

Creative and visual communication of health research: development of a graphic novel to share children's neighbourhood perspectives of COVID-19 lockdowns in Aotearoa New Zealand

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ABSTRACT

Research dissemination to target stakeholders including communities, policymakers and practitioners is a fundamental element of successful research projects. For many of these stakeholders, however, barriers to access and uptake exist, including time taken to publish, academic jargon, language barriers, paywalled articles and time taken to consume and understand academic outputs. Ultimately these barriers could prevent research from reaching target audiences or could severely delay the uptake of key research messages. Creative and visual dissemination approaches as a complement to traditional academic outputs offer numerous advantages and may improve real-world uptake in a timely manner. In this practitioner piece, the authors present detailed methods for the development of a graphic novel using research findings from an online survey that asked children what they liked about their neighbourhood during COVID-19 lockdowns in Aotearoa New Zealand. Here, they share critical reflections from the process of developing and disseminating this creative communication, with the aim of informing and supporting future creative and visual dissemination of research findings.

KEYWORDS

creative dissemination • graphic novel • knowledge translation • research dissemination • research impact

Visual Communication 2023

Vol. 0(0) 1-22

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DOI 10.1177/14703572231157042



INTRODUCTION

The importance of research dissemination

Dissemination of findings to policy and practice is a key part of the research process (Kerner and Hall, 2009), with increasing acknowledgement that research should generate impact and benefit its target audience (Schnitzler et al., 2016). Active dissemination involves going beyond traditional ‘passive’ methods (e.g. journal articles) and using additional/alternative methods to help share information (Edwards, 2015). Advantages of active dissemination approaches over passive approaches include overcoming barriers to information uptake, including lack of accessibility, use of jargon, using a one-size-fits-all approach and the substantial time taken for publishing (Ashcraft et al., 2020; Barczynski et al., 2009; Bodison et al., 2015; Chandler et al., 2015; Dobbins et al., 2002a; Schnitzler et al., 2016; Scullion, 2002).

Creative and visual dissemination techniques

Creative dissemination methods are a form of active dissemination; they vary widely in terms of style and each has their advantages and disadvantages (Bazeley, 2006) (see Table 1). The main strengths of creative dissemination techniques include enabling participant voice (Chandler et al., 2015; Duckworth and Smith, 2020; Farthing and Priego, 2016; Lapum et al., 2012), the ability to appeal to the general public by having more straightforward messages that involve little jargon (Ahamed et al., 2016; Bartlett, 2012; Chandler et al., 2015; McSween-Cadieux et al., 2017), and versatility by being able to be accessed while the audience is engaged in other activities (Bartlett, 2012; Berk et al., 2020; Farthing and Priego, 2016; Thoma et al., 2017; Vindrola-Padros et al., 2016). However, there are also weaknesses of and barriers to using these techniques, such as being more labour intensive or costly for those who are unfamiliar with the dissemination technique and so may require external assistance (Corl et al., 2008). Another challenge is the lack of long-term outcome monitoring for techniques such as theatre and exhibitions (Boydell et al., 2012; Chandler et al., 2015; Lapum et al., 2012). Finally, anonymity could be a problem with creative dissemination techniques where participants’ actual voices, images, or words are used for dissemination, meaning privacy can have a higher likelihood of being breached (Chandler et al., 2015).

The role of creative and visual communication in the time of COVID-19

The COVID-19 situation continues to change rapidly, and robust knowledge translation has become more important than ever. Evidence is needed to identify best practice that could inform policymakers about possible actions to undertake in response to different scenarios generated as a result of the pandemic. According to Dobbins et al. (2002a), research typically takes 8 to 15 years between the time of publication to the time of usage in real practice.

Table 1. Descriptions and comparisons of creative dissemination methods.

