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EDITORIAL

Visualizing medicine: The case for implementing graphical abstracts in clinical reporting

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Abstract

Graphical abstracts (GAs) are emerging as a pivotal tool in medical literature, enhancing the dissemination and comprehension of complex clinical data through visual summaries. This editorial highlights the significant advantages of GAs, including improved clarity, increased reader engagement, and enhanced visibility of research findings. By transforming intricate scientific data into accessible visual formats, these abstracts facilitate quick and effective knowledge transfer, crucial in clinical decision-making and patient care. However, challenges such as potential data misrepresentation due to oversimplification, the skill gap in graphic design among researchers, and the lack of standardized creation guidelines pose barriers to their widespread adoption. Additionally, while software such as Adobe Illustrator, BioRender, and Canva are commonly employed to create these visuals, not all researchers may be proficient in their use. To address these issues, we recommend that academic journals establish clear guidelines and provide necessary design training to researchers. This proactive approach will ensure the creation of high-quality GAs, promote their standardization, and expand their use in clinical reporting, ultimately benefiting the medical community and improving healthcare outcomes.

Key Words: Graphical abstracts; Clinical data dissemination; Visual communication; Research impact; Academic publishing

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Core Tip: Graphical abstracts significantly enhance the clarity and dissemination of complex clinical data in medical literature, offering both improved comprehension and increased reader engagement. Addressing challenges like data oversimplification and skill gaps in graphic design is crucial for their effective implementation and standardization.

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INTRODUCTION

Graphical abstracts (GAs) are increasingly recognized as a novel approach in medical literature, particularly for distilling and presenting complex clinical data and research in a visually compelling format[1,2]. These visual summaries distill essential points, making critical information immediately clear and more accessible to readers. This approach is particularly beneficial in clinical reporting, where the precision and speed of information delivery are crucial for sound decision-making and patient care[3-5]. The importance of visual tools in clinical communication is well-established.

GAs have gained significant popularity in the past two decades, emerging as a critical tool to enhance the accessibility and dissemination of scientific research[6,7]. They were initially more common in chemistry and biomedical journals but have now spread across multiple fields of science. The concept of GAs began taking off in the early 2000s, notably as more journals began to emphasize visual content to attract broader readerships, including those in social media. Chemistry journals, such as *Chemistry: A European Journal* and *Angewandte Chemie*, were among the first to adopt this format as early as the late 1990s[8]. Over time, GAs spread to other disciplines, including medicine, biology, and even social sciences[9]. GAs are especially prominent in fields that involve complex data or highly visual subject matter, such as chemistry, biology, medicine, and engineering[8,9]. Biomedical journals like *The Lancet* and *Journal of the American Chemical Society* use GAs extensively to make intricate research findings more accessible to non-experts[8]. Clinical research has also adopted a variant called the visual abstract, which presents study results in a table-like format[9].

Several leading journals have set clear policies regarding GAs. For example, Elsevier and Springer Nature journals often provide guidelines or mandates for GAs during submission. Journals like *PLoS One*, *Cell*, and *The Journal of Visualized Experiments* (*JoVE*) strongly encourage or require authors to submit GAs along with their manuscripts[9]. In contrast, some journals like *Nature* do not require GAs at submission but allow or encourage authors to add them at the acceptance stage[9,10]. Many journals see GAs as a valuable tool for promoting articles, particularly through social media and conferences[9]. The continued push towards visual media, accelerated by social media platforms, has made GA an essential part of modern research dissemination. They serve as an entry point for broader audiences, enhancing the visibility of articles and potentially boosting citation metrics[11]. Each journal has its unique specifications, so it is essential to consult journal-specific guidelines on aspects like file format, size, and resolution. GAs are now integral for researchers seeking to engage audiences beyond their immediate field[12,13].

Studies demonstrate that GAs significantly enhance comprehension and knowledge retention among readers. For instance, research has shown that visual summaries, particularly when shared on social media, increase engagement and dissemination metrics, such as Altmetric scores, which are key indicators of article visibility[10]. Moreover, studies in *Translational Behavioral Medicine* confirm that articles with GAs receive higher interaction rates compared to traditional text or figure-based formats, widening their reach and appeal[10]. These abstracts allow researchers to convey detailed scientific information in simplified, accessible ways, making them valuable for both specialists and broader audiences. GAs can help bridge language barriers, particularly in global healthcare settings. Visual representations condense complex research into universally understandable formats, enabling non-native English speakers to engage more effectively with scientific content[10,14].

