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Author Contributions
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Data curation: Traboco L, Pandian H. Formal
analysis: Traboco L, Pandian H. Investigation:
Traboco L, Gupta L. Methodology: Traboco

Designing Infographics: Visual Representations for Enhancing Education, Communication, and Scientific Research

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ABSTRACT

Infographics are graphic visual representations of educational content, used to deliver complex information, disseminate scientific research, and drive behavioral change. Herein, we review some of the factors pertinent to designing infographics and the potential for automation in the future. To guide high-impact design, it is vital to clearly define the objectives of the infographic and its target audience. Designing an effective infographic necessitates careful consideration of the layout, colors, font, and context. More recently, technical support to develop infographics are increasingly available through online software (Canva, Adobe, and Venngage) and emerging artificial intelligence programs. References can also become a visual representation of trends in scientific discovery. It is crucial for clinicians, researchers and scientists to have the knowledge and skills to design compelling infographics. In the era of social media, the uptake and effects of infographics for disseminating scientific research and public health education need to be further studied to understand their full potential.

Keywords: Infographics; Social Media; Research; Design; Technology

INTRODUCTION

Conveying information via written text or numbers alone can be uninteresting, arduous, and have little to no impact. However, combining these with visual aids, such as images or figures, in a well-curated, aesthetically appealing format allows a message to be expressed compellingly, with greater comprehensibility. This is called an information graphic or infographic, a device to present complex informational content in a powerful visual format which supports optimal cognitive processing, learning, retention, future recollection, and subsequently drives behavioral change. Infographics have emerged as a popular digital tool to share dense or abstract messages to diverse audiences in an efficient, precise, and influential manner. Visual abstracts are a form of infographic—an image summary of research, which lend themselves to ease of dissemination, usually through social media.[1,2]

Due to their immense potential, it is crucial for researchers, clinicians and scientists to have a firm grasp on designing infographics for instructional and educational purposes, evaluate their effectiveness, and be aware of common pitfalls to avoid. In this opinion piece, we explore some of the factors that need to be considered in designing high-impact infographics to disseminate scientific educational content, and the potential role of automation in the future.

IDENTIFYING THE INFOGRAPHIC'S OBJECTIVES

Infographics can serve many different objectives. Firstly, they can provide an eagle-eye view of the latest research, show insights and emerging discussions, and improve clinical practice.[3,4] In the era of social media, disseminating such information via an infographic on these channels may achieve more traction and engagement than journal sites. Furthermore, clinical trials have explored infographics and social media image campaigns for patient recruitment for clinical trials. Researchers could tailor their message to target specific patient groups, improving the diversity of their clinical trial participants.[4-6]

As a teaching tool, infographics enhance engagement, memory retention, recall, comprehension, and development of communication skills.[7,8] In the current climate of the coronavirus pandemic, infographics have been increasingly employed for patient education. For example, infographics were used to promote the goal of "flattening the curve" by encouraging hygienic practices such as handwashing and appropriate mask-wearing and providing information on local public health guidelines.[9-11] These have also been used to demonstrate the pathology of coronavirus and the immune response to infection.[10,12] Infographics can help improve health literacy by combatting misinformation and encouraging patients to verify false news.[13,14] For public health purposes, infographics should be tailored according to the target audience's current health literacy and preferred language.[15,16]

## COMMUNICATING SCIENCE THROUGH ART

Communication is central to Medicine, but challenges exist in conveying scientific information via non-traditional, artistic means. Firstly, images must be chosen wisely as they can affect emotion and comprehensibility. Those that are too abstract or unfamiliar will not facilitate affinity with the selected audience. Images that some may find disturbing or inappropriate,[17] such as photos of traumatic injury or intraoperative cases, must be avoided. Care must also be taken when using images due to copyright. Many online photos are free or under the public domain as a Creative Commons license,[18] which helps creators to maintain copyright but allows non-commercial use of their artwork. Static infographic images can be fortified with animations or even interactive content, and visual abstracts can be converted to video abstracts (**Fig. 1**).[19,20]

While online palette databases exist, Stones and Gent[21] do not recommend arbitrary selection of colors. Colors can convey subliminal messaging, such as red for emergency, urgency, or denoting an adverse outcome. Colors also affect the legibility of the accompanying text or font. As reading behavior is affected by alignment, colors, and dominant elements of the infographic, key messages should be clear, coherent, and bold (**Fig. 2**).

