



# Attitudes and perceptions of medical researchers towards the use of artificial intelligence chatbots in the scientific process: an international cross-sectional survey

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Chatbots are artificial intelligence (AI) programs designed to simulate conversations with humans that present opportunities and challenges in scientific research. Despite growing clarity from publishing organisations on the use of AI chatbots, researchers' perceptions remain less understood. In this international cross-sectional survey, we aimed to assess researchers' attitudes, familiarity, perceived benefits, and limitations related to AI chatbots. Our online survey was open from July 9 to Aug 11, 2023, with 61560 corresponding authors identified from 122323 articles indexed in PubMed. 2452 (4.0%) provided responses and 2165 (94.5%) of 2292 who met eligibility criteria completed the survey. 1161 (54.0%) of 2149 respondents were male and 959 (44.6%) were female. 1294 (60.5%) of 2138 respondents were familiar with AI chatbots, and 945 (44.5%) of 2125 had previously used AI chatbots in research. Only 244 (11.4%) of 2137 reported institutional training on AI tools, and 211 (9.9%) of 2131 noted institutional policies on AI chatbot use. Despite mixed opinions on the benefits, 1428 (69.7%) of 2048 expressed interest in further training. Although many valued AI chatbots for reducing administrative workload (1299 [66.9%] of 1941), there was insufficient understanding of the decision making process (1484 [77.2%] of 1923). Overall, this study highlights substantial interest in AI chatbots among researchers, but also points to the need for more formal training and clarity on their use.

## Introduction

Artificial intelligence (AI) broadly refers to the ability of a computer or a computer-controlled robot to perform tasks typically associated with human intelligence and to integrate cognitive functions.<sup>1-3</sup> Current models for translating languages often use complex systems called recurrent or convolutional neural networks that have two parts: an encoder and a decoder. The best models also use an attention mechanism to connect these parts.<sup>4</sup> In medicine and health care, AI systems have reduced diagnostic and therapeutic errors, promoted and increased physical activity, and are estimated to have reduced health-care costs.<sup>5-7</sup> AI has also become an increasingly important tool in scientific research, in which large amounts of data need to be retrieved, analysed, and interpreted.

Chatbots are AI programs designed to simulate conversation with human users using text or speech.<sup>7,8</sup> Popular AI chatbots include, but are not limited to, ChatGPT, Bing Chat, YouChat, and Google Bard. In scientific research, AI chatbots can automate tasks such as literature searches and reviews, data analyses and interpretation of large datasets, experimental design, and manuscript writing.<sup>9-11</sup> They also improve the readability of scientific articles for non-native speakers, possibly increasing equity and addressing barriers to promote research diversity.<sup>10-12</sup> AI chatbots can also be trained to differentiate between reproducible and non-reproducible studies by estimating a study's likelihood of replication.<sup>13</sup> Overall, AI chatbots improve the efficiency, accuracy, and reproducibility of scientific research.<sup>13</sup>

However, the use of AI chatbots in scientific research has challenges and limitations that need to be addressed. Some major concerns include the accuracy and reliability

of AI chatbots in performing or reporting scientific tasks and ethical issues regarding the use of AI in research, which include plagiarism, risk of amplifying biases and inaccuracies, research fraud, copyright issues, and low transparency in content generation.<sup>10-12</sup> These challenges might cause AI chatbots to spread misinformation, with harmful consequences.<sup>10,12</sup>

To better understand medical researchers' attitudes and perceptions towards the use of AI chatbots in the scientific process, we conducted a large-scale, international, cross-sectional survey. This survey sought to investigate the extent to which researchers are familiar with AI chatbots, the perceived potential benefits and limitations of using these AI chatbots in scientific research, and the factors that might influence their adoption.

## Methods

### Search strategy and selection criteria

We obtained a complete list of all journals indexed in MEDLINE (approximately 5300 journals as of April, 2023) along with their National Library of Medicine (NLM) IDs. We developed a search strategy of these NLM Identifiers in Ovid MEDLINE, which was limited to records indexed from March 1 to April 7, 2023. PubMed Identifier numbers associated with all yielded articles were exported from Ovid as a .csv file and input into an R script (created based on the easyPubMed package 2019) to capture author names, affiliated institutions, and email addresses. 122323 PubMed IDs were retrieved and exported into R. Corresponding author email extraction was completed on May 29, 2023, and cleaned for potential errors or duplicates before survey administration. The protocol was registered on the Open Science Framework and is available online.

