

**Title**

Mapping the Use of Comics in Health Education: A Scoping Review of the Graphic Medicine Literature

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**Background/Introduction**

Graphic medicine, a term coined by cartoonist-physician Ian Williams in 2007, is an emerging field of study concerned with the “intersection of the medium of comics and the discourse of healthcare”<sup>1</sup>. Authors of the *Graphic Medicine Manifesto* argue, “manifestos acknowledge that there is not one “universal subject”...” resulting in a field that has few boundaries beyond “comics” and “healthcare”<sup>2</sup>. Looking at the nine “Comics and Medicine” annual conference schedules quickly puts this into context, as you find presenter perspectives from comic studies, education, medicine, nursing, art therapy, library science, disability studies, gender and women’s studies, and more<sup>3</sup>.

Comics has long suffered a so-called “definitional project” that is beyond the scope of this study, but does force us to make clear our scope of the term<sup>4</sup>. For purposes of this study, we have adopted McCloud’s definition of comics: “Juxtaposed pictorial and other images in deliberate sequence, intended to convey information and/or to produce an aesthetic response in the viewer”<sup>5</sup>. This definition is not without problems, notably excluding single panel comics<sup>6,7</sup> (as will this study), its breadth allows our inclusion of fotonovelas while maintaining a distinction from illustrated books<sup>8</sup>.

Comics have a long history of use in education, albeit a history rife with conflict. While this conflict is beyond the scope of this study, it is impossible to discuss comics and education without acknowledging the damage caused the “comics scare” of the 1950’s and, in particular, by psychologist Fredric Wertham’s 1954 book, *Seduction of the Innocent*.<sup>9,10</sup> This scare led to a drastic decrease in comics’ popularity and prevalence in education – which was more common than often assumed - until the

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<sup>1</sup> I. Williams, "Why "Graphic Medicine", " <https://www.graphicmedicine.org/why-graphic-medicine/>.

<sup>2</sup> Ian Williams MK Czerwiec, Susan Merrill Squier, Michael J. Green, Kimberly R. Myers, and Scott T. Smith, *Graphic Medicine Manifesto* (University Park, PA: Pennsylvania State University Press, 2015).

<sup>3</sup> "Comics and Medicine Conferences," <https://www.graphicmedicine.org/comics-and-medicine-conferences/>.

<sup>4</sup> Thierry Groensteen, *The System of Comics* (Jackson: University Press of Mississippi, 2007).

<sup>5</sup> Scott McCloud, *Understanding Comics: The Invisible Art* (Northampton, MA: Kitchen Sink Press, 1993).

<sup>6</sup> Neil Cohn, "Un-Defining "Comics": Separating the Cultural from the Structural in "Comics", " *International Journal of Comic Art* 7, no. 2 (2005).

<sup>7</sup> Aaron Meskin, "Defining Comics?," *The Journal of Aesthetics and Art Criticism* 65, no. 4 (2007).

<sup>8</sup> A. Farthing and E. Priego, "'Graphic Medicine' as a Mental Health Information Resource: Insights from Comics Producers," *Comics Grid-Journal of Comics Scholarship* 6 (2016).

<sup>9</sup> Carol L. Tilley, "Seducing the Innocent: Fredric Wertham and the Falsifications That Helped Condemn Comics," *Information & Culture* 47, no. 4 (2012).

<sup>10</sup> David Hajdu, *The Ten-Cent Plague: The Great Comic-Book Scare and How It Changed America* (New York: Picador, 2009).

relatively recent resurgence.<sup>111213</sup> Examples of the use of comics in other areas of education are more numerous than can be included here, but some examples include: engaging students in science<sup>141516</sup>, communicating science to the public<sup>17</sup>, supporting English language learners<sup>18</sup>, teaching engineering students<sup>19</sup>, and developing multimodal literacy<sup>20</sup>.

Visual communication, including comics, are not new to medicine. In the mid-twentieth century, comics were employed to fight national health care reform with support from professional medical organizations<sup>2122</sup>. While not strictly educational, comics depicting "heroes of medicine" appeared early in comics history<sup>23</sup>, and depictions of healthcare workers have been ever-present and ever-evolving in comics<sup>24</sup>. Some early attempts at patient information and public health comics have been found, but their impact at the time is unclear<sup>25262728</sup>. Narrative, qualitative research about the experience of medicine presented in the medium of comics has also been reported<sup>29</sup>. The value of pictures,

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<sup>11</sup> W. W. D. Sones, "The Comics and Instructional Method," *The Journal of Educational Sociology* 18, no. 4 (1944).