This editorial strongly advocates for the widespread adoption of GAs in clinical reporting across disciplines. The objective is to enhance the speed and effectiveness of knowledge dissemination in medicine, ensuring that research findings become more accessible and have a greater impact on clinical practice. Encouraging the use of GAs will cultivate a more informed and engaged medical community, thereby improving patient outcomes and driving healthcare innovation.

ADVANTAGES OF GAs

GAs are valuable tools for enhancing the comprehension of complex clinical data, offering a visual means to distill intricate research findings. For instance, in a study focused on randomized controlled trial outcomes in medical research, GAs improved reader comprehension by 35% compared to traditional text abstracts[15]. This clarity is crucial in clinical environments where the rapid understanding of data directly impacts patient care. In addition, the format allows readers

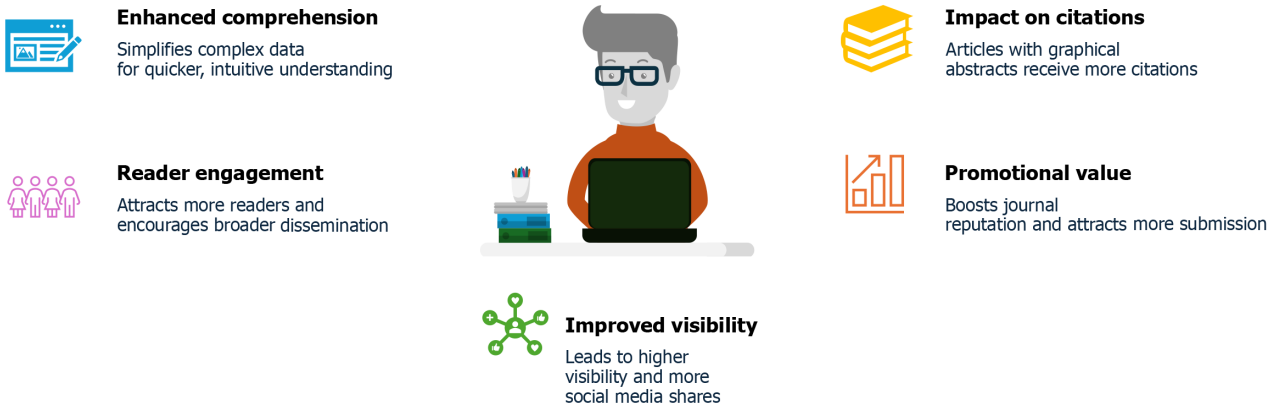


Figure 1 Benefits of graphical abstracts.

to extract key findings more quickly and effectively than from text alone, as demonstrated in several studies[8]. GAs also increase article visibility and engagement. Research in journals such as *Gastroenterology* has shown that articles featuring GAs not only attract more social media attention but also significantly increase citations. A study found that articles with GAs received 40% more citations and higher social media dissemination than those without[16]. While citations are an important measure of research impact, GAs also encourage interdisciplinary collaboration by making research accessible to a broader audience[15], which is particularly relevant in fields like clinical research where collaboration is essential [17–21]. Figure 1 illustrates the benefits of GAs, including improved citation rates, engagement, and broader interdisciplinary reach.

However, while GAs offer numerous advantages, they also present challenges. Creating a high-quality GA requires time, specialized skills, and resources[22–24]. Many researchers, particularly those working in more qualitative fields, may struggle with visually representing their data. Poorly designed Gas cluttered with excessive information or poorly labeled elements can mislead readers, reducing rather than enhancing clarity[17]. Moreover, there is limited standardization in GA design, meaning some journals may present overly simplistic or inconsistent visuals[16]. Figure 2 outlines best practices in GA design, emphasizing simplicity, relevance, and clarity to ensure effective communication of complex data.

DESIGN PRINCIPLES

The success of a GA depends largely on its clarity and simplicity. For example, in a study of oncology outcomes, a GA using a basic bar chart helped readers quickly understand the efficacy of various therapies[15]. A well-designed GA uses clean lines, minimal text, and a limited color palette to focus attention on the most critical data points[16]. Logical flow through the use of arrows or image sequences ensures that the audience can easily navigate the information[24,25]. Simplicity is vital to ensure that the visual enhances comprehension without overwhelming the reader.

Relevance is another key consideration. Each element of the GA must directly correspond to the research's main conclusions. Selecting appropriate visual representations, such as charts for quantitative data or flow diagrams for clinical processes, ensures that the GA reflects the study's key findings without omitting critical details[26,27]. Studies have shown that visually organized information is more likely to be retained and accurately interpreted by readers[15,17].