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For ChatGPT see <https://openai.com/blog/chatgpt>

For Bing Chat see <https://www.bing.com/new>

For YouChat see <https://you.com/>

For Google Bard see <https://bard.google.com/>

For the search strategy see <https://osf.io/7e8yz>

For the easyPubMed package see <https://CRAN.R-project.org/package=easyPubMed>

For the protocol see <https://osf.io/5fshu>

### Respondent recruitment

To be included, respondents had to self-identify as medical researchers and have completed at least one terminal degree in their respective field of study or have at least 5 years of experience in a research-focused role (eg, research coordinator). Students (both undergraduate and graduate) were ineligible to participate in this survey.

A range of academic disciplines within the field of medicine were included (eg, life sciences, public health, bioengineering, and medical education). We used convenience sampling to recruit respondents, targeting corresponding authors identified by our sampling strategy. An email containing a recruitment script approved by the research ethics board, detailing the study and its purpose, and a link to the survey was sent via email using Microsoft Outlook Mail Merge software<sup>14</sup> on July 9, 2023. When respondents clicked on the survey link, they were directed to a webpage containing an informed consent form. Respondents who agreed to the form would then proceed to the survey. This survey was closed, meaning that only invited respondents were able to participate.

If respondents did not respond to the original invitation email, reminder emails were sent twice in batches of 10 000 between July 17 and July 24, 2023. A 1-week waiting period followed the final email reminder. The online survey was open from July 9 to Aug 11, 2023.

Financial compensation was not offered; participation was entirely voluntary and anonymous. With the exception of the screening question, all other questions could be skipped if participants did not wish to respond. Participation could be withdrawn at any time during the survey by closing the browser; however, withdrawal was not possible after the survey was submitted.

### Data analysis

The survey was created, distributed, and collected using SurveyMonkey software (University of Ottawa, ON, Canada).<sup>15</sup> The first draft of the survey (created by JYN and reviewed by the rest of the team) was developed based on a literature review and input from experts in the field of AI and scientific research. Survey questions were beta tested by a team of authors and two invited researchers with survey methods expertise outside of the author list before administration of the survey.

The survey contained 29 closed-ended questions, covering demographic information, experience with AI chatbot, role of AI chatbots in the scientific process, perceived benefits and challenges of AI chatbots in the scientific process, and open-ended questions

Survey data were exported and analysed using Microsoft Excel. Counts and percentages were used to summarise the collected data. Qualitative data collected from open-ended questions were analysed thematically and pilot coding was conducted beforehand (by AL and NS). Each author independently coded the responses of the first

20 respondents for question 14 (the first open-ended question), and then collaborated to develop a shared codebook based on their results. After reaching a consensus on the codes, all remaining open-ended responses were coded and the codebook was iteratively updated. Individual codes were grouped into themes and finalised through consensus. Any conflicts were resolved with a discussion between AL and NS, and if needed, by a third author (SGM). A descriptive definition of each theme was then created.

This study was conducted in compliance with the CHERRIES guidelines. Ethical approval was granted by the Ottawa Health Science Network Research Ethics Board (20230288–01H). All data collected were kept confidential and anonymous, and no identifying information of respondents was collected.

### Results

After deduplicating the list, survey invitations were sent to 61560 corresponding authors and 2452 (4.0%) provided responses. 2292 (93.5%) respondents met eligibility criteria, of whom 2165 (94.5%) completed the survey. As not all respondents completed all survey questions, the total number of responses for each question varies. The raw collected survey data can be found online.

Demographic data can be found in the appendix (pp 3–4). Most respondents were male (1161 [54.0%] of 2149), less than half were female (959 [44.6%]), and 29 (1.3%) identified as non-binary, self-described, or preferred not to say. Most respondents were aged 36–45 years (706 [32.8%] of 2156). Respondents primarily worked in 95 countries, with the greatest representation from the USA (601 [28.1%] of 2137), Canada (163 [7.6%]), and Italy (129 [6.0%]). Most were senior researchers (1136 [52.5%] of 2165), faculty members at a university or academic institution (1369 [63.4%] of 2158), primarily in clinical research (1107 [51.3%] of 2159), and had published more than 21 research articles (1549 [72.4%] of 2133).

Respondents' experience with AI chatbots and their affiliated institution's views on using AI chatbots in the scientific process are shown in table 1. Notably, 1294 (60.5%) of 2138 respondents were familiar with the concept of AI chatbots, and of those who had used AI chatbots, most used ChatGPT (1402 [65.6%] of 2136). Less than half of respondents used an AI chatbot for purposes relating to the scientific process (945 [44.5%] of 2125 respondents), and 882 (41.5%) used ChatGPT for these purposes. However, 1180 (55.5%) respondents had never used an AI chatbot in this context. Respondents were likely (790 [37.0%] of 2136) or very likely (451 [21.1%]) to use AI chatbots for their future research.