<sup>12</sup> Gene Yang, "History of Comics in Education," <http://geneyang.com/comicsedu/history.html>.

<sup>13</sup> A. Humphrey, "Beyond Graphic Novels: Illustrated Scholarly Discourse and the History of Educational Comics," *Media International Australia*, no. 151 (2014).

<sup>14</sup> A. Negrete and C. Lartigue, "Learning from Education to Communicate Science as a Good Story," *Endeavour* 28, no. 3 (2004).

<sup>15</sup> J. Hosler and K. B. Boomer, "Are Comic Books an Effective Way to Engage Nonmajors in Learning and Appreciating Science?," *CBE Life Sci Educ* 10, no. 3 (2011).

<sup>16</sup> M. Tatalovic, "Science Comics as Tools for Science Education and Communication: A Brief, Exploratory Study," *Jcom* 8, no. 4 (2009).

<sup>17</sup> J. Shurkin, "Science and Culture: Cartoons to Better Communicate Science," *Proc Natl Acad Sci U S A* 112, no. 38 (2015).

<sup>18</sup> Jason Ranker, "Using Comic Books as Read-Alouds: Insights on Reading Instruction from an English as a Second Language Classroom," *The Reading Teacher* 61, no. 4 (2007).

<sup>19</sup> Katharine Shilcutt, "What Can Cartoonists Teach Engineers?," <http://news.rice.edu/2018/02/19/what-can-cartoonists-teach-engineers/>.

<sup>20</sup> Sean P Connors, "Weaving Multimodal Meaning in a Graphic Novel Reading Group," *Visual Communication* 12, no. 1 (2013).

<sup>21</sup> "Comics in the Fight against Government-Controlled Medicine," *Journal of the American Medical Association* 144, no. 1 (1950).

<sup>22</sup> H. K. Knoblauch, "A Campaign Won as a Public Issue Will Stay Won: Using Cartoons and Comics to Fight National Health Care Reform, 1940s and Beyond," *American Journal of Public Health* 104, no. 2 (2014).

<sup>23</sup> B. Hansen, "Medical History for the Masses: How American Comic Books Celebrated Heroes of Medicine in the 1940s," *Bulletin of the History of Medicine* 78, no. 1 (2004).

<sup>24</sup> C. Tilley, "Of Cornopleezeepi and Party Poopers: A Brief History of Physicians in Comics," *AMA J Ethics* 20, no. 1 (2018).

<sup>25</sup> "Health-Education Via Comic Books," *American Journal of Public Health and the Nations Health* 52, no. 10 (1962).

<sup>26</sup> E. Barnes, "Captain Chemo and Mr Wiggly: Patient Information for Children with Cancer in the Late Twentieth Century," *Social History of Medicine* 19, no. 3 (2006).

<sup>27</sup> Edward F. Schneider, "Quantifying and Visualizing the History of Public Health Comics," *iConference 2014 Proceedings* (2014).

<sup>28</sup> M. Krakow, "Graphic Narratives and Cancer Prevention: A Case Study of an American Cancer Society Comic Book," *Health Commun* (2016).

<sup>29</sup> M. B. Weaver-Hightower, "Losing Thomas & Ella: A Father's Story (a Research Comic)," *Journal of Medical Humanities* (2015).

illustrations, and pictograms (specifically not comics) in patient communication has been well-established since the 1990's<sup>303132</sup>.

This study sought to map the use of comics in health education to better understand: a) what populations are targeted and b) what effect(s) their use have. As the field of graphic medicine continues to grow and expand in use, these understandings will provide more solid footing for future research<sup>33</sup>. A scoping review was deemed appropriate for this purpose, as this methodology is well-suited to understanding an as-of-yet reviewed topic that spans disciplines<sup>34</sup>.

## Methods

To map the literature on the use of comics in health education, we conducted a scoping review under the methodological framework for scoping reviews as articulated by Arksey and O'Malley and further articulated by Levac *et al.*<sup>3536</sup> This methodology is the most commonly used methodology for scoping reviews.<sup>37</sup> The framework includes guidance on the following aspects, which are further detailed below: identifying the research question, identifying relevant studies, study selection, charting the data, and collating, summarizing, and reporting the results.

### Research question

This review was guided by the question, "How are comics employed in health education settings and what effects do they have?" We did not seek to address the question of "why" comics, as that question has been sufficiently addressed elsewhere.<sup>3839404142</sup>

### Relevant study identification

Our search protocol was developed to maximize the number of studies that were eligible for inclusion, consistent with our goal of mapping the landscape of the field. Two members of the research team are

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<sup>31</sup> P. S. Houts et al., "The Role of Pictures in Improving Health Communication: A Review of Research on Attention, Comprehension, Recall, and Adherence," *Patient Education and Counseling* 61, no. 2 (2006).

