

Review

# The Role of Visual Abstracts in the Dissemination of Medical Research

Beverley C. Millar<sup>1,2,3</sup> and Michelle Lim<sup>4</sup>

## ABSTRACT

Medical research within the UK has continued to grow, most notably during the COVID-19 pandemic over the last two years, which highlights the importance of disseminating relevant research findings. For all researchers involved in clinical trials and scientific research, the end goal of success is not completed following the publication of the research findings, but ultimately true impact and significance is achieved when such research has a role in developing clinical practice. Each year between 2.5 - 3 million scientific papers are published and the number continues to rise, therefore it is becoming increasingly difficult to ensure that published research has such a targeted impact as it must first get noticed. Increasing time commitments result in difficulties for clinicians keeping up-to-date with the current literature and in order to address this, journals and researchers have developed approaches to share peer-reviewed research with the wider research community in an effective and efficient manner. One such approach has been the introduction of the visual abstract which comprises of an infographic style format, coupled with a shortened, limited word summary of the research abstract detailing the key question, methodology, findings and take home message of the research study. The visual abstract has characteristics which enable it to be shared on social media platforms and in turn increase the interest and impact within the research community. Visual abstracts are being increasingly introduced within medical journals and organisations to help disseminate valuable research findings. This review focuses on visual abstracts, what they are, their history, structure and role within research dissemination and medical education.

## KEY WORDS

dissemination, medical education, science communication, social media, visual abstract

## INTRODUCTION

*“If a tree falls in a forest and no one is around to hear it, does it make a sound?”*

(Henriksen and Mishra, 2019)<sup>1</sup>

The ultimate goal of medical research is to have impact on clinical practice and as reported by the National Institute for Health Research, “*clinically research-active hospitals*

*have better patient care outcomes*”.<sup>2</sup> However, increasing numbers of high quality medical research although published, may never be disseminated, cited or read, other than by the authors, the peer-reviewers and the editor of the accepting journal, thus questioning the significance and value of such research.<sup>1</sup> It is therefore fundamentally important to disseminate research to a wide audience to facilitate and promote the implementation of research findings into clinical practice.<sup>1</sup>

The impact of research, particularly in academia, has traditionally been measured quantitatively in terms of number of publications, the impact factors of journals where the research has been published, the number of citations and the *h*-index.<sup>3</sup> This form of assessment has been viewed by some as outdated and it has been suggested that the validity of the traditional form of assessment has been compromised due to a number of issues, such as, the increased numbers on author lists, the volume of papers published, self-citations, extensive reference lists and papers published in high impact journals by common groups of authors<sup>3</sup>. More recently, due to the advancements in digital technology, additional complementary research evaluation, attention and dissemination metrics have been introduced by institutional repositories and journal websites, such as Altmetric<sup>4</sup> and PlumX Metrics<sup>5</sup>. These metrics aim to provide a more comprehensive indication of the impact of research outputs, within the online environment and complement the traditional bibliometrics.<sup>6</sup> These additional indices reflect digital footprints and provide a more comprehensive overview of the interest that the published research has had in terms of citations including clinical, patent and policy documents, usage, captures, mentions and social media<sup>6</sup>. Currently, however, traditional citation bibliometrics still remain the

<sup>1</sup>School of Medicine, Dentistry and Biomedical Sciences, The Wellcome-Wolfson Institute for Experimental Medicine, Queen’s University, 97 Lisburn Road, Belfast BT9 7BL, Northern Ireland, UK,

<sup>2</sup>School of Biomedical Sciences, Ulster University, Cromore Road, Coleraine, BT52 1SA

<sup>3</sup>Northern Ireland Public Health Laboratory, Belfast City Hospital, Lisburn Road, Belfast, Northern Ireland, BT9 7AD, UK.

<sup>4</sup>James Cook University Hospital, Marton Road, Middlesbrough, TS4 3BW, UK

**Correspondence to:** Professor B. Cherie Millar  
**E-mail:** cherie.millar@qub.ac.uk



most recognised for impact evaluation of peer-reviewed publications and researcher activity within academia.

Irrespective of which bibliometrics are favoured, it is important that for peer-reviewed published research to have educational or clinical impact such research must be first noticed and subsequently read by the appropriate and varied target communities within research, education, government as well as healthcare policy makers and discipline specific groups providing guidelines.

*“What information consumes is rather obvious: it consumes the attention of its consumers. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.” (Simon, 1971)<sup>7</sup>*

The concept of attention and various aspects of attention have been discussed and researched extensively amongst psychologists for centuries<sup>8</sup>, however with the ever increasing demands on individuals' time, attention is currently globally seen as a valuable commodity which is required to be captured. The term “*attention economy*” was originally devised in 1971 by the psychologist, economist and Nobel Laureate, Herbert Alexander Simon, who believed that an abundance of information would result in the consumption of attention<sup>7</sup>. Attention economy is not only important to organisations and business but also to publishers and authors of clinical and scientific research. Investment must be given to design approaches to capture the attention of readers and other researchers to facilitate the communication of research findings to key stakeholders whether that be service users, multidisciplinary healthcare teams or other researchers, by a variety of dissemination approaches to ensure attention and understanding in a resourceful manner<sup>9</sup>.

*It is astonishing with how little reading a doctor can practice medicine, but it is not astonishing how badly he may do it. (Osler, 1904)<sup>10</sup>.*

It is essential that all clinicians, healthcare staff, researchers and students, can adapt and draw upon the current research knowledge to deliver safe, quality evidence based-practice for patient care and successful outcomes<sup>11</sup>. Developments within medicine are constantly and rapidly evolving and it is common practice to consult clinical journals to keep informed of recent research and reflect on such literature, which could impact or change clinical practice. Reviewing and reflecting on current medical literature, not only in relation to specific speciality disciplines, but in general terms, contributes to personal learning and continuing professional development in terms of keeping knowledge skills up-to-date, as well as identifying centres of excellence which could potentially be sources of clinical guidance in the future<sup>11,12</sup>. Importantly, the construction of clinical practice guidelines is built upon a solid evidence-base by systematic review of the published literature.<sup>13</sup> It has been calculated that the growth in publication outputs from scientific research in the field

of Life Sciences has an annual growth rate of 5.07% and a doubling time of 14 years<sup>14</sup>. The time required to navigate through the oceans of articles published each month, filter and subsequently read, result in individuals facing challenges of how to allocate their time to focus on the articles which are significant in terms of their personal interests and those whose findings could impact on their clinical practice. As such, recently a variety of strategies have been documented to keep abreast with such medical literature through journal surveillance, manuscript review, rounds/seminars, amongst other approaches<sup>11</sup>.

*‘With half an hour’s reading in bed every night as a steady practice, the busiest man can get a fair education before the plasma sets in the periganglionic spaces of his grey cortex’ (Osler, 1909)<sup>15</sup>.*

Visual abstracts are a communication approach increasingly being used by authors and journals to stimulate selective attention and disseminate research findings to a broad audience both within and outside the readership of a particular journal in a concise manner and shared via social media.<sup>16</sup> Such image-focused summaries provide clinicians and researchers with a snapshot of current research findings and help guide which articles to select for further in-depth examination, whether for educational or research purposes. Visual abstracts, what they are, their history, role and structure are discussed in this article to complement their introduction within the *Ulster Medical Journal*.