Most respondents reported that their research institution did not offer any training on using AI tools (1487 [69.6%] of 2137), although 244 (11.4%) indicated that their institution offered training on appropriate use

For more on the CHERRIES guidelines see <https://www.jmir.org/2004/3/e34/>

For the raw survey data see <https://osf.io/f62ds>  
See Online for appendix  
For the survey see <https://osf.io/79f6e>

	Number of responses (%)
<b>How familiar are you with the concept of AI chatbots?</b>	
Very familiar	283 (13.2%)
Familiar	1294 (60.5%)
Unfamiliar	357 (16.7%)
Very unfamiliar	169 (7.9%)
I am not sure	35 (1.6%)
Total	2138 (100.0%)
<b>Which of the following AI chatbots have you used before (for any purpose)?*</b>	
Bing Chat	246 (11.5%)
ChatGPT	1402 (65.6%)
YouChat	26 (1.2%)
Google Bard	206 (9.6%)
I have never used an AI chatbot	658 (30.8%)
Other	75 (3.5%)
Total	2136 (100.0%)
<b>Which of the following AI chatbots have you used before specifically for purposes relating to scientific processes?*</b>	
Bing Chat	87 (4.1%)
ChatGPT	882 (41.5%)
YouChat	9 (0.4%)
Google Bard	82 (3.9%)
I have never used an AI chatbot for purposes relating to scientific processes	1180 (55.5%)
Other	47 (2.2%)
Total	2125 (100.0%)
<b>How likely are you to use an AI chatbot for your research in the future?</b>	
Very likely	451 (21.1%)
Likely	790 (37.0%)
Unlikely	348 (16.3%)
Very unlikely	248 (11.6%)
I am not sure	299 (14.0%)
Total	2136 (100.0%)
<b>Does your research institution provide any training on how to appropriately use AI tools in the scientific process?</b>	
Yes, and I have taken it	64 (3.0%)
Yes, but I have not taken it	180 (8.4%)
No	1487 (69.6%)
I am not sure	406 (19.0%)
Total	2137 (100.0%)
<b>Has your research institution implemented any policies surrounding the use of AI chatbots in the scientific process?</b>	
Yes	211 (9.9%)
No	1178 (55.3%)
I am not sure	742 (34.8%)
Total	2131 (100.0%)

2165 respondents completed the survey, but as not all respondents completed all survey questions, the total number of responses for each question varies. AI=artificial intelligence. \*Participants could select all that apply.

**Table 1: Respondent experience with AI chatbots**

of AI tools in the scientific process and 64 (26.2%) of 244 completed such training. When asked if their institution had implemented any policies surrounding AI chatbot

	Number of responses (%)
<b>How much training and education do you think researchers need to effectively use AI chatbots in the scientific process?</b>	
A lot	665 (32.5%)
Some	1048 (51.2%)
Very little	173 (8.4%)
None	34 (1.7%)
I am not sure	129 (6.3%)
Total	2049 (100.0%)
<b>Would you be interested in learning more or receiving training about how to use AI chatbots in the scientific process?</b>	
Yes	1428 (69.7%)
No	189 (9.2%)
Maybe	431 (21.0%)
Total	2048 (100.0%)
<b>How important do you think AI chatbots will be in the future of scientific research?</b>	
Very important	741 (36.2%)
Important	935 (45.6%)
Unimportant	110 (5.4%)
Very unimportant	18 (0.9%)
I am not sure	246 (12.0%)
Total	2050 (100.0%)
<b>In general, how do you perceive the potential impact of AI chatbots on the future of scientific research?</b>	
Very positively	282 (13.8%)
Positively	954 (46.6%)
Negatively	290 (14.2%)
Very negatively	90 (4.4%)
I am not sure	432 (21.1%)
Total	2048 (100.0%)