<sup>32</sup> I. M. Barros et al., "The Use of Pictograms in the Health Care: A Literature Review," *Res Social Adm Pharm* 10, no. 5 (2014).

<sup>33</sup> A. J. King, "Using Comics to Communicate About Health: An Introduction to the Symposium on Visual Narratives and Graphic Medicine," *Health Commun* (2016).

<sup>34</sup> Mai T. Pham et al., "A Scoping Review of Scoping Reviews: Advancing the Approach and Enhancing the Consistency," *Research Synthesis Methods* 5, no. 4 (2014).

<sup>35</sup> Hilary Arksey and Lisa O'Malley, "Scoping Studies: Towards a Methodological Framework," *International Journal of Social Research Methodology* 8, no. 1 (2005).

<sup>36</sup> Danielle Levac, Heather Colquhoun, and Kelly K. O'Brien, "Scoping Studies: Advancing the Methodology," *Implementation Science : IS* 5 (2010).

<sup>37</sup> Andrea C. Tricco et al., "A Scoping Review on the Conduct and Reporting of Scoping Reviews," *BMC Medical Research Methodology* 16 (2016).

<sup>38</sup> MK Czerwiec, *Graphic Medicine Manifesto*.

<sup>39</sup> Farthing and Priego, "'Graphic Medicine' as a Mental Health Information Resource: Insights from Comics Producers."

<sup>40</sup> S. McNicol, "Humanising Illness: Presenting Health Information in Educational Comics," *Medical Humanities* 40, no. 1 (2014).

<sup>41</sup> Negrete and Lartigue, "Learning from Education to Communicate Science as a Good Story."

<sup>42</sup> I. Williams, "Graphic Medicine: Comics as Medical Narrative," *Medical Humanities* 38, no. 1 (2012).

health sciences librarians and co-developed the search strategy. The value of search strategies being developed by information professionals is well-documented.<sup>43</sup>

Search terms were initially developed based on a more general MEDLINE (PubMed) search used by the primary author for a regular blog series, "This Week in Graphic Medicine"<sup>44</sup>. Search terms were expanded to capture the full scope of comics, including, for example: Comix, Manga, Graphic Novel\*, Photonovel\*, and the medical subject heading "Caricatures as Topic", which also captures "Cartoon as Topic". The terms "webcomic", "bande dessinée", and "fotonovel" were attempted but did not exist in the databases searched. See Appendix 1 for the full search strategy.

The following databases were searched: MEDLINE (PubMed), SCOPUS, CINAHL (EBSCO), Web of Science (Core Collection), ERIC, and Google Scholar. PsycINFO was searched initially but produced no relevant results using comics and education terminology. Google Scholar results were limited to the first 200, as sorted by relevance by Google. The searches were conducted without limiters so that results would be as broad as possible.

The search was initially conducted in January 2017 and was updated in October 2017. In addition to database searches, we hand-searched the reference lists of all included studies and followed-up on citations included in the aforementioned "This Week in Graphic Medicine" blog maintained by the primary author.

#### Study selection and charting

Included studies were required to be (1) healthcare relevant, (2) in the comics medium (as previously defined), and (3) involve purposeful education. Studies were then further excluded if they were about/included any of the following: animation, political cartoons, single panels, comedy, diagnostic tools, book reviews, art therapy, marketing, caricature, literary analysis, and/or historical analysis. No limits were placed on publication year, language, or study methodology. Every effort was made to obtain full-text of all potentially relevant studies based on initial screening, but those that were unobtainable were excluded.

Search results were de-duplicated in EndNote X8 and then initially managed using REDCap electronic data capture tools hosted at the University of Massachusetts Medical School.<sup>45</sup> Titles and abstracts of all citations were screened by two authors (MN/LL), with those that did not meet the inclusion criteria discarded. Citations were then returned to EndNote X8 for the remainder of the review. Full text of all remaining potentially relevant studies were then obtained and further assessed against inclusion/exclusion criteria (MN/LL). Studies whose relevance was in question were discussed openly among authors, with the final decision for inclusion made by MN.

Studies that met the inclusion criteria were charted using a data extraction sheet designed by LL and MN. Data were extracted by MN and LL (based on initial reviewer) and were further reviewed in totality

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<sup>43</sup> Angela J. Spencer and Jonathan D. Eldredge, "Roles for Librarians in Systematic Reviews: A Scoping Review," *Journal of the Medical Library Association : JMLA* 106, no. 1 (2018).