## THE PURPOSE OF VISUAL ABSTRACTS

*“Visualisation lays the foundation of new modes of thought and dissemination of scientific ideas and information” (Ostergren, 2013)<sup>17</sup>*

Visualisation of key research outcomes offers the advantage of using a common language, thereby permitting global dissemination in a format which is accessible and understandable.<sup>17,18</sup> Such visual representations not only improve memorability in comparison to verbal representation but also help to persuade the viewer to examine the research in greater depth by retrieving the article.<sup>17,18</sup> The routine use of visualisation to communicate research findings not only allows scientists to develop competency in relation to visual literacy skills but more importantly, leads to the enhancement of cognition by means of visual thinking.<sup>17,18</sup>

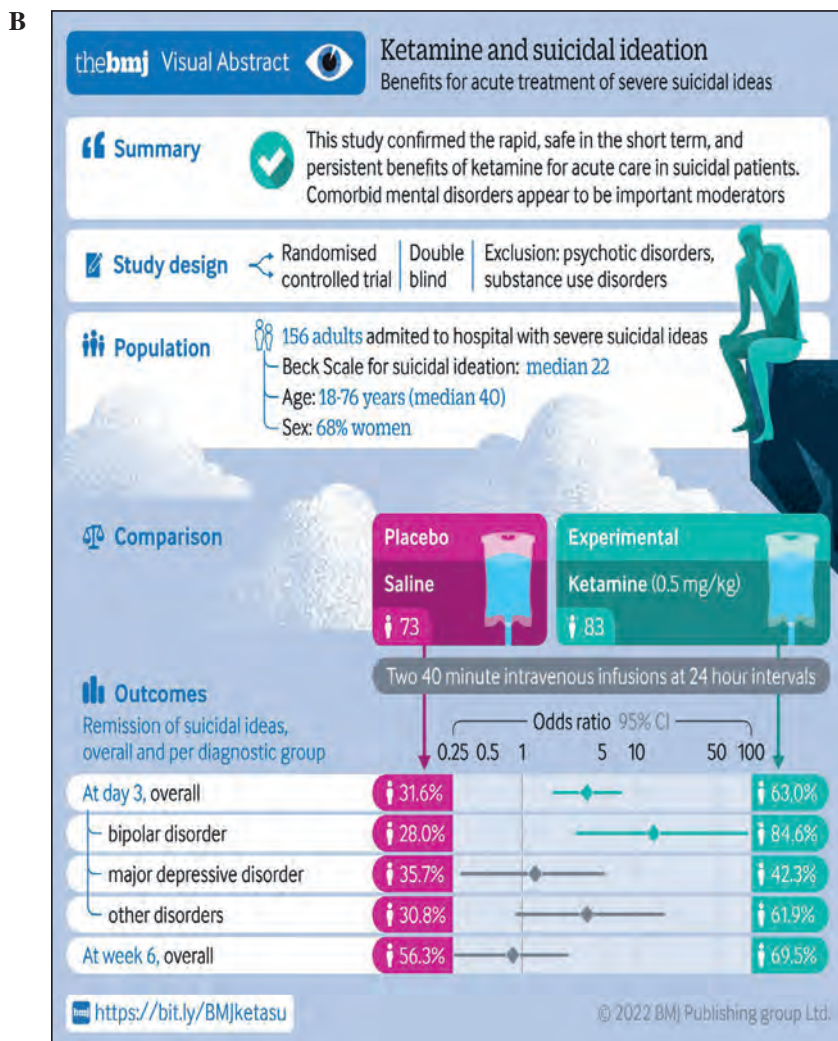
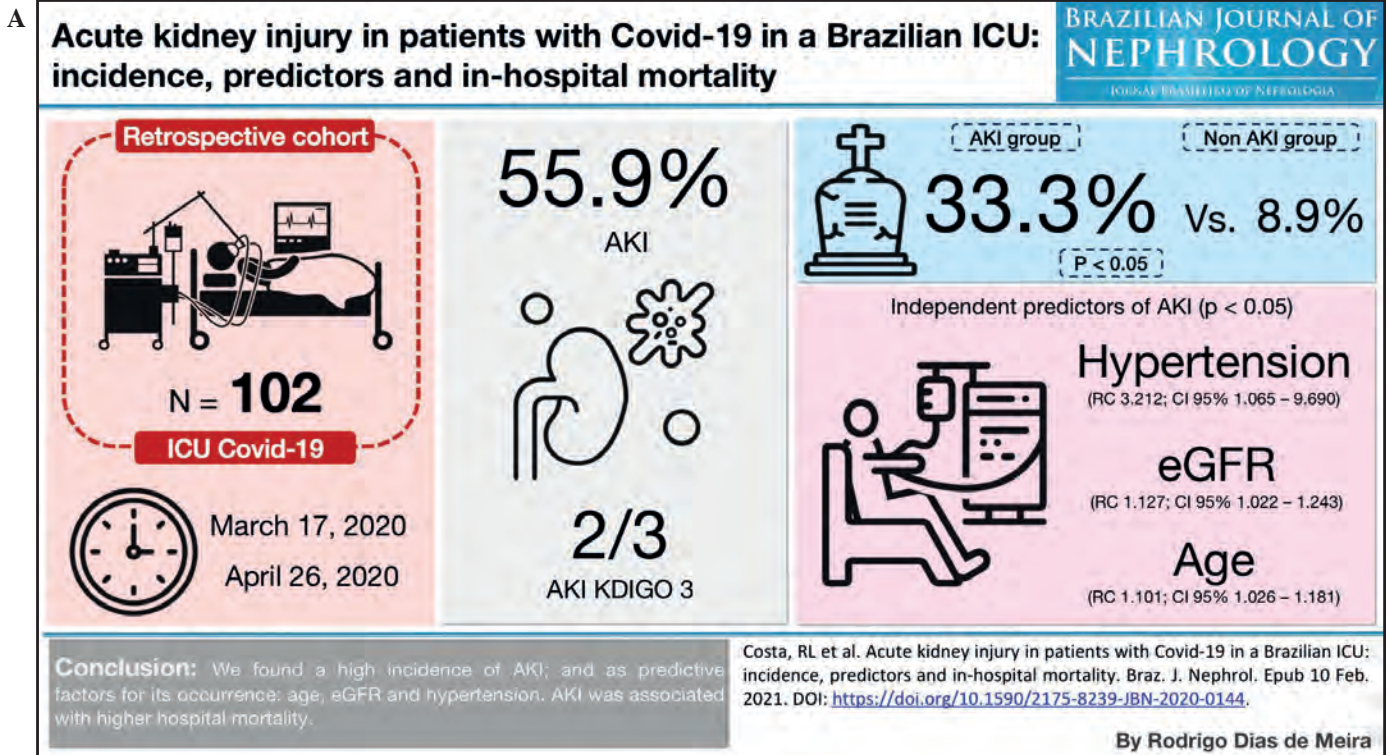
Nearly six years ago, Professor Andrew Ibrahim, Creative Director of *Annals of Surgery*, wished to improve how researchers could disseminate their research findings visually and the result was the introduction and sharing by the journal of the first visual abstract in July 2016 via social media using the hashtag #VisualAbstract.<sup>19</sup> The concept of visual representations of scientific research findings was not novel as many journals since the 1980s have used other visual formats such as central illustrations and graphic summaries to convey such information. Central illustrations and graphic summaries are used to convey the primary message