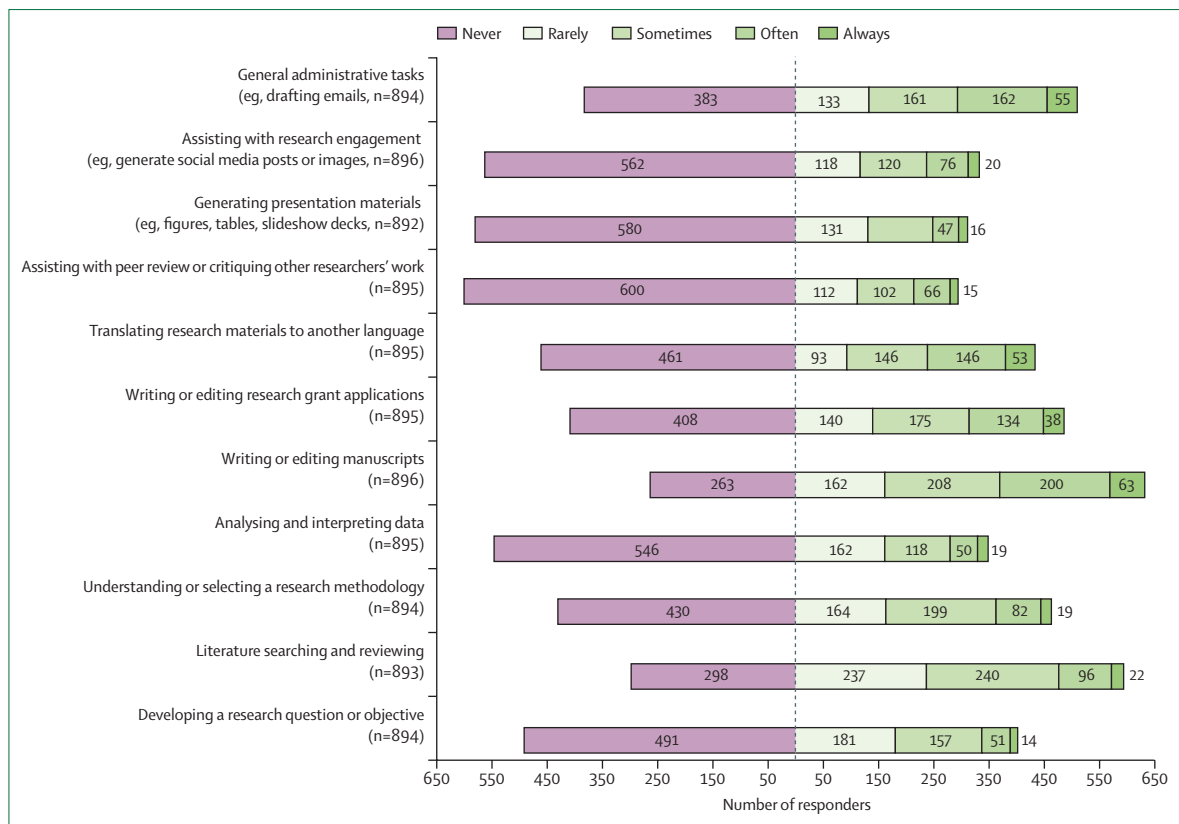
2165 respondents completed the survey, but as not all respondents completed all survey questions, the total number of responses for each question varies. AI=artificial intelligence.

**Table 2: Role of AI chatbots in the scientific process**

use in the scientific process, 211 (9.9%) of 2131 respondents answered yes.

Participant responses about the perceived role of AI chatbots in the scientific process are shown in table 2. Slightly more than half of respondents answered that some training is necessary (1048 [51.2%] of 2049) and 665 (32.5%) felt a lot of training was necessary to effectively use AI chatbots in the scientific process. Most respondents expressed clear interest in learning more or receiving training on using AI chatbots in the scientific process (1428 [69.7%] of 2048). Respondents also felt that AI chatbots would be very important (741 [36.2%] of 2050) or important (935 [45.6%]) in the future of scientific research. Most stated that AI chatbots would have a very positive or positive outcome (1236 [60.4%] of 2048), whereas 380 (18.6%) felt AI chatbots would negatively or very negatively impact future scientific research.

Respondents rated their agreement with statements regarding how helpful an AI chatbot would be in different



**Figure 1: Respondent use of AI chatbots in different steps of the scientific process**  
AI=artificial intelligence.

steps of the scientific process on a five-point scale ranging from very helpful to very unhelpful (appendix p 1). Notably, 1235 (60.4%) of 2044 respondents felt AI chatbots would be very helpful or helpful in conducting literature searches. Respondents had mixed views regarding AI chatbot helpfulness in understanding or selecting a research methodology; 820 (40.3%) of 2033 perceived AI chatbots to be unhelpful or very unhelpful, whereas 754 (37.1%) felt they would be very helpful or helpful. Of the participants who answered this question, senior researchers chose the options “always”, “often”, and “sometimes” regarding their AI chatbot usage more frequently than researchers in other career stages. These findings stratified by participants’ usage of AI tools in scientific processes can be found online. Respondents overwhelmingly felt that AI chatbots would be very helpful or helpful when writing or editing manuscripts (1329 [65.2%] of 2040), research grant applications (1183 [58.2%] of 2032), and translating research materials into another language (1346 [65.9%] of 2044; appendix p 1). Of 2039 respondents, 902 (44.2%) perceived AI chatbots to be unhelpful or very unhelpful for peer review or critiquing other researchers’ work. 848 (41.6%) of 2041 respondents felt AI chatbots would be very helpful or helpful for generating presentation materials, and 1059 (51.9%) of 2040 respondents thought AI chatbots would be very helpful or helpful for research

engagement. Finally, 1261 (61.8%) of 2040 respondents believed AI chatbots were very helpful or helpful for performing general administrative tasks.