<sup>44</sup> Matthew Noe, "This Week in Graphic Medicine," <https://www.graphicmedicine.org/category/this-week-in-graphic-medicine/>.

<sup>45</sup> Paul A. Harris et al., "Research Electronic Data Capture (Redcap)—a Metadata-Driven Methodology and Workflow Process for Providing Translational Research Informatics Support," *Journal of Biomedical Informatics* 42, no. 2 (2009).

by MN. The following data was extracted: publication year, study design, study question, study population (students; patients; consumers; other), sample size, country (of participants), intervention type (reading; creating; other), genre of comic, nature of comic (creation information), study outcomes, and notable conclusions.

### Summation of results

Upon completion of data extraction, data was compiled into Microsoft Excel and grouped into categories according to their primary study population: students, patients, consumers, and other. Smaller categories (those with <10 studies) comprise the "other" category and include healthcare practitioners and active military. Methodological quality or risk of bias were not evaluated and results are presented in narrative format, as is consistent with scoping review methodology.<sup>4647</sup>

## **Results**

### *Description of included studies*

The initial search identified 5,097 studies after duplicates were removed. Screening of titles and abstracts left 1,443 studies that required further review. This number was significantly higher than originally anticipated by the authors and was caused by two major factors: the ambiguity of the term "comics" and a significant number of citations containing no abstract. After full-text review, 167 articles were selected for inclusion. For a full list of included articles, see Appendix 2.

### **Students**

We identified seventy-four articles that specifically addressed the use of comics to teach health in classroom settings, divided among the following populations: K-12 (50), college (4), medical school (17), and other groups (3).

#### *K-12*

Fifty studies examined comics in K-12 populations, with the earliest example coming from a 1958 study examining the impact of reading the *Rex Morgan* comic strip on 1190 high school students understanding of mental health. Results indicated that the comic format was well-received by students and there were small knowledge gains by a "minority of students"<sup>48</sup>. Similar results were reported in studies using comics to educate about food choice<sup>495051</sup>, learning about viruses<sup>5253</sup>, and are repeated

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<sup>46</sup> Arksey and O'Malley, "Scoping Studies: Towards a Methodological Framework."

<sup>47</sup> Levac, Colquhoun, and O'Brien, "Scoping Studies: Advancing the Methodology."

<sup>48</sup> Arnold M. Rose, "Mental Health Attitudes of Youth as Influenced by a Comic Strip," *Journalism Quarterly* 35, no. 3 (1958).

<sup>49</sup> M. M. Leung et al., "Manga Comic Influences Snack Selection in Black and Hispanic New York City Youth," *Journal of Nutrition Education and Behavior* 46, no. 2 (2014).

<sup>50</sup> May May Leung et al., "Fight for Your Right to Fruit: Development of a Manga Comic Promoting Fruit Consumption in Youth," *Open Nutrition Journal* 9 (2015).

<sup>51</sup> M. M. Leung et al., "Fight for Your Right to Fruit: Psychosocial Outcomes of a Manga Comic Promoting Fruit Consumption in Middle-School Youth," *Health Commun* (2016).

<sup>52</sup> J. Diamond et al., "Viruses, Vaccines and the Public," *Mus Soc Issues* 11, no. 1 (2016).

<sup>53</sup> A. N. Spiegel et al., "Engaging Teenagers with Science through Comics," *Res Sci Educ* 43, no. 6 (2013).

nearly identically across all comics reading only interventions (25), regardless of study design, sample size, or location.

Studies that focused on creating comics (6) were also reported. These studies found that the creative process was an empowering experience for the students<sup>54</sup>, though their generalizability is in question as sample sizes were low. No studies reported the combination of both comics reading and creating, but an additional nineteen studies described the use of comics as part of an intervention package, including combinations of video, classroom lesson/activities, and/or exercise questions. In these studies, it becomes impossible to evaluate the specific impact of the comics alone, however a series of studies on stroke education in Japan have proven effective and show that a manga and cartoon are valuable even without teacher intervention<sup>5556575859</sup>.