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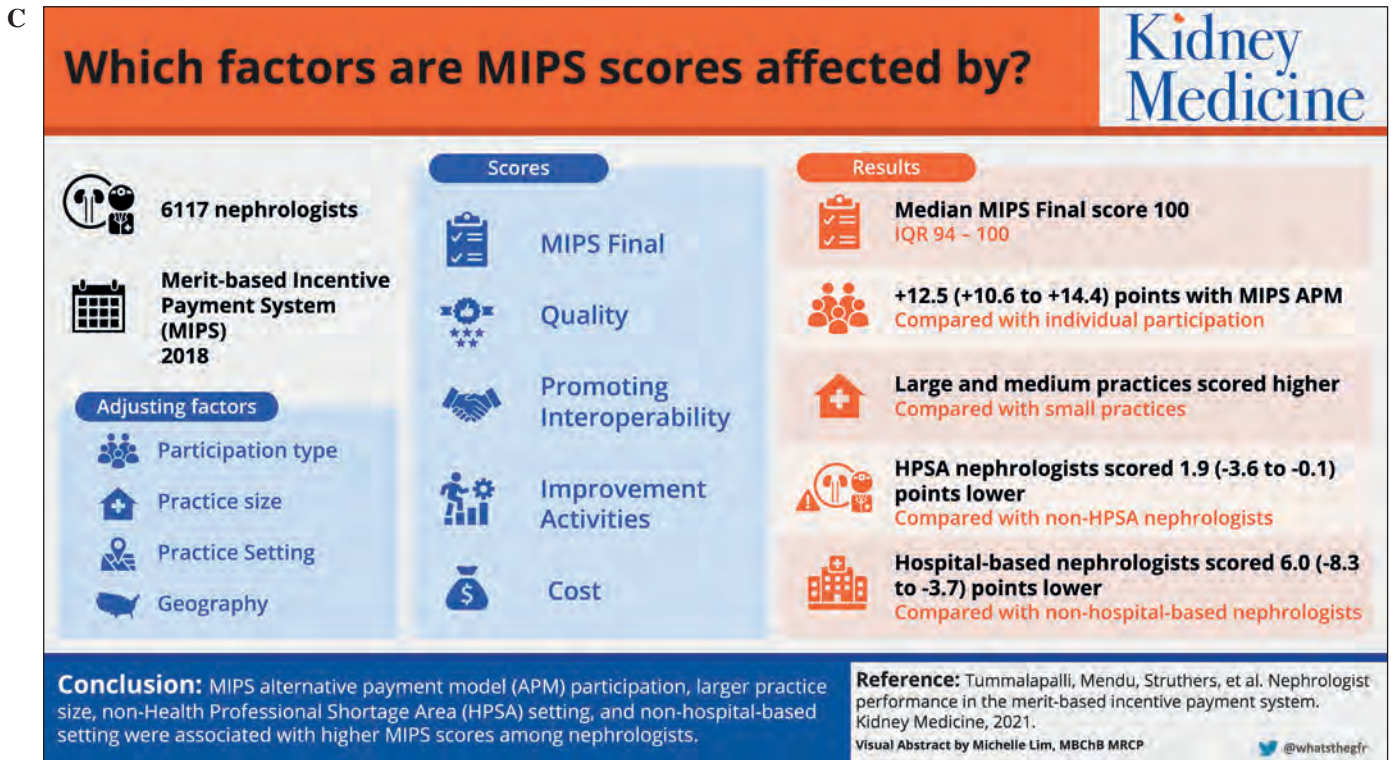


**Figure 1: Examples of visual abstracts used in the peer-reviewed published literature.**

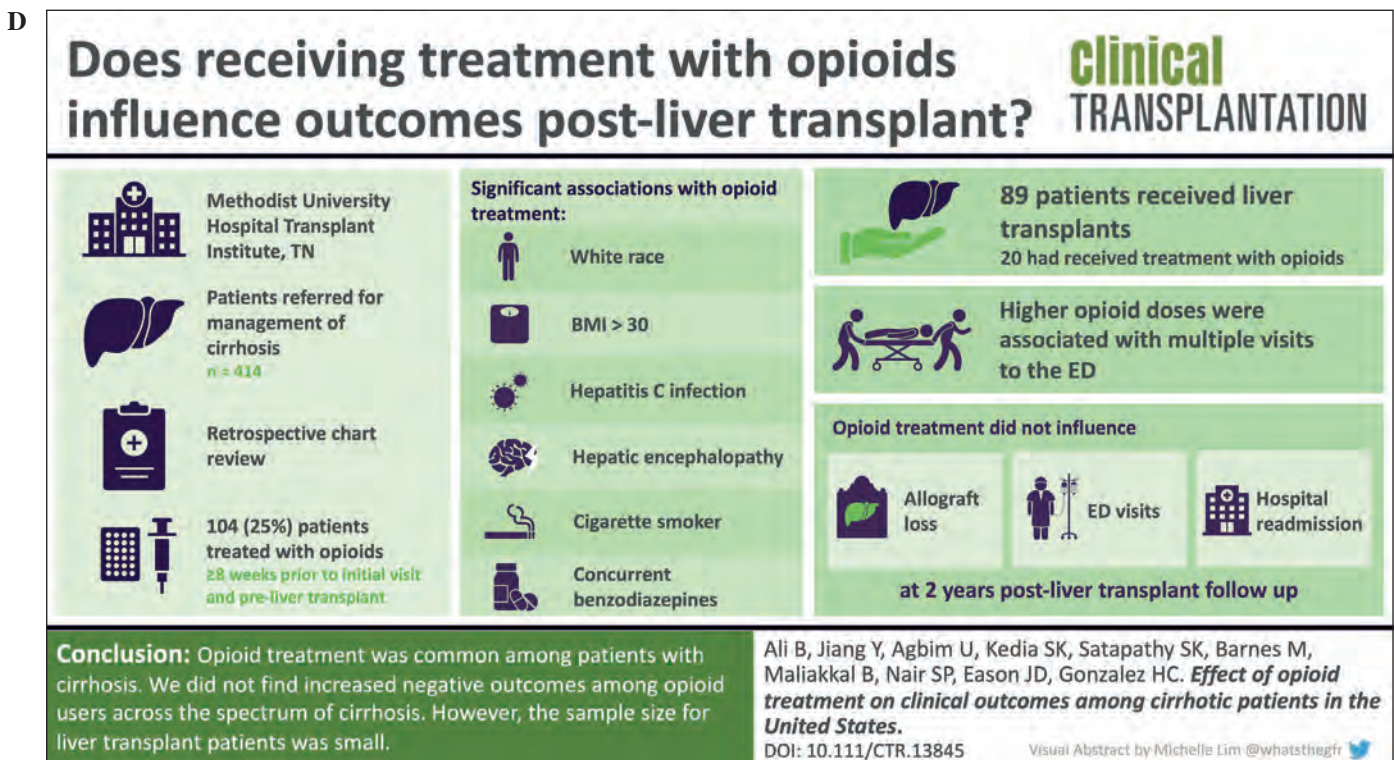
- (A) Taken from Costa RLD, Sória TC, Salles EF, Gerech AV, Corvisier MF, Menezes MAM, et al. Acute kidney injury in patients with Covid-19 in a Brazilian ICU: incidence, predictors and in-hospital mortality. *J Bras Nefrol.* 2022;43(3):349-358, under a Creative Commons Attribution (CC BY) License. (<https://creativecommons.org/licenses/by/4.0/deed.en>).<sup>24</sup>
- (B) Taken from Abbar M, Demattei C, El-Hage W, Llorca PM, Samalin L, Demaricourt P, et al. Ketamine for the acute treatment of severe suicidal ideation: double blind, randomised placebo controlled trial. *BMJ.* 2022 Feb 2;376:e067194, under a Creative Commons Attribution-Non-Commercial (CC BY-NC 4.0) License (<http://creativecommons.org/licenses/by-nc/4.0/>).<sup>25</sup>