Category	Example/description	Target audience	Strengths	Weaknesses
Audio-enriched posters	The research was about HIV prevention needs for African American college women (Chandler et al., 2015). The Enhanced Audio Recorded Research (EARR) Model was developed for this in order to integrate audio into a poster presentation for their research findings. Audio clippings from the interviews with participants were made available through QR codes or dial-by-number, with each number printed on the posters.	Other researchers at a project showcase.	<ul style="list-style-type: none"> - Allows for emotions to be shown. - Reflects the personalities of the participants rather than the researchers. - Empowers the participants by allowing them to remove the anonymity and show who they are. - Shows the audience to better relate to the participants and understand the meaning of the findings. - Appeals to multiple types of learning - Gives a more holistic experience to the audience. 	<ul style="list-style-type: none"> - Lacks anonymity that could be harmful when working with vulnerable populations. - Clippings only show a small amount of what the participants talked about, so the full meaning may not be translated properly. - Requires the audience to have a mobile device. - Audio clippings cannot be accessed outside of the research showcase.
Cartoons, comics and graphic novels	Barlett's (2012) study was about working with people who have been diagnosed with dementia and are campaigning for social change (i.e. more freedom for people with dementia). Farthing and Prigo (2016) have used comics as a way to document the experience of living with medical conditions. Ahmed et al. (2016) used comics to enhance the learning of English for school children and to nurture a sense of patriotism for Malaysia in them. Short and Reeves (2009) produced a review on the use of graphic novels in education and communicating business concepts. Williams et al. (2021) developed a graphic novel to share research findings from research on gender and palliative care. Carroll et al. (2019) produced a series of comic strips to communicate key findings on barriers to participation in a research project with disabled children and young people.	<p>General public and others with dementia (Barlett, 2012). General public, though a particular emphasis on families and friends of those with the conditions (Farthing and Prigo, 2016), and medical practitioners, school children (Ahmed et al., 2016). Generation Y (born between 1982 and 2003) (Short and Reeves, 2009).</p>	<ul style="list-style-type: none"> - Cartoons are able to elicit strong reactions (Rose and Flynn, 2017). (Barlett, 2012). - Cartoons are widespread and are versatile in terms of topic. - Involves collaboration that can bring out different perspectives. - Gives a voice to those who are not normally portrayed in good light in mainstream media and people who are not talked about at all (Farthing and Prigo, 2016). - Helps with understanding lived experiences. - Many opportunities for distributing the comics. - Using words and images together could help with maximizing the meaning wanted by the researcher (Ahmed et al., 2016). - Graphic novels provide an attractive medium for storytelling (Short and Reeves, 2009). - Graphic novels can be catered towards more mature audiences and can communicate concepts more thoroughly than comics. - Graphic novels involve high audience participation as the audience needs to use their imaginations to fill in the missing gaps from the story. - Allows people to fully experience the journey of a cardiac ward patient, or any other scenario, through the use of multimodal sensory methods (Lapum et al., 2012). - Stimulates the audience's thinking by giving them the opportunity to empathize with the story. - Allows the usage of different types of media e.g. poetry, illustrations, audio, and photographs. - Gives a voice to the participants of the research rather than directly translating the findings to what the researchers interpret them as. 	<ul style="list-style-type: none"> - Cartoons could be deemed as inappropriate as they tend to be humorous (Rose and Flynn, 2017). - Requires a professional cartoonist/illustrator and is labour-intensive for the researcher, as they need to make sure the themes within the cartoon are conveyed properly (Barlett, 2012). - Sacrifices academic detail for impact and accessibility (Farthing and Prigo, 2016).
Exhibition	"The 7024th Patient" was an exhibition developed by Lapum et al. (2012) to showcase the experiences of cardiac ward patients. The patients' stories were translated into poems and photographs that told their stories. Involved narrative setting by telling the story of a patient that started from being at home, to the surgery and then rehabilitation.	Medical practitioners (Lapum et al., 2012).	<ul style="list-style-type: none"> - Stimulates the audience's thinking by giving them the opportunity to empathize with the story. - Allows the usage of different types of media e.g. poetry, illustrations, audio, and photographs. - Gives a voice to the participants of the research rather than directly translating the findings to what the researchers interpret them as. 	<ul style="list-style-type: none"> - Is labour and time intensive; also requires a lot of funding and a suitable place for the exhibition (Lapum et al., 2012). - The data is still being translated by the research team in order to create the poetry and other forms of art. - Requires a large team and likely someone who understands how to create an exhibition. - Need to carefully consider how to develop the narrative and the main themes so that the audience understands how each part of the exhibition was designed (Rust and Robertson, 2003). - Requires extensive resources in marketing the exhibition in order to ensure it gets an acceptable level of visitation.

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Table 1. (Continued)