In the process of creating effective GAs, it is crucial to prioritize fundamental design principles that enhance clarity, readability, and visual appeal[8]. Rather than focusing predominantly on specific software tools, researchers should consider key elements such as data visualization best practices, color theory, and typography guidelines to create scientifically accurate and aesthetically engaging visuals. Data visualization best practices involve selecting the most appropriate type of graphic to effectively represent the data[28]. For example, bar charts may be suited for categorical comparisons, while scatter plots are more effective for illustrating correlations between variables. Clear labeling, appropriate scaling, and the elimination of unnecessary visual clutter are essential to ensure that the data are accurately conveyed without overwhelming the audience. Color theory plays a significant role in ensuring that visuals are accessible and comprehensible. Researchers should consider using color schemes that accommodate individuals with color vision deficiencies, such as colorblind-safe palettes, while maintaining sufficient contrast to highlight key findings. Furthermore, colors should be used intentionally to direct attention and differentiate between different elements in the design. Typography is another critical aspect, as the readability of the text significantly impacts how well the information is communicated. Researchers should prioritize legible fonts, maintain consistent font sizes, and use typographic hierarchy to emphasize key points without overcrowding the design with excessive text.

In terms of tools, while specific software packages like Adobe Illustrator, Canva, and BioRender are widely used and offer advanced features, the choice of software should align with the needs and expertise of the researcher. Instead of prescribing particular platforms, researchers should look for software that offers essential features, such as vector graphic capabilities for scalability, pre-designed templates for ease of use, and an intuitive interface that does not require advanced graphic design skills. Features such as drag-and-drop functionality, customizable icons, and export options for



Figure 2 Best practices for graphical abstracts design, emphasizing simplicity and logical flow.

high-resolution images are also beneficial for creating polished and professional visuals. For researchers who may not have advanced graphic design skills, there are more accessible solutions beyond individual tools. Detailed comparison of commonly available software is provided in Table 1. Collaboration with professional graphic designers can ensure that visuals meet high standards of design while allowing researchers to focus on content. Moreover, many academic institutions and journals now offer in-house design support or provide access to ready-made templates tailored for scientific content. These resources can be especially useful for researchers who want to ensure consistency with the journal's guidelines for GAs. Additionally, automatic design tools that leverage artificial intelligence and machine learning are emerging, allowing users to quickly generate visuals without in-depth design knowledge. These tools can suggest layouts, color schemes, and design elements based on the content input, making them valuable for researchers looking for efficient, high-quality solutions. Ultimately, by focusing on design principles and leveraging the right tools and resources, researchers can create GAs that are not only visually compelling but also scientifically accurate and accessible to a broad audience. This approach ensures that the visual elements support the communication of complex ideas in a clear, engaging, and effective manner[29].

CHALLENGES AND CONSIDERATIONS

GAs, while effective in simplifying and visually conveying complex medical information, face several significant challenges that must be addressed to ensure accuracy and reliability. One key concern is the risk of oversimplification, where essential elements like statistical variability or methodological intricacies are lost when transforming detailed findings into a visual form. For example, focusing solely on average outcomes without showing variability can give readers a false impression of the data's robustness. Similarly, omitting methodological nuances, such as sample size calculations or control variables, can lead to misinterpretations, distorting the study's validity and implications. It is essential to find the right balance between clarity and depth to avoid misleading conclusions while maintaining the integrity of the research[2]. Another challenge is the skill gap in graphic design. Many researchers lack the necessary skills to create effective and aesthetically coherent GAs, which require knowledge of visual hierarchy, color theory, and data visualization principles. Poorly designed abstracts, including inconsistent use of fonts, improper color schemes, or unclear visual cues, can fail to convey the intended message, reducing the impact of the research. Providing researchers

Table 1 Comparison of graphical abstract creation tools

Software	Free version	Paid pricing	Ease of use	Scientific focus	Key strengths	Key limitations
Canva	Yes	$12.99/month (Pro)	Very easy	No	Large template library, beginner-friendly	Lacks scientific icons, watermark on free plan
BioRender	Yes	$9/month (Academic Basic), $35/month (premium)	Easy	Yes	Extensive scientific icon library, designed for life sciences	Watermark in free version, limited export
Inkscape	Yes	Free	Moderate	No	Powerful vector design tool, open-source	Steeper learning curve, no scientific templates
Adobe Illustrator	No	$20.99/month (Academic)	Difficult	No	Professional-quality designs, unmatched customization	Expensive, requires design experience
Microsoft PowerPoint	No	Part of Office 365 ($69.99/year)	Very easy	No	Widely used, familiar interface	Limited graphic design capabilities
Mind the Graph	Yes	Starts at $5/month	Easy	Yes	Affordable, designed for researchers	Limited icon library compared to BioRender
GIMP	Yes	Free	Difficult	No	Free, full-featured image editor	More suited for image editing than vector-based abstracts
Smart Servier Medical Art	Yes	Free	Very easy	Yes	Free, high-quality medical and biological illustrations	Limited customization options