(C) Taken from Tummalapalli SL, Mendu ML, Struthers SA, White DL, Bieber SD, Weiner DE, et al. Nephrologist Performance in the Merit-Based Incentive Payment System. *Kidney Med.* 2021;3(5):816-826.e1, under a Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND) License. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).<sup>26</sup>



(D) Visual Abstract used in conjunction with the full article by Ali B, Jiang Y, Agbim U, Kedia SK, Satapathy SK, Barnes M, et al. Effect of opioid treatment on clinical outcomes among cirrhotic patients in the United States. *Clin Transplant.* 2020;34(6):e13845.<sup>27</sup>



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or the most important findings detailed in a paper by means of a single illustration or graphical image. Unlike visual abstracts, they do not contain any details on methodology and generally appear at the end of the paper or at the end of the results section, the beginning of the discussion or as a thumbnail linked to the article.<sup>20</sup> In contrast, a visual abstract is generally presented at the beginning of the article after the scientific abstract. The purpose of the unique layout of the visual abstract is to provide a visual summary of research studies using visual icons in a format where scientific abstract meets infographic. Historically visual abstracts have used single or dual coloured icons and a limited text to convey the main outcomes of studies accompanied with a citation to the full article and credit to the visual abstract constructor.<sup>21</sup> The purposes of the visual abstracts are multi-fold namely to (i) assist readers scan recent research articles to acquire a flavour and comprehension for what is new and current in clinical research, (ii) engage and entice the reader to retrieve and read complete articles, which is fundamentally important prior to changing or influencing decisions relating to clinical practice<sup>19,21</sup>, (iii) promote a deeper engagement and discussion regarding the study findings<sup>21</sup>, (iv) help facilitate the establishment of scientific communities<sup>22</sup>, (v) increase a broader readership and (vi) provide a preview output which lends itself to dissemination particularly via social media. Since 2016, over one hundred medical journals and organisations, initially many nephrology and surgical journals and subsequently other various specialisms, including, but not limited to, the *New England Journal of Medicine*, *The British Medical Journal*, *Stroke*, *Academic Psychiatry*, *Medical Education* and *JAMA Open*, have adopted visual abstract formats, with several journals including *Bone and Joint Research* and the *British Journal of Sports Medicine*, dedicating sections to this aspect.<sup>23</sup> Some examples of the varied visual abstract designs are shown in Figure 1.

## RESOURCES AND SKILLS TO PREPARE A VISUAL ABSTRACT

There is much variation in the style and structure of visual abstracts currently shared on social media and as such, journals have provided guidelines to help standardise these outputs based on current published evidence to ensure



**Figure 3:** Key resources relating to the preparation of visual abstracts

**Figure 2:** The top ten tips for preparing an effective visual abstract

Ten tips for creating an effective visual abstract		
	<b>Content</b> Prioritise the content included in the text abstract as this is what the authors have deemed most important.	<b>1</b>
	<b>The title</b> Frame this as the question the study has set out to answer. This will give your visual abstract a context and focus.	<b>2</b>
	<b>Consider the flow of information</b> Ensure that your readers are clearly oriented and directed to follow the flow of information on your visual abstract.	<b>3</b>
	<b>Font</b> Stick to one font family and do not use decorative fonts. Avoid underlining as this can be mistaken for hyperlinks.	<b>4</b>
	<b>Icons</b> Depict information graphically and avoid copying and pasting graphs and charts from the article which will cause clutter.	<b>5</b>
	<b>Space and alignment</b> Ensure that spacing and alignment are uniform by using inbuilt rulers. Be minimalistic and avoid clutter.	<b>6</b>
	<b>Diversity and inclusivity</b> Use gender-neutral icons where possible and avoid icons that stereotype or have religious or political connotations	<b>7</b>
	<b>Attribution and copyright</b> Include a full reference, Twitter handles (@) and hashtags (#) of the authors and institutions. Attribute icons appropriately.	<b>8</b>
	<b>Feedback</b> Seek feedback from multiple sources (with and without relevant expertise) to ensure clarity and accessibility.	<b>9</b>
	<b>Final checks</b> Run a spellcheck and ensure that your visual abstract is clearly legible on screens of different sizes.	<b>10</b>

consistency and validity of the visual abstracts associated with their journal. There are three main valuable resources which help guide in the construction of a visual abstract and which have been consulted when designing the templates for use in the *Ulster Medical Journal*, namely (i) Visual Abstract Primer (edited by Andrew Ibrahim)<sup>21</sup> which covers topics such as creating a visual abstract and leveraging a visual abstract for dissemination, (ii) Andrew Ibrahim's Guidelines to Standardise Visual Abstracts for Scientific Research<sup>19</sup> and (iii) Michelle Lim's short course on designing and the design process of visual abstracts.<sup>28</sup> The guidance detailed below and in Figure 2 and Figure 3 has been taken from these three resources.

In order to prepare an effective and informative visual abstract, it is not essential to use costly and complicated illustrative software or to possess extensive artistic or graphic design skills. It is important however, to be able to condense information and represent such information logically and coherently into three main sections encompassing the methodology, the main findings and conclusions of the research study. Additional skills which are required include creativity in thought of how to represent these findings using visual icons and the ability to organise information into bite size sections.<sup>28</sup>

## VISUAL ABSTRACT STRUCTURE

PowerPoint is the preferred digital tool to construct visual abstracts and used extensively by numerous journals and as such, the *UMJ* have prepared PowerPoint templates which will be used when visual abstracts accompany clinical papers. All template formats consist of four main areas as detailed below and examples of visual abstracts relating to previous articles published in the *UMJ* are shown alongside their paired scientific abstract, which is the primary source of the most important content prioritised in the visual abstract (Figures 4-6). Details relating to the four areas of the visual abstract are detailed below and general guidelines are provided in Figure 2.