Category	Example/description	Target audience	Strengths	Weaknesses
Infographics	The 2015 American Heart Association Guidelines were translated into a collection of infographics on BortingM.org (Thoma et al., 2017).	Medical practitioners, and those with heart conditions and their families and friends.	<ul style="list-style-type: none"> - An increase in article abstract readership was documented. - Contains illustrations or photographs that can help the audience visualize the data. - Easy to access by having a variety of methods for disseminating the infographics. - Information is concise and visually appealing to the target audience. - Can be co-designed with the target audience to increase the suitability of the content and language. - Can be distributed in places where the target audience is likely to go to. 	<ul style="list-style-type: none"> - Did not result in a significant increase in research article readership. - The research findings could be presented inaccurately. - Does not involve collaboration outside of the research team.
Leaflet	A leaflet was developed for disseminating findings from an ethnographic study with families of children who were recently diagnosed with leukaemia (Vindrola-Padros et al., 2016). The children co-designed the leaflet with the researchers, with the latter ensuring that the distributed leaflet was child-friendly.	Children aged 7–16 years old.	<ul style="list-style-type: none"> - Good for disseminating research to those with low literacy skills (Rose and Flynn, 2017). - The animated documentary medium allows for the deidentifying of participants. - Can preserve the anonymity of participants but retain emotions and actual experiences. - Videos allow the participants to share their stories themselves (Brannen, 2002; Duckworth and Smith, 2020). - Along with deidentifying, videos can also be edited to prevent the exposure of too much personal information. - Allows the participants to share their views on the findings. 	<ul style="list-style-type: none"> - Researchers self design the final product and the language could still be too academically focused for children to understand. - The focus is still mainly on text, so could fail to appeal to those who are visual learners and people with low literacy skills.
Movies/videos	Animated documentaries were used in Rose and Flynn's (2017) study to discuss the impacts of maternal incarceration on children. Creature Comforts is an example of this style by using animals to represent people (Rose and Flynn, 2017). Duckworth and Smith's research was about how further education can improve lives. Videos were produced to share stories from learners, their families, teachers and employers (Duckworth and Smith, 2020). In the study by Brannen (2002), children were asked to document their concepts of care in a family environment.	<p>Young people in similar situations (Rose and Flynn, 2017).</p> <p>Others looking into doing further education and people that fit the type of person being shown in the video (Duckworth and Smith, 2020).</p> <p>Academics, children and their families, and teachers (Brannen, 2002).</p>	<ul style="list-style-type: none"> - Podcasts as an article dissemination strategy increased abstract readership (Thoma et al., 2017; Naiff, 2020). - Good for rapid dissemination by using a strategy where anyone can access the content anywhere and whenever (Tripathy et al., 2017). - By being able to be continuously accessed, podcast listenership increases at a steady pace over time (Nwosu et al., 2020). - Audio recording equipment can be cheap or free if using university facilities. - Podcast hosting sites and editing software are freely available. - Quality indicators can be tracked using statistics on the podcast. - Podcasts have a high day tolerance i.e. listeners are more willing to wait for longer periods of time before listening to the podcast. - Podcasts are versatile in terms of content and length (Berk et al., 2020). - Podcasts allow the addition of entertainment to mundane tasks, such as commuting and cooking (Malecki et al., 2019). - Gives healthcare professionals the opportunity to stay up-to-date despite being busy. 	<ul style="list-style-type: none"> - Animation is labour-intensive and animators that work with the researchers may not understand the gravity of the findings (Rose and Flynn, 2017). - Clients are often unable to articulate exactly what they want in the animation until it is near being a finished product, so would be in a state that is difficult to amend. - Requires careful management of expectations for the outcomes of the product. - Editing the product could lead to biases by cutting out certain aspects, with this all determined by the researcher (Brannen, 2002). - Recruiting participants and video editing can be expensive in terms of time and funding. - Text and film are still different media, so film may miss out on some of the complexities text can show. - The film-making process does not actually give the participants more say or power than they already have, as the researcher still dictates the process. - Using podcasts did not significantly increase full article readership (Thoma et al., 2017). - People who listen to more podcasts tend to be the ones contributing to new listenership of other podcasts (Gunawardena et al., 2009). - Need good marketing strategies in order to get new unique listeners. This is especially important if the target audience is policymakers or people with decision-making powers (Naiff, 2020). - Important to create a good recording environment as a high-quality podcast is necessary for good listenership (Berk et al., 2020). - Requires planning before the podcast is recorded and this could be time-intensive.
Podcast	Nwosu et al. (2017) developed a podcast about palliative care technology and innovation – AmPaI. AmPaI involved interviews, opinion pieces and education-focused content. An educational podcast was created by Berk et al. (2020) to share the findings of new and interesting medical research articles. It also tells the listeners about new innovations. The Round Table is a weekly medical podcast produced by physicians from the University of Toronto (Malecki et al., 2019). Two co-hosts (one guest and one fixed) would discuss two recently published research articles that could have implications on adult medicine. A researcher-practitioner partnership (RPP) podcast was created to disseminate community-engaged research that has direct and indirect impacts on the community (Naiff, 2020). This podcast was also about fostering networks between academics, policymakers, practitioners, and the community.	<p>Aimed at healthcare professionals in palliative care (Nwosu et al., 2017).</p> <p>Healthcare professionals who often do not have the time to read articles (Berk et al., 2020; Malecki et al., 2019).</p> <p>Community groups and individuals, and policymakers (Naiff, 2020).</p>		

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Table 1. (Continued)

Category	Example/description	Target audience	Strengths	Weaknesses
Research showcase	Macpherson et al. (2017) developed a collaborative exhibition that involved the participants talking about their involvement and thoughts about the findings. The research was a part of the larger Connected Communities Programme that was about empowering community partners. To realize this objective, an annual research showcase is done. Researchers from the University of Brighton and some arts-based organizations developed the 'Resilience House' together for showcasing.	Researchers and policymakers.	<ul style="list-style-type: none"> - Allowed for those who normally would not attend such events to do so, such as marginalized youth. - Gave opportunities to young people to participate and improve on their public speaking and social skills. - An in-person showcase could mean greater acceptance of the findings by researchers, policymakers, and the general public. - The skills of community partners would be developed as well, in order for them to feel confident in presenting. 	<ul style="list-style-type: none"> - Bureaucratic processes can result in uncertainty and challenges in planning and delivering showcases (e.g., researchers not knowing if they are approved for the showcase until just before the showcase). - Limited time to develop exhibition and to confirm all the participants. - Additional work is required to encourage visitor numbers and stakeholder attendance.
Social media bots	Social media bots are about automating the production of information and news that the audience would be interested in (Lokot and Diakopoulos, 2015). There are many different types of social media bots that have different duties. For example, a Twitter bot may focus entirely on disaster relief updates while another might focus on drones. Scanfield and Scanfield (2010) demonstrate the potential of social media bots to create opportunities for positive behaviour change and to disseminate correct information.	The specific audience that would subscribe for news by the bot (Lokot and Diakopoulos, 2015; Scanfield and Scanfield, 2010).	<ul style="list-style-type: none"> - Can have multiple sources of input, e.g. blogs and videos (Lokot and Diakopoulos, 2015). - Aids the discovery of information that is hard to find or new. - Are a good way to bridge existing methods of information sharing with social media e.g. connecting traditional news to Reddit. - Can be used to design reminders for people on Twitter (e.g. when to take medication) (Scanfield and Scanfield, 2010). - Helps to discredit invalid information shared on social media. 	<ul style="list-style-type: none"> - Some bots are not transparent about their sources (Lokot and Diakopoulos, 2015). - Requires continuous coding to ensure the bot is working properly. - Need to make sure bots are informing people rather than persuading them with the way the information is presented.
Storyboarding	Ayrtton (2010) developed storyboard trust stories about different scenarios, such as parachute jumping and mental health advocacy. They are about using text and visual elements to tell a story – using the static aspect of drawings, the moving, dynamic aspect of film and the textual aspect of narrative fiction.	The general public (Ayrtton, 2010).	<ul style="list-style-type: none"> - Allows researchers to step out of their comfort zone from text, so can spark change and ideas. - Storyboards are multimodal, by incorporating elements of film, drawings, and text. - Helps the audience to better understand the human condition by incorporating more than one sensory mode. - Requires the author to reflect on their findings and how the audience would perceive the characters. 	<ul style="list-style-type: none"> - A skilled artist is needed. - There could be potential issues within researcher-artist collaborations, such as clarifying expectations. - Some audience members could prefer purely visual or textual methods of dissemination instead.
Storytelling	Storytelling is about producing targeted stories to convey findings and cause behaviour change. Bosisis et al. (2020) created stories about vaccine safety that involved visual elements, such as charts, graphs, photographs and maps. Other stories within the biomedical science field were also developed.	Patients and their families (Bosisis et al., 2020).	<ul style="list-style-type: none"> - Stimulate our thoughts (Bosisis et al., 2020). - Helps the audience relate to the story and bring a 'human' aspect to it. - Biomedical data is basically inaccessible for people with low health literacy skills. - Storytelling is useful for influencing people who are less likely to read articles, such as politicians or funders (Dietrich, 2018). 	<ul style="list-style-type: none"> - Need to identify the target audience and evaluate their health literacy skills in order to decide what a suitable amount of jargon would be (Bosisis et al., 2020). - Different levels of health literacy in the stories would appeal to different audiences, so not everyone would respond well to the story.