Respondents rated how often they had used AI chatbots in different steps of the scientific process on a five-point scale ranging from always to never (figure 1). Notable findings include that 477 (53.4%) of 893 respondents had sometimes or rarely used an AI chatbot for literature searching and reviewing, 370 (41.3%) of 896 sometimes or rarely used an AI chatbot for writing or editing manuscripts, and 315 (35.2%) of 895 sometimes or rarely used an AI chatbot for writing or editing research grant applications. Regarding language translation, 461 (51.5%) of 895 had never used AI chatbots for this purpose; however, of those who did use an AI chatbot for translation purposes (434 [48.5%] of 895), those in the top five countries that found AI to be very helpful were based in the USA (109 [19.1%] of 571), Italy (48 [8.4%]), China (42 [7.4%]), Canada (35 [6.1%]), and Spain (29 [5.1%]). The findings stratified by participants’ perceptions of AI helpfulness as a translational tool are shown online.

Respondents rated their agreement with statements relating to the benefits of AI chatbots in different steps of the scientific process on a five-point scale ranging from strongly disagree to strongly agree (figure 2). The most agreed and strongly agreed upon benefits of AI chatbots

For the data stratified by participants’ usage see <https://osf.io/v2csn>

For the data stratified by participants’ perceptions see <https://osf.io/kc4zt>

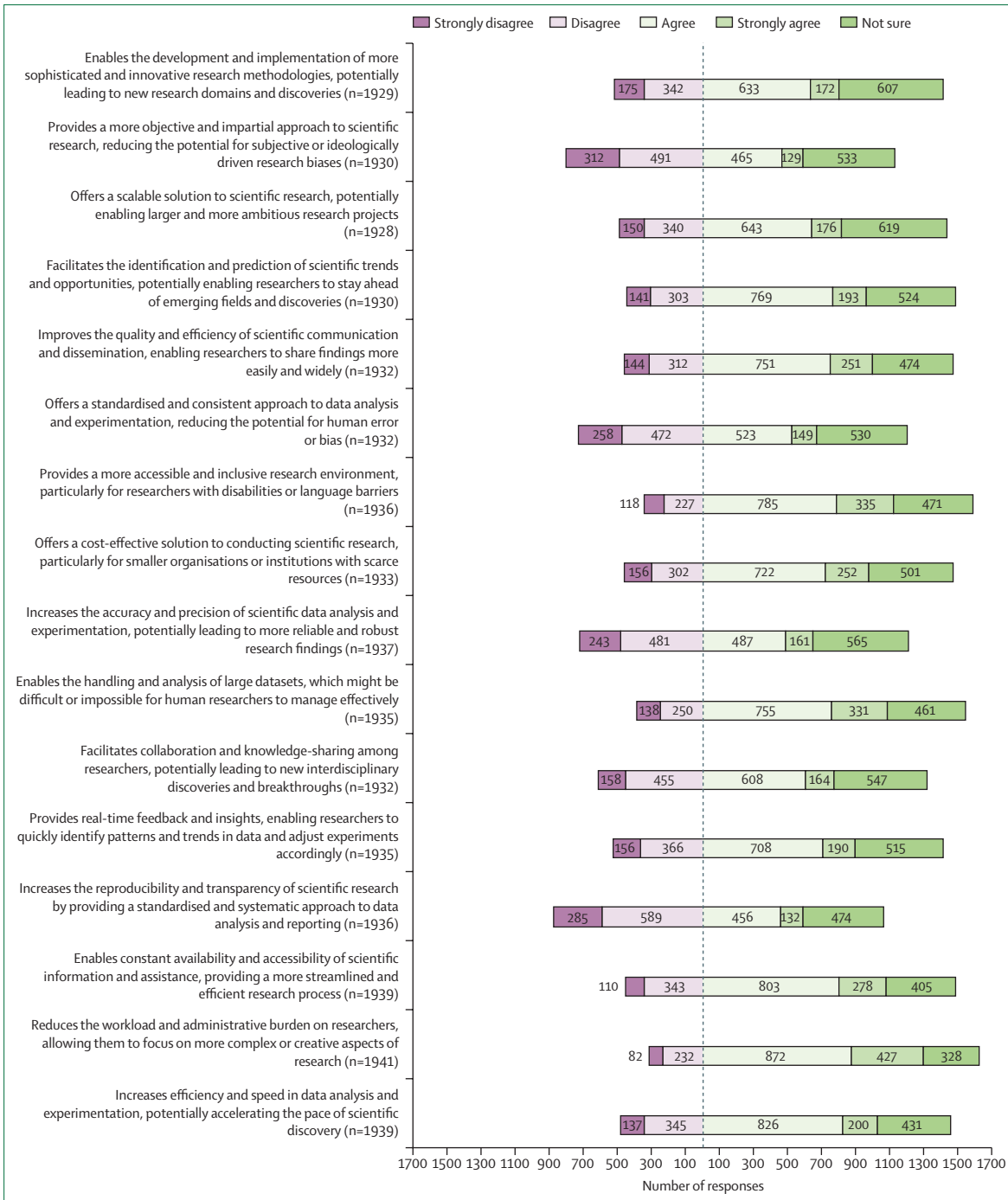


Figure 2: Respondent agreement with potential benefits of using AI chatbots in the scientific process  
AI=artificial intelligence.