with training in basic design principles, along with hands-on experience with tools like Adobe Illustrator, BioRender, or PowerPoint, can help bridge this gap. These training programs can take the form of short online tutorials, intensive workshops, or design modules integrated into research curricula.

The absence of standardized guidelines across journals is a critical issue. While traditional abstracts follow clear editorial standards, GAs remain inconsistent in both format and content, making peer review more difficult and can lead to discrepancies in interpretation. This inconsistency can also hinder the reproducibility of research, as key information may be underrepresented or omitted in a visual format. Standardized guidelines, developed with input from both researchers and graphic designers, could resolve this problem by ensuring clarity, uniformity, and consistency across journals. Such standards should cover essential elements like the balance between imagery and text, acceptable design formats for different types of research, and guidance on including crucial methodological details[5]. To address these challenges, both the scientific community and publishers must collaborate. Journals should take the lead by establishing clear, actionable guidelines for GAs that cover all aspects of design, content, and data representation. Additionally, researchers should be offered opportunities to build essential graphic design skills through accessible training programs. These combined efforts would improve the quality, effectiveness, and standardization of GAs across scientific publications[8,17].

By addressing the key challenges outlined in Table 2, such as oversimplification, the design skills gap, the absence of guidelines, and time constraints, through targeted solutions, the scientific community can enhance both the quality and impact of GAs.

CASE EXAMPLES

GAs have demonstrated significant effectiveness in enhancing reader engagement and comprehension in clinical and scientific literature. Two notable examples illustrate this impact.

Gastroenterology

A study on the use of visual abstracts in *Gastroenterology* reported that these graphical summaries helped in distilling complex data into more digestible, visual snippets that were easier for both clinicians and patients to understand. The before-and-after impact was notable in that articles with visual abstracts received more views and social media engagement compared to those without, suggesting that visual abstracts could significantly amplify the reach and accessibility of complex medical information[30].

Suicide prevention research

In another example, the use of visual abstracts was evaluated in the dissemination of research findings in suicide prevention. A study conducted by the Rocky Mountain MIRECC used visual abstracts to disseminate findings on veterans' mental health and suicide prevention. It was found that this strategy significantly improved the reach and engagement of their publications, reaching a broader audience that included medical professionals, the general public and stakeholders in public health. This approach demonstrated the potential of GAs to effectively convey urgent and complex information across diverse audiences[31].