Central to the construction of a visual abstract which is aesthetically pleasing and which contributes to promoting attention and further cognitive pursuit, is to ensure that its individual elements are discernible and there is a clear relationship between these sections with a logical flow.<sup>17,18</sup> Research has suggested several key tips to ensure that there is a minimum pressure on the working memory namely by minimising clutter, avoidance of prolixity and information overload and ensuring that images and text are germane to the key messages which need to be conveyed.<sup>18</sup>

### 4a WRITTEN ABSTRACT

#### Introduction

Prophylactic antibiotics have been shown to reduce the rate of surgical site infection (SSI), however there is little evidence supporting the effectiveness of one antibiotic over another. We have studied SSI rates and antibiotic prophylaxis protocols in Northern Ireland trauma surgery over a 10-year period to identify the most effective antibiotic protocol associated with lowest rate of SSI.

#### Method

Antibiotic prophylaxis protocols from 2004-2014 were sought from each of the region's 4 trauma hospitals and their dates of introduction recorded. For the same period, the number of trauma procedures carried out quarterly and the number of SSIs were recorded for each hospital from the return of prospectively collected SSI surveillance forms.

#### Results

26849 trauma procedures were included with an overall SSI rate of 1.34% (95% Confidence interval [CI] 1.21 to 1.49). Single dose flucloxacillin (2 grams) with single dose gentamicin (3mg/kg) was the most commonly used protocol used in 3 different hospitals for a combined 13.5 years covering 11445 procedures. The SSI rate was 0.72% (95% CI 0.58-0.89). Triple dose cefuroxime (1.5 grams) was used in 2 different hospitals for a combined 10 years covering 8864 procedures. The SSI rate for this regime was 2.46% (95% CI 2.16-2.80). Single dose cefuroxime (1.5 grams) was used in 2 different hospitals for a combined 8 years covering 6540 procedures. The SSI rate was 0.92% (95% CI 0.71-1.18).

#### Conclusion

In this prospective observational cohort study prophylaxis using flucloxacillin and gentamicin was associated with the lowest SSI rate. Single dose cefuroxime was associated with a lower rate of SSI compared to triple dose ( $p < 0.001$ ). Identification of antibiotic regimes associated with the lowest SSI rates will promote the judicious use of antibiotics, improve antibiotic stewardship while allowing for continued benefit in the prevention of SSI in an era of ever-increasing antibiotic resistance.

### 4b VISUAL ABSTRACT

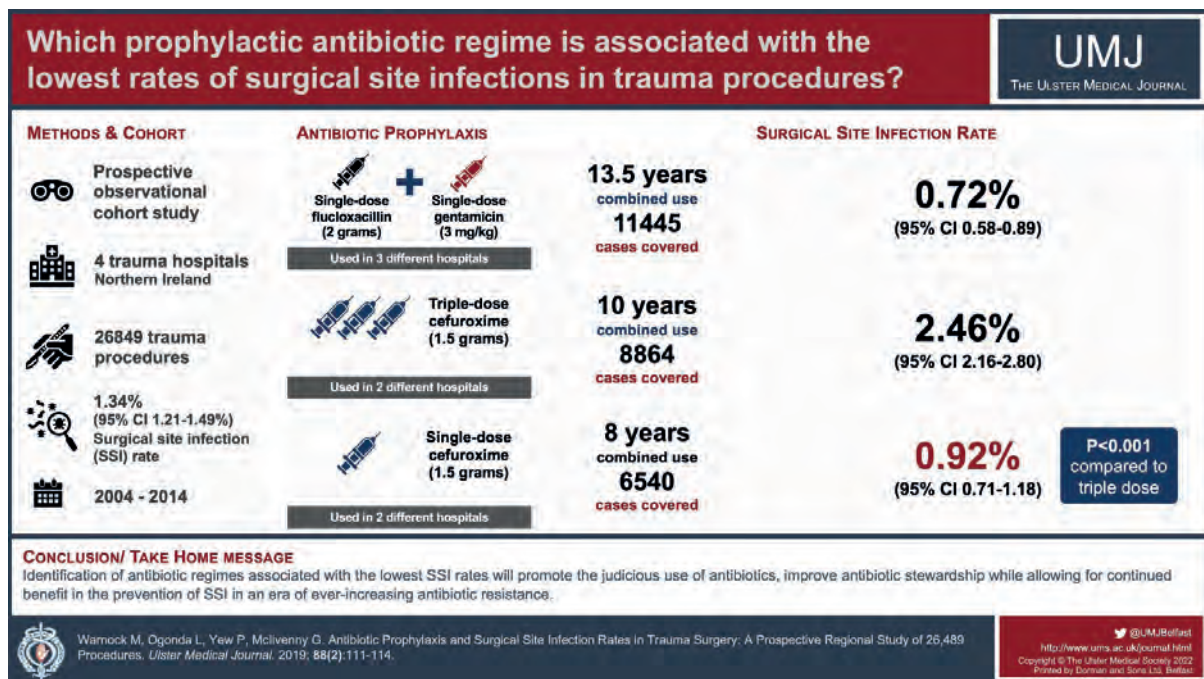


Figure 4: Paired (a) written abstract and (b) visual abstract of a clinical paper previously published in the *Ulster Medical Journal* entitled "Antibiotic Prophylaxis Protocols and Surgical Site Infection Rates in Trauma Surgery".<sup>29</sup>



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### 5a WRITTEN ABSTRACT

#### Background

The delivery of cataract surgery during the COVID-19 pandemic is challenging because of the risk of nosocomial SARS-CoV-2 infection when patients attend hospital for elective care. In order to ascertain the risk to patients awaiting cataract surgery, this study aimed to identify the presence of systemic comorbidities that are associated with a high risk of severe disease or death due to COVID-19.

#### Methods

A prospective study of 315 patients (630 eyes) was conducted from 3rd June to 31st July 2020. An electronic health record was used to identify any systemic comorbidities that would render a patient 'clinically extremely vulnerable' to COVID-19, as outlined by the Department of Health for Northern Ireland. Patient demographics, best-corrected visual acuity (VA) and risk of postoperative anisometropia were also recorded.

#### Results

The median age of patients awaiting cataract surgery was 76 years (range 22-97). Of the 315 patients, 72% were aged over 70 and 16% were aged over 85. A systemic comorbidity that would confer high risk status was identified in 21% of patients. This high risk status was attributable to severe respiratory disease, cancer, and immunosuppression therapies in the majority of cases. The high risk group were younger than those deemed non-high risk, but there were no significant differences with respect to gender, anticipated degree of surgical difficulty, VA, or whether the patient was undergoing first or second eye surgery. Of those patients awaiting first eye cataract surgery, the mean VA in the listed eye was 0.84 logMAR and 39% (70/179) had a VA <0.3 logMAR (6/12 Snellen acuity) in their fellow eye. 57% of patients were awaiting first eye surgery, and 32% of those patients would be at risk of symptomatic anisometropia postoperatively.

#### Conclusion

One-fifth of patients awaiting cataract surgery were found to be at high risk of severe disease or death from COVID-19 and these patients may experience delays in their surgical care. Additional planning is required in order to minimise the morbidity associated with delayed cataract surgery.