included increased efficiency and speed of data analysis (1026 [52.9%] of 1939), reduction of workloads and administrative burden on researchers (1299 [66.9%] of 1941), enabling constant availability and accessibility to scientific information and assistance (1081 [55.7%] of 1939), more effective handling and analysis of large datasets than

human researchers (1086 [56.1%] of 1935), offering a cost-effective solution to conducting scientific research (974 [50.4%] of 1933), providing a more accessible and inclusive research environment (1120 [57.9%] of 1936), and improved quality and efficiency of scientific communication and dissemination (1002 [51.9%] of 1932).



Figure 3: Respondent agreement with potential challenges of using AI chatbots in the scientific process  
AI=artificial intelligence.

Ratings on whether AI chatbots could increase the reproducibility and transparency of research by providing a standardised and systematic approach were mixed (figure 2); 285 (14.7%) of 1936 participants strongly disagreed or disagreed (589 [30.4%]), 474 (24.5%) were not sure, and 456 (23.6%) agreed or strongly agreed (132 [6.8%]) with the statement. 565 (29.2%) of 1937 participants were not sure whether AI chatbots could

increase the accuracy and precision of data analysis and experimentation, whereas 243 (12.6%) strongly disagreed or disagreed (481 [24.8%]) with the statement. Respondent views were mixed on whether AI chatbots could reduce human error or bias by offering a standardised approach to data analysis as 530 (27.4%) of 1932 were not sure, 523 (27.1%) agreed, and 149 (7.7%) strongly agreed; however, 472 (24.4%) respondents disagreed and 258

(13.4%) strongly disagreed with the statement. Overall, most respondents (1676 [81.8%] of 2050) believe that AI chatbots will be very important or important in the future of scientific research (appendix p 2).

Respondents rated their agreement with statements relating to potential challenges of using AI chatbots in the scientific process on a five-point scale ranging from strongly disagree to strongly agree (figure 3). The most agreed and strongly agreed upon challenges of AI chatbots included biased or skewed data outputs (1384 [71.9%] of 1924), ethical and legal concerns (1480 [76.8%] of 1927), resistance or pushback from researchers (1374 [71.4%] of 1924), absence of accountability (1405 [73.0%] of 1924), absence of transparency and interpretability in the decision making process (1456 [75.7%] of 1923), insufficient understanding of how AI chatbots make decisions and generate responses (1484 [77.2%] of 1923), insufficient ability to handle context-dependent or situation-specific information (1426 [74.1%] of 1924), insufficient ability to capture the nuances and complexity of human thought and reasoning (1467 [76.4%] of 1921), data privacy and security concerns (1401 [72.9%] of 1921), and challenges related to user acceptance and adoption (1437 [74.7%] of 1924).

The open-ended questions allowed participants to provide additional feedback and comments on the use of AI chatbots in scientific research. The designated themes, subthemes, individual codes, and frequencies for open-ended questions can be found online. Results from the thematic analysis tallies can also be found online. The main themes discovered in the thematic analysis include the “Nature of AI Chatbot Training and Its Composition”, “Nature of AI Chatbot Policies in Research Institutions”, “Helpfulness of AI Chatbots in Additional Steps of the Scientific Process”, “Extent of AI Chatbot Usage in Additional Steps of the Scientific Process”, “Additional Benefits of AI Chatbots in the Scientific Process”, and “Final Comments Regarding AI Chatbot Use or the Survey”. Further details exploring these themes are shown online.

## Discussion

To our knowledge, this survey is the first of its kind in terms of the design and magnitude to provide an international perspective on medical researcher knowledge, use, and perceptions of AI chatbots in the scientific process and the possible effect on how medical research is conducted when these AI chatbots are newly being applied to the field. Overall, respondents expressed mixed opinions regarding the possible benefits of using AI chatbots in the scientific process, whereas most respondents agreed on the disadvantages and challenges. Many agreed that AI chatbots could be helpful in various steps of the scientific process, but not in their current state due to many limitations and errors.