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Table 1. (Continued)

Category	Example/description	Target audience	Strengths	Weaknesses
Theatre	Boydell et al. (2012) designed a theatre production about breast cancer and what it is like for survivors.	Breast cancer survivors and their families (Boydell et al., 2012).	<ul style="list-style-type: none"> - Engages people in conversation about the production topic (Boydell et al., 2012). - Helps people feel less isolated about their medical condition and normalizes what they are going through. - Allows people who have not experienced the condition or situation to become better allies to those who have. - Theatre can express emotions that could be absent from text. 	<ul style="list-style-type: none"> - People's lived experiences are being displayed so could make them relive unhappy memories (Boydell et al., 2012). - It is hard to measure the long term outcomes from this type of dissemination. - Theatre is interpretive, so the findings of the research could be misconstrued. - Balancing the artistic and scientific portions of the project could be difficult. - Theatre can take a long time to plan and produce. - Performative dissemination methods could be too big of a project and hard to control for specific aspects (Jones, 2006). - Can only disseminate to those who live in the area where the production is being shown.
Video podcasting	Cod et al. (2008) produced a video podcast for a radiology website to educate people through lectures.	Students who are studying or have an interest in radiology.	<ul style="list-style-type: none"> - Video podcasting is versatile in that different kinds of images can be displayed - movies, still-image slides, or animation. - Lectures can be produced at little cost due to the images either being continuous footage or still-image slides. - Viewers can choose where and when to view the podcast. - Can be downloaded onto different devices. - Websites are easy to access and can be looked at whenever (Newell and Dale, 2015). - Helps with more rapid learning. - Allows researchers to quickly publish their findings and relate them to how the community has responded. - Gives direct feedback to researchers through website traffic and other statistics. - Incredibly versatile as websites can be used to show anything (Bose and Flynn, 2017). 	<ul style="list-style-type: none"> - Has a steep learning curve or requires expert involvement. - May lose efficiency as the podcast might be designed to be listened to simultaneously while looking at the images, so people would need to focus entirely on the podcast. - Optimal podcast length needs to be carefully considered. - Need to establish an audience base through marketing using the right channels in order to generate traffic for the website (Newell and Dale, 2015). - Website needs to be continuously updated and made easy to use for all visitors.
Website creation	A website was designed by Newell and Dale (2015) to showcase different ways local communities have innovated to help mitigate climate change in British Columbia, Canada. It was made to help assist communities in finding best practice methods that could work in their community. Also contained different channels that enabled communication from community members with scientists.	General public and policymakers (Newell and Dale, 2015).	<ul style="list-style-type: none"> - Serves as both an informative and educational dissemination method that allows researchers to transform their knowledge into something that the public can understand. - Can involve interactive aspects that would make the workshop information more memorable. - Allows researchers to share exactly what the findings say from their research, rather than making them interpretive. 	<ul style="list-style-type: none"> - Disseminating to decision-makers could mean that hierarchical relationships cause people to not speak up about their viewpoints. - Many participants in the workshops stated that they found the information helpful, but did not know how to apply it. - The focus of presentations would need a good balance between science and understandability for the participants.
Workshops	Research dissemination workshops were undertaken by McSween-Cadieux et al. (2017) to inform decision-makers about implementing anti-malaria interventions. The objective of these workshops was to educate the main actors who could contribute to anti-malaria strategies.	Decision-makers who are the main actors in anti-malaria interventions.	<ul style="list-style-type: none"> - Serves as both an informative and educational dissemination method that allows researchers to transform their knowledge into something that the public can understand. - Can involve interactive aspects that would make the workshop information more memorable. - Allows researchers to share exactly what the findings say from their research, rather than making them interpretive. 	<ul style="list-style-type: none"> - Disseminating to decision-makers could mean that hierarchical relationships cause people to not speak up about their viewpoints. - Many participants in the workshops stated that they found the information helpful, but did not know how to apply it. - The focus of presentations would need a good balance between science and understandability for the participants.

This timeline needs to be shortened for this unprecedented situation and so it is important to choose the tools of dissemination wisely.