Where designing infographics that are creative, effective, and aesthetic presents a challenge; Khoury et al.[22] suggest establishing a partnership with graphic designers. Collaboration with
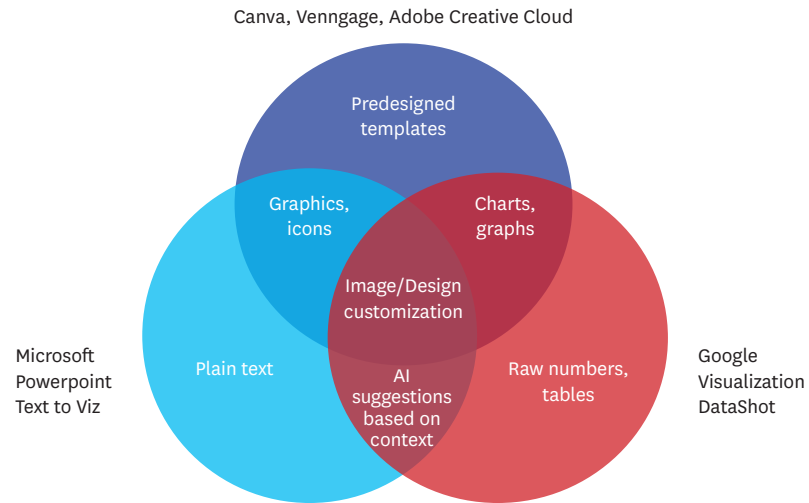
Fig. 1. Summary of design platforms and tools for infographics.
AI = artificial Intelligence.
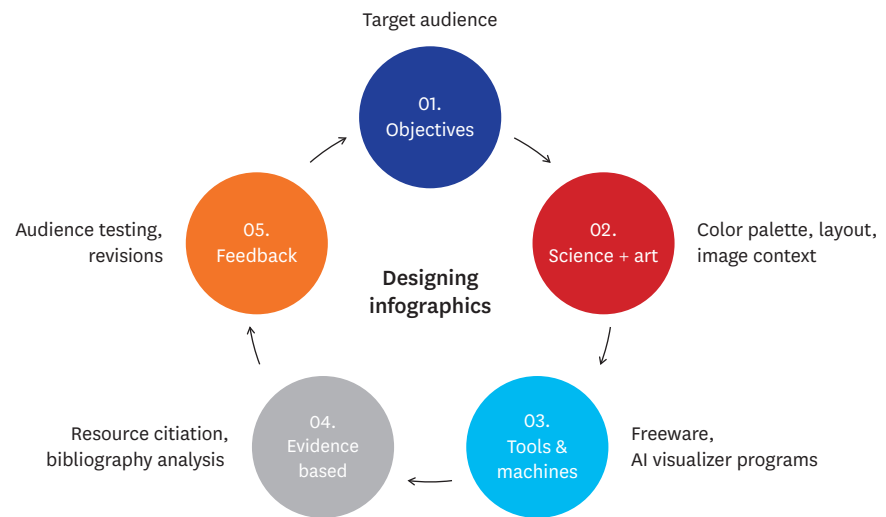
Fig. 2. Example of an infographic using Canva template emphasizing the key points of the manuscript.

expert graphic designers can lead to the development of a high-quality infographic, which can capture the attention of a lay audience. However, it is important to consider the time commitment and additional funding required to obtain the support of a graphic designer. With growing clinicians' and scientists' workloads and times of austerity, this may be challenging to facilitate.

HARNESSING MAN AND MACHINE

There are numerous tools for anyone to start creating infographics. Canva (www.canva.com/features/), for example, is one online tool for design and publishing which offers a free trial and more advanced creative services at a fee.[23] It has a range of templates and a database of images and illustrations, text font, audio, and videos. Copyrighted elements can be ethically unlocked with a paid subscription. Platforms also allow users to form teams, share design

access and create infographics simultaneously. The final product can be synchronized with social media accounts and published afterward. Venngage (www.venngage.com/features) and Adobe Creative Cloud (www.adobe.com/express/features) are other examples of online platforms with similar features to create infographics.[24,25] Many of these sites also provide educational courses on improving the quality of infographics to promote engagement.

However, despite the availability of such platforms, a less technologically proficient user can find these challenging to utilize. With this in mind, artificial Intelligence (AI) has been gaining popularity, wherein a computer is trained to recognize elements of previous infographics, and subsequently create new ones by integrating these. AI can be seen in Microsoft Powerpoint's Design Ideas features: it can suggest icon images and layouts based on the words inputted to the slide.[26] In the Text-to-Viz program by Cui et al.,[27] they use natural language processing by analyzing word definitions and context, subsequently converting them into graphic suggestions. For example, where texts refer to being environmentally friendly, green or blue colors are suggested. Key facts can be given emphasis by using a highlight, increased size, or bold font. For raw data tables and statistics, Google Visualization Features[28] can convert spreadsheets into various chart types for users to select from. DataShot[29] is another system that assigns table elements a score of importance (e.g., context, significance), and then proposes layouts depending on the score.

KEEPING INFOGRAPHICS EVIDENCE-BASED

An infographic is not complete without references, as these add validity and credibility for both a lay and medical audience. In Saudi Arabia, Jahan et al.[30] assessed 297 infographics on chronic health conditions for patients created by healthcare institutions, and none had references. References provide clinicians with the option to acquire more detailed information, before making changes to clinical practice.[31] In the future, the credibility of infographics could be improved further by compiling them into a searchable platform that can be vetted by physicians and researchers.[32,33]

Infographics can also be a reference for bibliography analytics. With the growing numbers of articles published daily, it is becoming progressively more challenging to keep up with the output. Research papers can be compared and arranged in a visual network following their citation, contradicting, and supporting concepts.[34] Such aids are a feature of Connected Papers (connectedpapers.com) and in software coding tools such as VosViewer (www.vosviewer.com).[35,36] Open Knowledge Map (openknowledgemaps.org) is another bibliography visualization tool that provides image clusters of similar papers.[37]

FACILITATING FEEDBACK

An infographic can be 'tested' on a small group of people for initial feedback and evaluation. Dependent on the target audience, infographics could be shared more broadly through social media.[38,39] Subsequent feedback can be collated and incorporated within future iterations of the infographic. Where new information comes to light surrounding the topic, the infographic may need revision and modification. It is essential to assess and review the target audience's response and interaction with the infographic, to facilitate optimal communication and education.[39]

CONCLUSION

Infographics are rapidly gaining popularity as a mode of dissemination of information for science. It is crucial for researchers, scientists, and clinicians to know the principles and impact of design as a form of health communication. Due to the rise of social media, we need to be more discerning regarding the visual material we produce, disseminate and encounter. Infographics can be formulated by members of the research team with support from graphic designers if time and funding allow. Feedback from colleagues and 'test' members of the target audience can be crucial to check comprehensibility. Finally, while technology may afford more accessible means to create elaborate infographics, it is essential to ensure critical messages remain coherent and enriching to the target audience.

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