In our survey, most respondents were already familiar with the concept and had used an AI chatbot before for research purposes, with the most used AI chatbot being

ChatGPT. Respondents overwhelmingly felt that AI chatbots were most helpful in writing and editing manuscripts. However, only a few respondents (11.4%) reported that their institution offered training on the appropriate uses of AI tools or chatbots in the scientific process and a small proportion (9.9%) reported that their affiliated institution implemented policies in this context. Considering that many widely available AI chatbots have major and well known shortcomings (eg, hallucinations defined as making incorrect predictions or patterns), these findings were surprising and unfortunately, awareness campaigns addressing the limitations of AI were only offered in some research institutions and few had implemented clear policies on AI chatbots use in research. The absence of available training and policies could be due to adoption of AI chatbot use in research in the past 2 years or perhaps due to the prohibition of using AI tools, such as chatbots, in research articles by several publishing organisations and journals.<sup>16,17</sup> Insufficient training is not because of an absence of interest, as most respondents conveyed clear interest in learning more and receiving training about use of AI chatbots in the scientific process.

The absence of training and policies also raises concerns for research integrity, as many journals now require authors to disclose all use of AI, yet undeclared ChatGPT-assisted manuscripts are being published in peer-reviewed journals.<sup>18</sup> This fact indicates an absence of effective safeguarding tools or mechanisms surrounding the detection of AI-generated material in the peer-review process, but also suggests a worrying pattern that research integrity might already be compromised.

The principal perceived benefits of AI chatbots include the time saved on drafting manuscripts, language translation, or generating figures and tables. AI chatbots are already known for automating time-consuming tasks in the research process and providing writing and editing assistance;<sup>10,11</sup> such benefits are also reflected by our findings.

Interestingly, 61.8% of respondents viewed AI chatbots as very helpful or helpful for general administrative tasks and 44.5% had previously used them in research. Most respondents reported to have never used an AI chatbot due to substantial limitations still present in many current AI chatbot models. Respondents were most concerned about the difficulty in validating AI chatbot outputs due to insufficient understanding or transparency behind the decision making and response generation processes.

The use of AI tools has already been widely discussed in medicine and health care due to the known pattern recognition capabilities when handling medical data. A systematic review by Ali and colleagues<sup>5</sup> found that the benefits of AI use in health care for patients include early diagnosis, patient monitoring, and automated decision making. Goodman and colleagues<sup>19</sup> state that AI tools incorporated into support systems have guided clinical decision making using patient health records to make

For more on the **open-ended questions** see <https://osf.io/7qfc3>

For the **thematic analysis** see <https://osf.io/k67cp>

For more on the **themes** see <https://osf.io/evrcs>

algorithmic predictions during clinical uncertainty. For example, sepsis warning systems can use real-time data to identify early-stage sepsis in patients before physicians can detect any clinical signs. Ultimately, physicians can incorporate AI-powered clinical decision support predictions into clinical decisions; however, these predictions require critical evaluation and human judgement because the AI algorithm contains bias and can also produce false positives.<sup>19</sup> Similarly, Ruksakulpiwat and colleagues<sup>20</sup> state that although ChatGPT can provide general and basic medical information and simplify medical reports for radiologists quite well, this AI chatbot also contains errors and currently requires human validation. In our survey, many respondents noted that AI chatbots can provide real-time feedback and insights, are useful in data analysis—particularly for large datasets—and facilitate the identification and prediction of scientific trends and opportunities. Survey respondents also emphasised that if AI chatbots were to be used in scientific research, the outputs will require human judgement and evaluation.

Many AI chatbots are easily accessible and publicly available at little to no cost for their initial use. A 2023 poll by YouGov found that 62% of American respondents were somewhat or mostly concerned about the growth of AI.<sup>21</sup> Additionally, 56% of respondents expressed support for federal regulation of AI rather than self-regulation by tech companies, because 82% of respondents did not trust tech executives to regulate AI.<sup>21</sup> These findings are supported by Gillespie and colleagues,<sup>22</sup> who conducted a global survey of more than 17 000 people and found that 61% of respondents were wary about trusting AI systems. Respondents were most concerned about the safety, security, data privacy measures, and fairness of AI systems, which were among the principal concerns voiced by our survey respondents in terms of using AI chatbots in scientific research.

A 2023 survey<sup>23</sup> conducted by User Interviews aimed at UX researchers or designers and Research Ops specialists found that 77·1% of respondents were already using AI in at least some of their work and around half (51·1%) used ChatGPT for this purpose. The survey reports that the most cited benefit of AI was efficiency, as 40·4% of respondents used AI for qualitative coding purposes and 45·5% used AI for writing reports.<sup>23</sup> Another survey of 1600 researchers also supported these perceived benefits,<sup>24</sup> as respondents felt that AI tools in research would increase the processing of data, speed up computations, automate data acquisition, and reduce overall time and resources spent by researchers. Additionally, negative effects of AI use in research were perceived to be primarily the risk of bias and discrimination in data (55%), fraud (55%), and increased reliance on pattern recognition without complete understanding (69%). Similarly, Noy and colleagues<sup>25</sup> present results from a trial involving 453 college-educated professionals showing that using ChatGPT substantially increased productivity, improved task quality, and reduced task

completion time. These findings need to be interpreted with caution due to slight vagueness in the methods, which might exaggerate the results.