In Aotearoa New Zealand, we undertook an online survey asking children what they liked about their neighbourhoods during the COVID-19 lockdown. Anecdotally, it seemed that families were spending much more time together, at home and outside. Children were able to experience a completely new side of their neighbourhood, by having fewer cars on the road and more time to explore. This unique situation inspired us to explore what aspects of children's neighbourhood environment supported their wellbeing through this time. An academic output of the survey findings has been reported elsewhere (Smith et al., 2022). However, this 'passive' approach did not allow for sharing more nuanced perspectives of children and for reaching non-academic audiences. Accordingly, visual communication was seen as an optimal supplementary dissemination approach to overcome barriers to take up (Bodison et al., 2015) and to ensure children's voices were not diluted by the more restricted article publication approach. The aim of this practitioner piece is to describe the methods used to produce the creative dissemination output, to share the output and to reflect on the utility of this process.

METHODS

Protocol for developing content

The methods for collection of data used in this study have been reported in full elsewhere (Smith et al., 2022). For this activity, the 186 text responses to the survey question – 'what did you like about your neighbourhood during lockdown?' – and children's submitted photos and drawings were extracted and examined by Catherine Ma and Melody Smith to identify key areas of interest that reflected the gamut of experiences children spoke about. Recent studies on children and COVID-19 (Cuevas-Parra, 2020; Stavridou et al., 2020) were also used as guides for potential topics of interest that could arise. In total, seven candidate topics were identified that covered ideas that appeared frequently in the data: 'Carless Society', 'Community', 'Loneliness', 'Mental Health', 'Same but Different', 'Time in Nature' and 'Time with Family'. Each topic had at least 20 entries from the 186 responses.

Identifying optimal form(s) of creative dissemination

Our team discussed advantages and disadvantages of different creative dissemination techniques, drawing from the literature in Table 1. Ultimately, we selected a graphic novel format for its advantages in terms of audience reach (Bartlett, 2012), graphic novels' utility as a medium for storytelling (Ahamed et al., 2016), the need to collaborate with non-researchers (Bartlett, 2012) and because they allowed a tangible visual output to be produced that could also be shared virtually. Compared to other techniques such as comics, graphic novels can cater for more mature audiences by being longer and allowing ideas

to be developed more fully (Short and Reeves, 2009), which extends our target audience from children through to policymakers. This medium also gives a voice to people whose voices tend to be ignored, like children's (Farthing and Priego, 2016). Apart from this, specific to our dataset, this medium allows the inclusion of the children's drawings, photos and poems in the product created.

Creating the graphic novel

Figure 1 briefly outlines the process used to create the graphic novel and more detail about each stage is provided as supplementary information. First, quotes that fit each of the seven topics were consolidated into categories within a Microsoft Word document (Stage 1). Catherine Ma then created a draft storyline for each of the seven topics with ideas on what images should be used for the panels alongside the dialogue and Melody Smith provided initial feedback on the data (Stage 2). Of note, both authors had substantive experience working with the dataset so had a considerable grasp of the data and key messages shared by children. Much of the dialogue for the stories consisted of direct quotes from the answers given by the children themselves. This was done in order to preserve their original meanings and preclude the imposition of the researchers' interpretation. Direct quotes were formatted differently from the remaining data (in bold); they were prioritized when determining whether to retain or remove information and were used verbatim with no paraphrasing. Other dialogue, specifically those not from the children (e.g. the narrator or non-human characters) was created from interpretations of the children's messages or were neutral statements. The image ideas were inspired by the drawings and photos uploaded by the participants. Catherine Ma and Melody Smith identified candidate content for chapter headers from participant-provided poetry and graphical data.

From these researcher-derived storylines, Carol Green created storyboards for each of the seven topics in canva.com, including panels with textual data drawn from the storylines (Stage 3, Figure 1). Considerations at this stage were ensuring a coherent and logical storyline for each chapter, and that the research team had specified an optimal chapter length of 1–3 pages. Accordingly, Carol Green made minor changes to the supplied content, in some cases removing or modifying dialogue. PDFs of each storyboard and an associated chapter heading page were created and Melody Smith reviewed these storyboards virtually, using annotated PDFs (Stage 4). Considerations when reviewing the storyboards were ensuring appropriate interpretation of children's data, that information presented in each storyboard was consistent with the overall topic and that each storyboard presented a discrete and succinct message. During this process, target audiences and the importance of connecting with children, families, policy-makers and practitioners were kept front-of-mind. Although not a key driver, budgetary considerations (in terms of illustration and printing costs) were also kept in mind when aiming for succinct chapters that still described children's experiences and perceptions