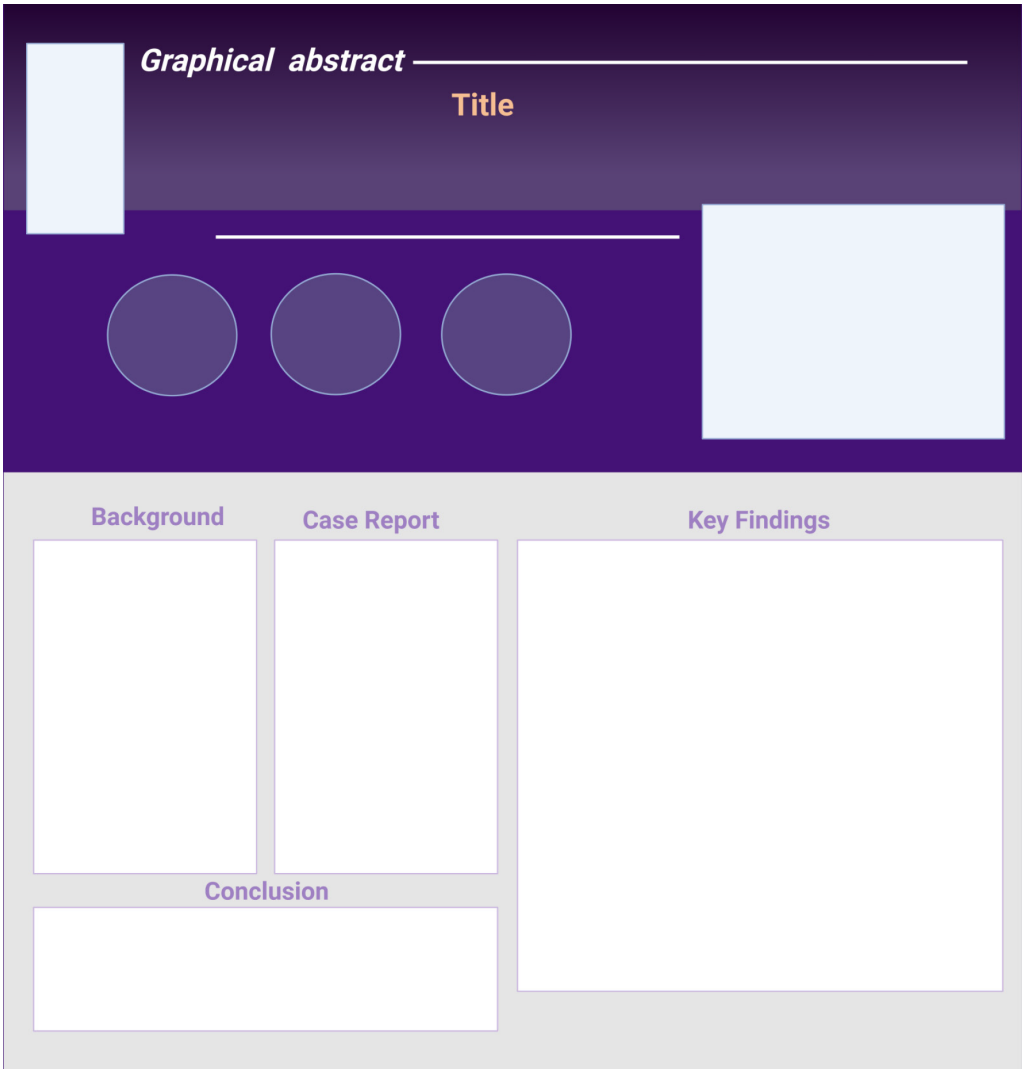


Figure 3 Template for creating graphical abstract for case reports.

These cases highlight the utility of GAs in both enhancing the accessibility of scientific findings and engaging a wider audience, thereby bridging the gap between complex research data and practical application. A template for creating GAs for a case report is given in Figure 3.

CONCLUSIONS

GAs have the potential to revolutionize medical literature by making complex clinical data more accessible and understandable. These visual summaries help both medical professionals and the public quickly grasp key information, leading to better decision-making and patient care. Studies show that GAs boost reader engagement, visibility, and citation rates, enhancing the impact of research publications. However, challenges such as the risk of oversimplification, researchers' lack of graphic design skills, and the absence of standardized guidelines must be addressed. To fully leverage GAs, journals should establish clear creation guidelines and offer training resources for researchers. This will ensure high-quality, standardized outputs, fostering a more informed medical community and improving healthcare outcomes through better communication and understanding of research findings.

Table 2 Challenges and recommendations for graphical abstracts

Challenge	Description	Consequences	Recommendation
Risk of oversimplification	Simplifying complex data may omit important details, such as variability and methodological context	Leads to misinterpretation or misconceptions about the research findings	Balance clarity and completeness; ensure crucial points like statistical variability are included
Skill gap in graphic design	Researchers often lack necessary skills in visual hierarchy, data representation, and design software	Poorly designed abstracts diminish the clarity and impact of the research	Provide targeted training in design software (*e.g.*, Adobe Illustrator, BioRender) and basic design principles through online courses or workshops
Lack of standardized guidelines	No universal standards for GAs exist, leading to inconsistencies in format and content across journals	Inconsistent formatting complicates peer review and interpretation, affecting reproducibility	Develop universal guidelines with input from researchers and designers, covering balance of text and imagery, and necessary methodological details
Complexity of visual data representation	Visualizing certain data types (*e.g.*, statistical results, methodological details) can be difficult without loss of context	Inappropriate visual choices may obscure key findings, confusing readers	Provide journals with examples of best practices for different types of data and create discipline-specific templates for GAs
Time and resource constraints	Creating high-quality GAs can be time-consuming and may require resources not available to all researchers	Researchers might rush through or avoid creating GAs, reducing their potential benefits	Journals could offer simplified design tools and templates, while institutions provide resources or personnel trained in graphic design to assist researchers
Subjectivity in visual design	Lack of clear guidelines can lead to subjective design choices that are inconsistent between researchers or disciplines	Reduces clarity and uniformity, complicating interpretation across publications	Journals should include specific visual design elements (font types, color palettes) in their guidelines to ensure uniformity

GA: Graphical abstract.

FOOTNOTES

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