### 5b VISUAL ABSTRACT

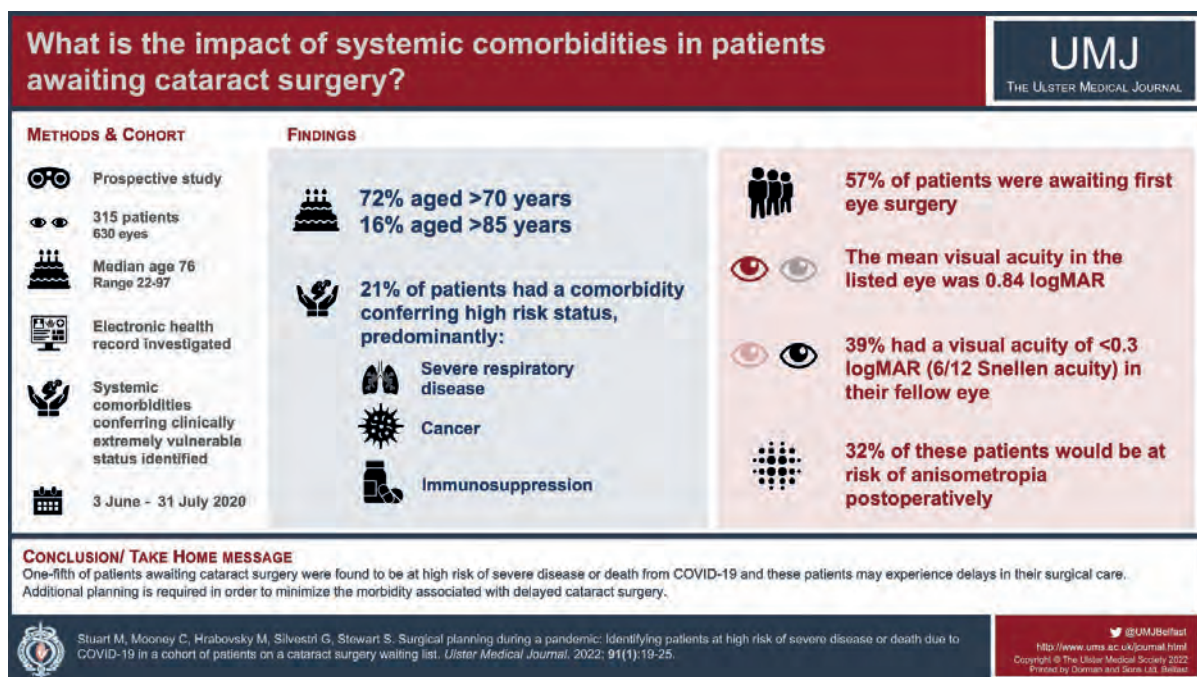


Figure 5: Paired (a) written abstract and (b) visual abstract of a clinical paper previously published in the Ulster Medical Journal entitled "Surgical planning during a pandemic: Identifying patients at high risk of severe disease or death due to COVID-19 in a cohort of patients on a cataract surgery waiting list".<sup>30</sup>

### 6a WRITTEN ABSTRACT

#### Aim

This project aimed to evaluate the role of ultrasound scan (USS) in children presenting with acute onset right iliac fossa (RIF) pain and suspected appendicitis

#### Methods

We retrospectively studied 100 consecutive children undergoing USS for RIF pain. Children with low to moderate clinical probability of appendicitis were seen by the surgical team and subsequently underwent USS by a radiologist or a sonographer with a special interest in paediatric USS. The clinical findings, blood tests, and radiological diagnosis led to a decision to operate, observe or discharge. USS findings were subsequently verified with the final histology. The six-month follow-up data of these patients were also analysed.

#### Results

35 males, median age of 11 years (range 4-17), and 65 females, median age of 14 years (range 6-18) were included. A total of 23 appendicectomies were performed. On histology appendicitis was confirmed in 20, including 16 pre-operatively diagnosed on USS. 6 of these appendicectomies were performed on clinical suspicion with normal USS. 1 patient was diagnosed with neuroendocrine tumour of the appendix. Only 2 negative appendicectomies were performed. 62 patients were discharged without intervention. USS sensitivity was 74%, and specificity was 92% for appendicitis. An additional 16 patients were identified with alternate pathology including 5 ovarian cysts.

#### Conclusion

Appendicitis was more common in male patients; however, there was no difference in overall disease prevalence in male or female paediatric patients. Thus, USS is a valuable tool to exclude appendicitis in children with low to moderate probability.

### 6a VISUAL ABSTRACT

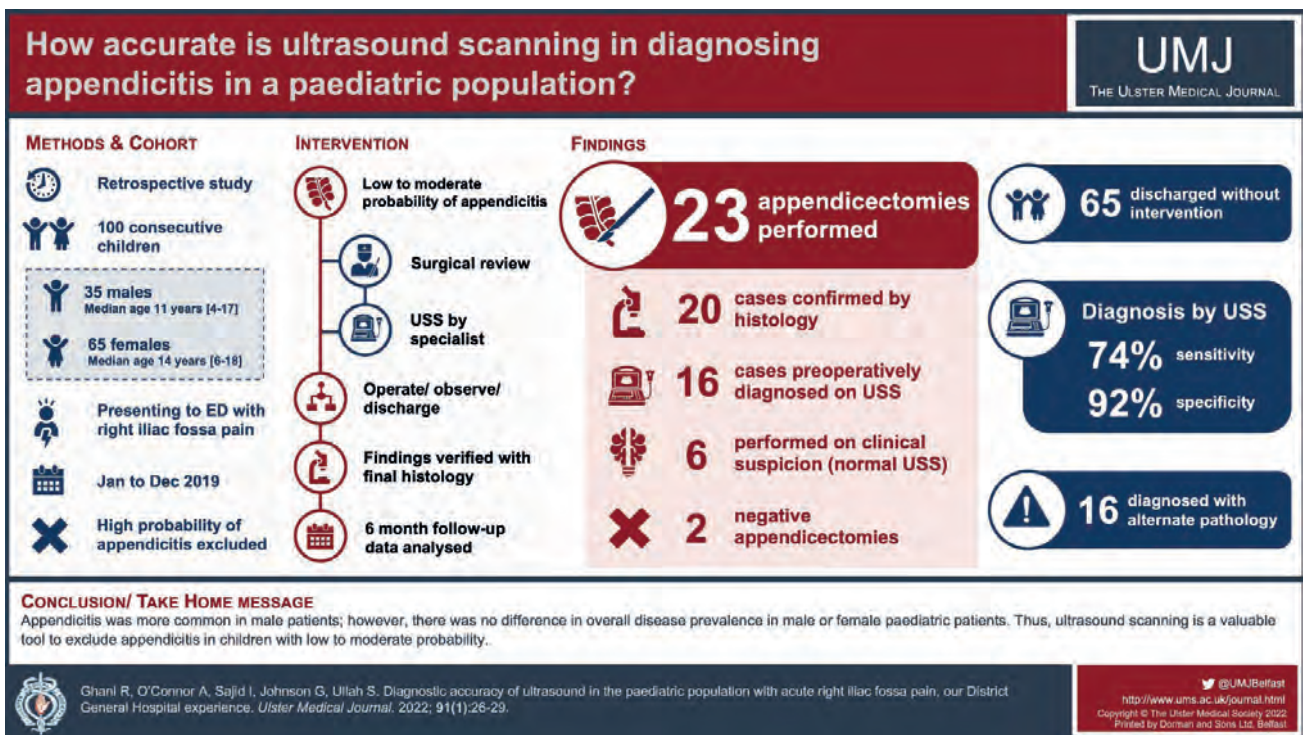


Figure 6: Paired (a) written abstract and (b) visual abstract of a clinical paper previously published in the Ulster Medical Journal entitled “Diagnostic accuracy of ultrasound in the paediatric population with acute right iliac fossa pain, our District General Hospital experience”.<sup>31</sup>

#### AREA 1: TITLE

In order to gain the readers’ initial attention and provide a clear context for the research study, it is recommended that the title should be framed as a question, rather than the same title of the original article. In other words, what question did the study set out to address?