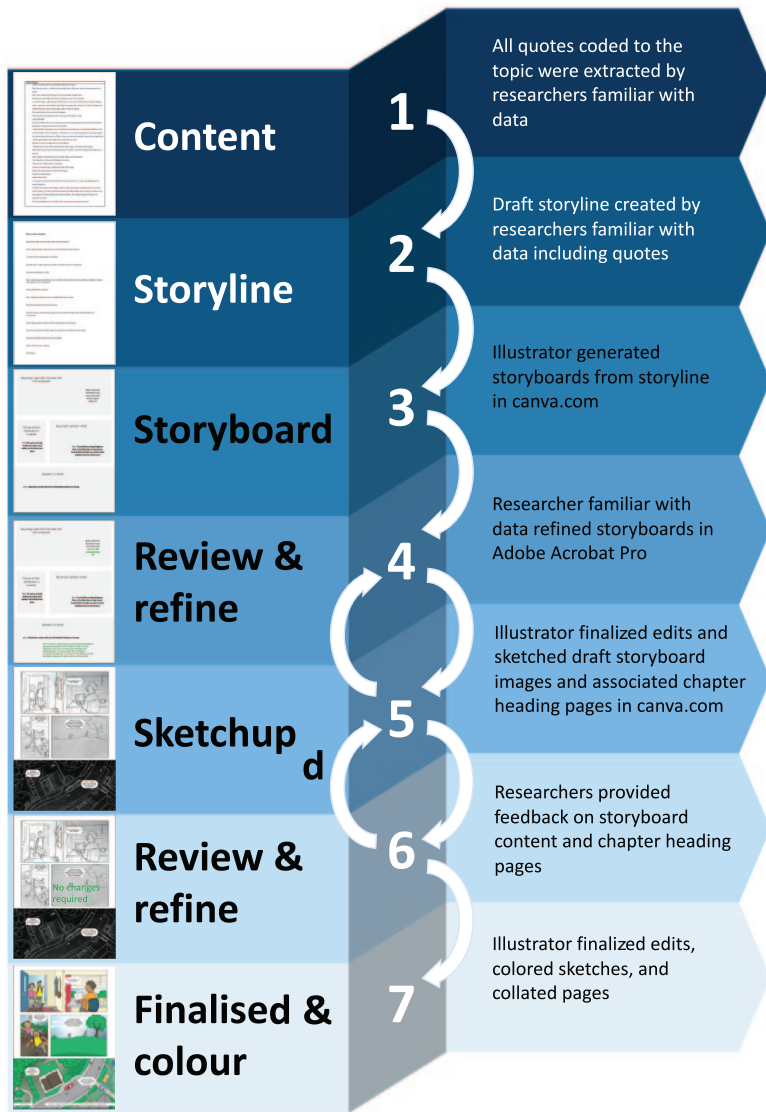


Figure 1. Outline of process used to develop the graphic novel from child-supplied content.

adequately. This process illuminated for Melody Smith fundamental differences between written and visual forms of story-telling. In particular, the visual storyboards reduced the need for repetitions of comments, where one panel could be used to cover a number of quotes without diluting the primary message. Another difference was the importance of providing additional context for the graphic novel compared with the ability to be more siloed when taking an academic written approach. Key changes that were made through this process were the combining of quotes that covered the same topic, removal of

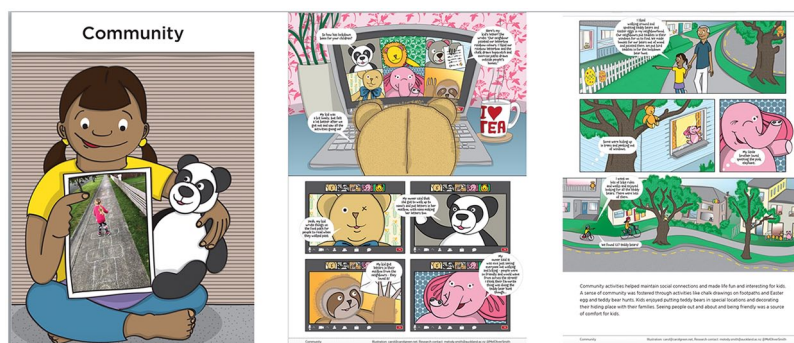


Figure 2. Example of one ‘chapter’ of the graphic novel, including title page, image submitted by a participant and quotes submitted by participants.

repetitive information and shifting of some content to other chapters to add depth to the chapters. In addition, two topics were merged – Mental Health and Loneliness were combined into one storyboard, titled ‘Keeping Connected’. The process of storyboarding revealed the need to combine these two topics in order to provide sufficient depth to the storyline. At this point, Carol Green also made additional minor changes to support the flow of the storyline and illustrations. Figure 2 shows an example of one completed ‘chapter’.

Audio-recording the graphic novel

We recognized that providing only a visual output would reduce accessibility and limit the utility of the novel. Drawing from the perspectives of Williams et al. (2021), we note the illustrations are recognized as telling a story of their own and thus we wanted the children to have a child-friendly description of the illustrations. Accordingly, we recorded an audio-book version of the graphic novel, with a child describing the illustrations and content for their peers. This version was produced solely as an audio file, separate from the visual output and was not linked with the visual output in any way. Importantly, we did not stipulate that text had to be read verbatim and we did not provide the child pre-determined text. Instead we allowed the child narrator to describe the novel illustrations as they saw them and to highlight elements that they thought would be of interest to children. For this process, we used protocols produced by Harrison and Loring (2021) and used the software Audacity for recording and editing recordings.

Dissemination of the graphic novel

A separate DOI was created for the graphic novel and audiobook version using the researcher institution figshare repository (auckland.figshare.com), providing permanent online links to the documents and making them freely accessible (Smith, 2021; Smith et al., 2021). Separate International Standard Book Numbers (ISBNs) for electronic, PDF and softcover versions of the graphic

novel were sought from the ISBN Agency, Te Puna Mātauranga o Aotearoa/National Library of New Zealand. ISBN number approval required following stringent criteria on ISBN number placement on all documents and legal deposit of the digital version of the document to the library within 20 working days of publication.

Following completion, the graphic novel and the audio file were uploaded to figshare and a legal deposit was made with Te Puna Mātauranga o Aotearoa/National Library of New Zealand. The links to the figshare documents were disseminated on social media (Twitter, Instagram and Facebook) and were sent via email to the research team's networks. Research team members also shared the PDF version of the novel directly with policymakers, practitioners and organizations with interests in children and healthy environments. Data on views, downloads and Altmetrics were collected to gauge uptake over time. Comparison data on article views, downloads and Altmetrics were also collected for the academic output to aid reflection on the utility of the creative dissemination outputs compared with traditional academic dissemination. On completion of the output, we undertook a critical reflection of the process using questions by Fook and Gardner (2007), specifically: what did I/others do, what were the different perspectives, how did I/others influence the situation and what was the influence of power?

