. Several of the research papers could not actually be found on PubMed or other search engines. It is important to know that all AI answers may not be factual and all references should be checked (just as articles written by humans are reviewed). Self doubt is a human trait that cannot be attributed to AI, as it glibly states falsehoods as facts.

Artificial intelligence has many advantages in that it does not tire, fatigue or develop a bad attitude. It can manage huge amounts of data that the human could not grasp. A disadvantage is that it did not, in this example, evaluate each piece of data for its relevance or accuracy in a minute or nuanced manner, nor utilize the most up-to-date research literature. The speed of data gathering was impressive and observed in this project. The errors in data selection and evaluation were also observed in this project. With its ability to gather large amounts of data and process it quickly, it is anticipated to be helpful in automated medical diagnosis and clinical decision making.<sup>1</sup> However, as new approaches to unsolved problems need to be found, the human brain is needed for creativity. Further, in this project, AI was able to find the information, but not evaluate its' insufficiencies. Humility in approach to data gathering may be a useful human trait as well.

Artificial Intelligence is a fact of life for now and for the future. In this example, it did not review the most recent or most relevant science to answer the research questions that we posed. However, this was a simplistic approach and we did not provide guidelines for a detailed approach to the problem. Nor were the questions specific enough to go into detail, which might be a factor to consider when using AI. Rather, this was a rudimentary trial to see how individuals without training can use AI to help solve a clinical problem and gain some insight into the research background. Certainly those experienced in its use would be able to reach more clinically relevant and useful solutions. It is key that artificial intelligence be used in a responsible and effective manner. Some educators may be concerned that AI is subject to misuse by hasty students preparing assignments. It is important that we are all tuned in and aware to keeps its' usage appropriate, efficient and advantageous for the population it serves.

### Conclusion

In the case of infant colic, the human ability to weigh and evaluate relevance in a data set appeared to be more clinically useful in answering the research questions than artificial intelligence. Improved human skills to use artificial intelligence intelligently will likely lead to obtaining improved clinical utility.

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