#### AREA 2: METHODS & COHORT

To ensure that the quality of the evidence, the research design should be described e.g., randomised controlled trial, retrospective cohort study, *in vitro* study, etc., and the time frame and any follow-up periods should be stated.



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### AREA 3: FINDINGS

The findings or outcomes of studies are varied and as such it is difficult to definitively state how this section should be formatted. It is important to think of the findings as discrete points and in the case of most studies, short comparative phrases can be included in text box headings, relating to each end point evaluated. Numeric values should be provided for each of the findings detailed including units and values relating to statistical significance, as this will not only highlight the validity of the research findings but also allow readers to interpret the findings themselves.

### AREA 4: CONCLUSION/TAKE HOME MESSAGE

It is important that the conclusion aligns with the question in the title and the key take home message the authors wish to convey. Although the original article may have numerous outcomes, it is important to select between one to three main take home messages. Stating numerous outcomes may distract from the key message which the authors wish to convey. It is important, that the primary outcome of the study is presented to minimise reporting conclusions which are not intentionally or non-intentionally biased.

On a cautionary note, although the primary aim of a visual abstract is to present research findings clearly in a simplified manner, if over simplified the outcomes could be potentially misleading with respect to the strength and significance of the study. Furthermore, due to space limitations, authors may only focus on the positive outcomes of the study and overlook findings which were not significant, inconclusive or negative. The visual abstract should be a true reflection of the manuscript content and that they are not used to promote authors' own biases or self-promotion which in turn could impact on research groups' credibility.<sup>17</sup> It is therefore important that where visual abstracts are a formal adjuvant published alongside the peer-reviewed article, that they are included in the peer-review process to ensure validity and quality, prior to the dissemination.

### THE PREPARATION OF ICONS

Icons, are graphical interphases which have meaning and have the ability to rapidly convey information which can be remembered effortlessly.<sup>32</sup> Icons, are a central to the preparation of an engaging and successful visual abstract as they have the potential to draw the attention of the reader and in turn enhance their understanding and visual learning of the content displayed.<sup>32</sup> Studies involving eye trackers to measure visual attention and subjective evaluations have shown that the composition of icons and backgrounds have an effect on user's attention to the viewed icons with solid single colour icons composed of planes resulting in greater fixation, in terms of duration and frequency, as well as subjective evaluation of attention compared to line-based icons, which appear as outlined figures.<sup>32</sup> It is therefore recommended that solid fill icons are the preferred format of icons used in visual abstracts. When choosing icons the use of 2-D icons is advised for clarity as 3-D icons may distract the reader

and clutter the visual abstract. Where possible chose .svg or .emf formats as these can be re-coloured in packages such as PowerPoint.

As a rule of thumb, one icon should be used to illustrate one key point. Icons used should be free of copyright restrictions and negate the requirement for attribution and such sources which are freely available include PowerPoint and Pixabay (<https://pixabay.com/>). The Noun Project (<https://thenounproject.com/>) offers an extensive catalogue of over two million icons, however the use of icons without attribution requires a small yearly payment, although educator and student licences are available with a discount. Flaticon (<https://www.flaticon.com/>) is a valuable resource for coloured icons which is free to use with attribution and without attribution with associated costs.

### DISSEMINATION OF VISUAL ABSTRACTS

Visual abstracts have a propensity to be shared and disseminated using social media platforms such a Twitter, Facebook, LinkedIn and Research Gate and in turn encourage the full articles to be downloaded.<sup>33</sup> Twitter as of the January 2022 has 396.5 million users with 206 million daily active users.<sup>34</sup> This social media platform permits the "tagging" of organisations, fellow researchers and educators, who may be interested in the research topic and tweets or posts encompassing visual abstracts which have been advocated to encourage engagement with the research studies. The twitter platform has been described as shifting the dissemination of research from a "pull" model i.e., requiring individuals to search for research articles themselves to a "push model" which translates to researchers actively transmitting information in a more direct approach to potentially interested audiences.<sup>35</sup> A recent article in the Journal of Urology which has published visual abstracts since 2016, reported visual abstract tweets significantly improved overall reader engagement by 65%, compared to tweets without visual abstracts.<sup>36</sup> This finding highlights the potential positive impact that the sharing of visual abstracts via Twitter may have in terms of subsequent citations, as it has been previously concluded from a systematic review, on the use of Twitter by medical journals, that using such social media communication improves citation based and alternative bibliometrics for academic medical journals when used in combination with strategies such as tweeting titles, links to articles, infographics or podcasts.<sup>37</sup> *The Journal of the American Geriatrics Society* has also examined the dissemination of research articles via social media and compared standard tweets correlating to published articles with tweets that also contained a visual abstract. Interestingly, the standard tweet received 24,984 impressions (i.e. times content was displayed) and 17 tweets (posts) and 36 likes over a period of eight days, whereas the visual abstract tweet received 168,447 impressions, 81 tweets and 100 likes over four days, highlighting a wider interest.<sup>38</sup> Numerous other studies have reported a similar significant greater research dissemination, social media engagement and clicks on links to the full articles, particularly by healthcare professionals, further emphasising the need for open access



journals to capitalise on this increase in footfall.<sup>16,39,40</sup> These findings highlight the potential that visual abstracts have in disseminating research when used in conjunction with social media and the impact that this communication combination approach has on audience engagement, the alternative bibliometrics relating to impact of research publications as well as academic citation.<sup>38,41</sup>

## OTHER USES OF VISUAL ABSTRACTS WITHIN MEDICINE

### Education, Journal Clubs, Scientific Conferences

Social media as a platform for electronic communication within medical education has been thrust into the use of alternative approaches to aid in building educational online communities during the COVID-19 pandemic.<sup>42</sup> Such digital sharing of education information, including visual abstracts has provided valuable approaches to increase the reach of research articles within disciplines as recently reported in surgical education.<sup>43</sup>