RESULTS AND DISCUSSION

This practitioner piece outlines in detail the process used to develop a creative dissemination output from an online survey that captured children's perspectives using a range of data types. Findings are presented drawing on a critical reflection of the process, and highlighting opportunities for future research and improvement. The completed graphic novel (Smith et al., 2021) and the audiobook (Smith, 2021) were both made freely accessible online. Here, we also draw from our critical reflections, in particular considering our differing perspectives, our roles in re-producing children's information and our influence in determining the final output content. This process was new to the research team and we anticipate that sharing our experiences will be useful to researchers interested in extending the reach of their research findings to non-academic audiences through creative and visual dissemination. A strength of the process was engaging with an experienced illustrator who was familiar with illustrating for a wide audience on the topic of environments and human wellbeing (for example, illustrating for children's books and audio-visual content, developing COVID-19 communication resources and creating illustrations for health and environment research, Green, 2022). In addition, the corresponding author had worked with the illustrator previously on children's health and environment research dissemination (e.g. Ikeda et al., 2018), resulting in a shared understanding of, and respect for, each other's expertise, likely leading to efficiencies in the working relationship. In their development

of a graphic novel to share research findings, Williams et al. (2021) reflected on the importance of the calibre of artistic expression and considered it an important component of creative dissemination. Specifically, it is essential to recognize that artwork contributes more than simply illustrating text and that illustrations provide a story in their own right. Accordingly, where possible, expertise in illustration is preferable in order to optimize the knowledge transfer process. Carol Green's capability to understand the topic from the outset, and to contribute to decision-making and story-telling alongside the research team as well as the pre-existing relationship likely streamlined the process and reduced the time taken to produce the output. For example, while draft content was developed by the research team, the illustrator made independent and significant contributions to the visual storytelling, and so in this case had equal 'power' in the dissemination process. This relationship and shared understanding also enabled an efficient form of flexibility and adaptability that might not be easily replicated elsewhere. It is essential that sufficient funding be allocated for optimal creative dissemination, including time for multiple feedback processes and iterations. Future research would benefit from working with illustrators (or other creative collaborators) at the planning stages of projects to agree on clear expectations of deliverables (potentially with exemplars) and associated costs, and to develop an efficient working relationship.

Throughout the process, the research team were challenged on their assumptions about content, flow and storytelling. Content shifted by necessity from structured stories developed by the research team that fitted with the academic research output and included verbatim comments only, to a more nuanced approach that combined quotes, changed words and merged topics in order to engage the reader and imbue the sense of the topic rather than provide a precise reiteration of data. Our critical reflections highlighted the researchers' new experiences in needing to 'let go' of their academic world-views of data and dissemination in order to prioritize the key messages and the needs of non-academic consumers. This reflection aligned with earlier work on disseminating research with children that recommended allowing space for change and adaptation (Egli et al., 2019). Challenging elitist norms around what constitutes effective and impactful research dissemination is necessary to remove barriers in knowledge transfer between researchers and the communities they are aiming to serve. As well as the creative dissemination approach outlined here (and others described in Table 1), simply developing plain language summaries and engaging participants in producing outputs are recommended (Lomas, 2007).

Even so, the critical reflection process highlighted the fact that, while the range of children's submitted content was included, perspectives of the final output are limited to those of the research team. Here, we draw from Hunleth et al. (2022), reflecting on the meaningfulness of children's participation and attending to researcher power, assumptions and biases in the representation of children's data. The research team comprise experts in child

health, participatory research, childhood studies and health promotion. Together, this skill-set meant the team were familiar with data collection with children and engaging with and interpreting children's data in meaningful ways (e.g. see Carroll et al., 2021; Egli et al., 2021). Examples of facilitating meaningful participation were tailoring methods to children's needs (children could submit text, photographic data, or illustrations), avoidance of jargon and use of clear, simple language and messaging on the survey. At the same time, we were also conscious of, and cautious about, how our roles as adults, parents and researchers might influence our interpretation and storytelling, for example by diminishing perspectives that did not fit tidily with our adult ideas. We drew from our experience to mitigate these issues, including recognizing the rights of children to have their perspectives heard and given due weight (United Nations, 1989), considering children as competent social actors in their own right (Williams et al., 2022) and utilizing existing research alongside the data to help develop key groupings of information to form chapters. Even so, future approaches may also benefit from involving participants in co-creating creative dissemination outputs or, where appropriate, conducting participant checks to ensure the content reflects messages shared by participants (Candela, 2018). It is likely the assumptions and values of our team of adults who were familiar with, and passionate about, environment and health research impacted the storytelling in ways that we were not able to capture. As the survey for the current study was completely anonymous, these approaches were not possible here.

The COVID-19 pandemic has brought with it numerous lessons for the future and has increased the need for rapid innovation and clear and effective knowledge transfer. Much of the progress achieved is the result of biomedical science and research. Alongside this important work, a growing body of research has explored how the COVID-19 pandemic has affected daily life, including for children and their families (Aitken, 2021; Bessell, 2021; Freeman et al., 2021; Holt and Murray, 2021; Million, 2021). In this context, this graphic novel was unique due to its centring of children's perspectives, a strengths-based focus on what children liked about their neighbourhoods during lockdown and the use of visual storytelling to convey research evidence to a wide audience. Children have the right to have their perspectives heard and taken seriously (United Nations, 1989), and this extends to understanding what helped them during COVID-19 lockdowns. A range of research has been conducted to explore children's perceptions and experiences in the COVID-19 pandemic, specifically during lockdowns (Comisiynydd Plant Cymru – Children's Commissioner for Wales, 2020; Cuevas-Parra, 2020; Götz et al., 2020; Manaakitia Ā Tātou Tamariki – Office of the Children's Commissioner, 2020). However, outputs arising from research in this area have generally taken the form of journal articles or online research reports, and have not focused specifically on what worked well for children.