Most researchers wanted to learn more and receive training on using AI chatbots, which suggests a need to develop structured training for biomedical researchers on use of AI chatbots in the scientific process. Creating set guidelines and standardised training surrounding AI chatbot use in research might help to maintain research integrity. Many researchers also expressed concern around AI chatbot use in research due to the many limitations or errors and ethical issues of current models. Before these tools can be used in research, these concerns need to be addressed. Finally, AI chatbots can possibly enhance research equity by helping non-native speakers overcome language barriers,<sup>10–12</sup> given that they continue to be widely available for free or at a low cost.

This survey provides insight into early AI chatbot use in medical research and can be incorporated to measure the evolution of this technology. Currently, there are substantial concerns and challenges regarding AI chatbot use that need urgent attention. Future research should focus on developing guidelines and formal training surrounding appropriate AI chatbot use in scientific research and facilitate a greater understanding of these tools. Furthermore, a code of ethics concerning the use of AI tools in academia and research is needed,<sup>10,11,26</sup> considering the impact that improper use might have on researchers, institutions, education, and the publishing industry, and the potential benefits that appropriate use can offer towards the dissemination of knowledge. Future studies should survey non-corresponding authors to ensure a more diverse set of opinions and perspectives. Furthermore, the current limitations and errors in AI chatbot models also need to be addressed by AI developers.

Because cross-sectional surveys observe a population at one point in time, they are quick and inexpensive to conduct. An additional strength of our study is that names and email addresses of corresponding authors were retrieved from March 1 to April 7, 2023, to minimise bounce-back or inactive emails.

Our study has several limitations. Non-English speaking researchers are largely excluded from the sample due to our own language and resource limitations. Additionally, respondents with partial fluency in English might have faced challenges in completing the survey, possibly limiting their ability to fully share their attitudes and opinions, and the perspectives of those without English fluency were likely entirely excluded; thus, our findings might not be applicable to those who primarily publish research in languages other than English. Another limitation is that the raw response rate of our survey will be underestimated as we did not account for bounce-back or inactive email accounts and autoreplies or verify how many of the 61 560 authors who identified as a medical researcher were actually medical researchers. Although we aimed to assess a large sample

of researchers from different disciplines, many invitees expressed that they could not participate as they had never used AI chatbots previously. In such instances, one of the authors (JYN) encouraged these researchers to still take the survey. Despite our best efforts to encourage all invitees, the generalisability of our findings might be affected as those with strong opinions for or against the use of AI chatbots were more likely to respond to our survey; thus, those with little experience or those who are unsure about the use of AI chatbots might be under-represented in our survey. Although the low response rate from this pool affects generalisability, the total number of participants still represents a large sample size. Most survey responses were from individuals in high-income countries, which might skew the findings and limit generalisability of our results to researchers in low-income countries, where the adoption and usage of AI chatbots might substantially differ. Another limitation is that AI chatbot use in research can only be observed at one point in time, therefore, our results provide a snapshot of researchers' perspectives at an early stage of AI chatbot use. Inherent to the cross-sectional survey design, our study is also susceptible to recall and non-response bias.

In conclusion, our study offers valuable insights into the perceptions and use of AI chatbots among researchers in scientific settings. Although a substantial proportion of respondents showed familiarity and had incorporated AI chatbots into their research processes, our findings underscore pronounced challenges, including the absence of formal training opportunities and institutional policies governing AI chatbot use. Despite the perceived benefits of AI chatbots in alleviating workload and administrative burdens, concerns persist regarding the transparency and decision making processes underlying these technologies. Our study highlights the pressing need for enhanced support structures and educational initiatives to facilitate the effective integration of AI chatbots into scientific workflows. By addressing these gaps, researchers and institutions can harness the full potential of AI chatbots to advance scholarly endeavours and drive innovation in scientific research.

#### Contributors

JYN designed and conceptualised the study. JYN and SGM co-drafted the manuscript. AL and NS analysed the data. JYN, SGM, AL, and NS have accessed and verified all the data in the study. CL, AI, RBH, and DM assisted with the study design and analysis of data. AL, NS, CL, AI, RBH, and DM made critical revisions to the manuscript. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

#### Declaration of interests

We declare no competing interests.

#### Data sharing

All data and materials associated with this study have been made publicly available to download on the Open Science Framework.

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For the study data see <https://osf.io/a25y8q/>

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