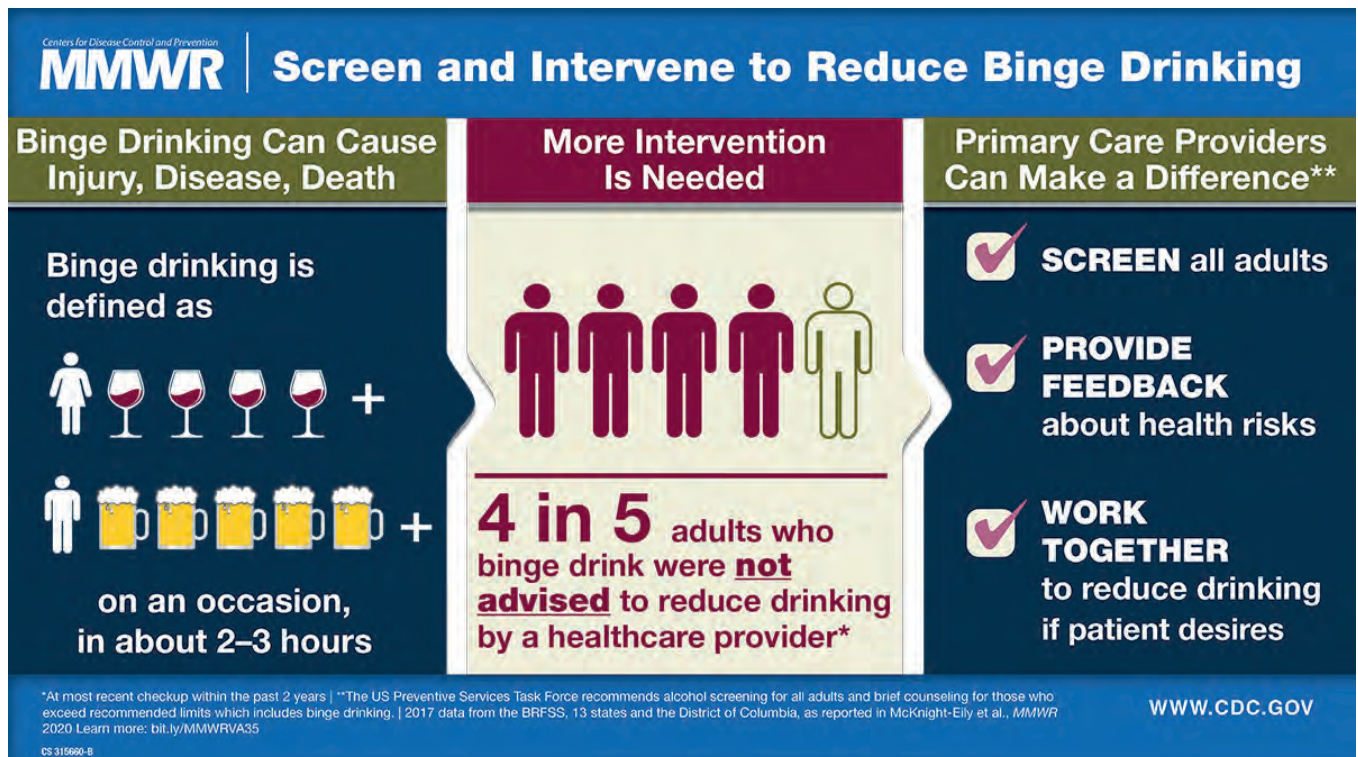
The use of visual abstracts in conjunction with social media has not been limited to their formal publication alongside the full journal article. As healthcare professionals have indicated that they have a preference for visual infographic formats rather than conventional written abstracts when communicating via social media and when viewing online journals,<sup>44</sup> it is not surprising that visual abstracts have been used as educational tools within journal clubs and

rounds. Presenting and sharing visual infographics has been shown to engage and enhance understanding as assessed by comprehension and recall when used in a weekly orthopaedic journal club.<sup>45-47</sup> Medical Schools have promoted the use of visual abstracts in education programmes to share and showcase educational innovation and scholarship by means of a visual abstract poster format thereby permitting presenters to have more time to engage in interactive discussion with interested individuals.<sup>48</sup>

Conferences have used visual abstracts to convey the current research has highlighted by The World Congress of Nephrology (WCN) which is an annual scientific, educational, and networking meeting of the International Society of Nephrology.<sup>49</sup> Recently the 2021 The Developing Excellence in Medical Education Conference (DEMEC) offered two mechanisms for authors to present their posters on a virtual platform either in the form of a visual abstract or a pre-recorded translational talk about their abstract in a “pitch” format.<sup>50</sup>

Live visual abstracts coupled with tweeting have started to trend at conferences to promote the central messages from presentations freely to a wider audience. Such live visual abstracts have the potential to increase the visibility of the conference as well as the presenters and their research.<sup>51</sup>

Key guidance for those who wish to use visual abstracts in this manner has been prepared within the Visual Abstract Primer (edited by Andrew Ibrahim).<sup>51</sup> The use of visual;



**Figure 7:** An example of a visual abstract for the lay community published by the Centers for Disease Control and Prevention journal in relation to the published article by McKnight-Eily LR, Okoro CA, Turay K, Acero C, Hungerford D. Screening for Alcohol Use and Brief Counseling of Adults - 13 States and the District of Columbia, 2017. *MMWR Morb Mortal Wkly Rep.* 2020 Mar 13;69(10):265-270.<sup>53,54</sup>



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abstracts were examined during an annual conference of Association of Vascular Access & Interventional Renal Physicians (AVATAR 2018).<sup>52</sup> The findings of this study indicated that such live visual abstracts tweeted using the handle #LiveVisualAbstract received significantly more impressions and engagements than other popular media tweets which covered the same session.<sup>52</sup> This highlights the potential that this approach can have on delivering information to a wide audience to encourage discussion online and enhancing medical education.

Visual abstracts have been predominantly constructed for and shared with the scientific research community, however more recently, a similar visual abstract format has been used to raise public, policy makers, news and media outlets awareness of important research findings. One such example is the Centers for Disease Control and Prevention journal, *The Morbidity and Mortality Week Report (MMWR)*, which publishes current research related to important public health issues.<sup>53</sup> Such visual abstracts are more akin to lay or plain language summaries and although not the focus of this review may offer an informative visual communication route between patients and healthcare providers (Figure 7).

## CONCLUSIONS

We live in a society where communication and information rely on embedded visual imagery. As researchers, the communicative power of visual abstracts, particularly when used in conjunction with social media, should be harnessed to disseminate research findings. Although not a replacement for the full article, visual abstracts act as a “taster” to entice a wide audience to examine, retrieve and read the full article in greater depth. Visual abstracts may be used to highlight current research findings and promote individual researchers and research groups through a variety of mechanisms. The primary formal approach is by means of independent review and inclusion alongside the peer-reviewed manuscript in the accepting journal, which is increasingly being used as a communicating strategy and subsequently shared on social media platforms. A less formal use of visual abstracts, is through journal clubs, blog posts and conference highlights providing educational value and personal knowledge development, as well as offering a mechanism and encouragement of discussion and debate. As the *Ulster Medical Journal* embarks on its visual abstract journey, it is intended that these will enhance interest in the published articles, increase awareness of the valuable research published in this journal and help to stimulate discussions and collaborations within medical research locally, nationally and internationally.

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