In terms of visual communication activities, the Phoenix Group generated resources to help families and schools support children's mental

wellbeing in general, but also specifically with regard to the impacts of COVID-19 on children (Phoenix Education Consultancy Limited, 2020). Alongside a range of downloadable toolkits and activities, active engagement has been supported through social media activities. Other examples of resources to support child wellbeing have been produced, although for the most part these have been based on extant knowledge rather than being direct outputs from COVID-19 specific research. Since the completion of this research, a study where children were invited to draw comics about their experiences has been published that highlighted the adult-centric nature of New Zealand's public health response to COVID-19 and the importance of working with children to understand their perspectives and needs for future policy and practice (Spray, 2022).

Sharing research directly with policymakers and practitioners was seen as an essential component to maximize research uptake (Schnitzler et al., 2016), but dissemination also extended to the general community. At the time of writing, the figshare link for the novel has been shared widely on social media platforms (Twitter, Facebook, Instagram). The novel has been shared as a PDF with stakeholders in urban design, transport planning, and children's health and wellbeing, as well as national ministries and international agencies, and groups interested in environments and child health and wellbeing. The graphic novel was picked up and shared in a range of ways across a wide audience base. For example, it was shared by Suzy Cato (a prominent presenter and producer of children's media for over three decades in New Zealand) on her YouTube channel 'Suzy's Book Corner' (Cato, 2021). Segments of the novel were also read, alongside playing snippets of the audiobook, on Suzy Cato's 'Suzy & Friends Radio Show'. The novel and its development was also profiled by the Editors of the journal *Kai Tiaki* (*Kai Tiaki* Editors, 2021) and was shared with nurses across the country through the College of Child and Youth Nurses Newsletter (New Zealand Nurses Organisation, 2022).

While the outputs were being completed by the team at approximately the same time, the graphic novel was made freely available on 13 May 2021 and it took a further eight months for the academic article to reach the public realm (predominantly due to time taken to review the manuscript, undertake revisions and re-review the manuscript). Free open access of the academic article to the public came at a cost of AUD3860. The graphic novel has received the most attention to date (Table 2) – interestingly in terms of Altmetric attention scores, members of the public comprised the highest proportion of those engaging with each of the outputs.

Measuring long-term uptake and societal benefits is fraught with challenges, including issues with measurement tools, timing and criteria for determining impact (Bornmann, 2012; Smith, 2001). These challenges are compounded by a historical over-reliance on bibliometric approaches

Table 2. Measures of engagement with the graphic novel, audiobook and journal article.

	Graphic novel	Audiobook of graphic novel	Journal article
Views	3004 ^a	1860 ^a	4387 ^c
Downloads	294 ^a	139 ^a	Not available
Altmetric	33 ^a	18 ^a	10 ^d
Altmetric ranking	Top 5%	Top 25%	Top 25%
Demographic characteristics of people engaging with the output by Altmetric attention score (%)			
Members of the public	61 ^b	55 ^b	67 ^d
Scientists	25 ^b	32 ^b	25 ^d
Practitioners	11 ^b	14 ^b	8 ^d
Science communicators	4 ^b	0 ^b	0 ^d

Note: all data were sourced on 2 September 2022 from: ^a<https://auckland.figshare.com>; ^b<https://figshare.altmetric.com>; ^c<https://www.tandfonline.com>; and ^d<https://www.altmetric.com>

for reporting and evaluating scientific research impact (Bornmann, 2017). Ultimately, understanding the true impact and uptake of these outputs will take time and ongoing targeted efforts to identify and assess uptake across a range of target audiences.

CONCLUSION

Creative and visual communication approaches can provide a useful complement to traditional academic outputs. Our research has demonstrated numerous potential advantages of developing creative outputs, in particular timely dissemination of freely-accessible information and enabling participants to have their perspective shared and reflected through multiple mediums. The limited bibliometric data presented suggest similar engagement by the general community between the creative output and academic article, but a higher level of practitioner engagement for the creative output. Team expertise in the topic and in illustration were important to enable the efficient development of a clear visual and written storyline. Future research would benefit from involving participants in generating creative outputs and undertaking detailed and long-term evaluation of uptake and impact.

ACKNOWLEDGEMENTS

The authors would like to thank the children who participated in this survey for taking the time to share their thoughts and perceptions. We would also like to acknowledge and thank all those who shared the survey invitation, including Dr Geoff Lealand, Suzy Cato, Women in Urbanism, and Bike

Auckland. Thank you to Dr Lisa Williams for providing feedback on the draft manuscript.

DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interest with respect to the research, authorship and publication of this article.

FUNDING

The authors disclosed receipt of the following financial support for the research, authorship and publication of this article: Melody Smith was supported by a Health Research Council Sir Charles Hercus Research Fellowship (17/013); Catherine Ma was supported by a Kate Edger Educational Charitable Trust summer scholarship; and Victoria Egli is supported by a Lotteries Health Research Postdoctoral Fellowship (# 128096).

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SUPPLEMENTAL MATERIAL

Supplemental material for this article is available online.

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