### *College (Non-Medical)*

Four studies addressed the role of health related comics in college courses, all of which are more descriptive than evaluative. Alexio, author of the comic book textbook *Biological Psychology*, and Norris describe using graphic novels to stimulate discussion, encourage research skills, and explore the impact of psychology on popular culture<sup>60</sup>. Squier and Mayo describe using health comics with graduate students to explore the experiences of illness and share their students' responses, which describe comics as offering multiple ways of knowing and reports of greater empathy<sup>6162</sup>. McNicol moves beyond descriptive studies with a series of interviews with students to better understand how comics can provide support in dealing with mental health conditions. Emerging themes included making complex topics easier to understand, increased empathy, more engaging, but also a general lack of awareness that health relevant comics even existed prior to study participation<sup>63</sup>.

### *Medical School*

Seventeen studies described the use of comics with medical students, all specifically targeting undergraduate medical education, with the earliest (2010) being description of a course taught by

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<sup>54</sup> B. W. Dandolini et al., "Rational Use of Antibiotics: An Experiment for the Health Education of School Children," *Ciencia e Saude Coletiva* 17, no. 5 (2012).

<sup>55</sup> Yuki Sakamoto et al., "Effects of Stroke Education Using an Animated Cartoon and a Manga on Elementary School Children," *Journal of Stroke & Cerebrovascular Diseases* 23, no. 7 (2014).

<sup>56</sup> Yuya Shigehatake et al., "Stroke Education Using an Animated Cartoon and a Manga for Junior High School Students," *ibid.*, no. 6.

<sup>57</sup> K. Matsuzono et al., "Effects of Stroke Education of Junior High School Students on Stroke Knowledge of Their Parents: Tochigi Project," *Stroke* 46, no. 2 (2015).

<sup>58</sup> S. Ohyama et al., "Effective Education Materials to Advance Stroke Awareness without Teacher Participation in Junior High School Students," *Journal of Stroke and Cerebrovascular Diseases* 24, no. 11 (2015).

<sup>59</sup> Akiko Ishigami et al., "Delivering Knowledge of Stroke to Parents through Their Children Using a Manga for Stroke Education in Elementary School," *Journal of Stroke & Cerebrovascular Diseases* 26, no. 2 (2017).

<sup>60</sup> Paul A. Aleixo and Claire E. Norris, "Planarian Worms, Shock Generators and Apathetic Witnesses: Teaching Psychology and Graphic Novels," *Psychology Teaching Review* 19, no. 1 (2013).

<sup>61</sup> S. M. Squier, "Graphic Medicine in the University," *Hastings Center Report* 45, no. 3 (2015).

<sup>62</sup> Carolyn M. Mayo, "Use of a Popular Comic Strip Character as a Teaching Tool in Aphasia: The Case for "Grandpa Jim", " *SIG 10 Perspectives on Issues in Higher Education* 14, no. 2 (2011).

<sup>63</sup> S. McNicol, "The Potential of Educational Comics as a Health Information Medium," *Health Information and Libraries Journal* (2016).

physician Michael Green to fourth year medical students<sup>64</sup>. Green expands on this work in 2011<sup>65</sup> and 2013<sup>66</sup> before conducting a thematic analysis of 58 students' comics projects that provide insight into the transformative experiences of professional identity formation and empathy development<sup>67</sup>. Studies by Vaccarella<sup>68</sup>, Babaian and Chalian<sup>69</sup>, George and Green<sup>70</sup>, and Tsao and Yu<sup>71</sup> further address the need to combat empathy decline in medical education, stating that "the comics may serve as a reminder and reflection tool for the importance of empathy by increasing knowledge on the patient perspective, attitudes toward empathy and observational skills." This focus on empathy is seen in studies both about creating comics (telling students' stories) and in reading comics (both patient and practitioner experiences).

Additionally, an ongoing series of educational anatomy comics have been studied for their effectiveness in medical education. Park, Ki, and Chung first describe the comics in 2011, remarking that reception to the comics "has been generally favorable", despite the more simplistic, two-dimensional art style<sup>72</sup>. Follow-up studies in 2013<sup>73</sup> and 2016<sup>74</sup> found that course grades were higher for those students who reported engagement with the comics than for those who did not and students felt the comics were engaging and useful conversation starters.

### *Other*

In addition to the aforementioned expected population groups, two studies describing comics in nursing education and one study with undergraduate, pre-medical students were found. Overbay describes a course on childhood development in which nursing students are asked to "clip comics that demonstrate developmental principles of childhood and write an explanation of the principle" and reports student enjoyment for the assignment<sup>75</sup>. El Hussein, Salyers, and Osuji describe using comics to teach the concept of malignancy to nursing students, who expressed appreciation for the images and indicated

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<sup>64</sup> M. J. Green and K. R. Myers, "Graphic Medicine: Use of Comics in Medical Education and Patient Care," *BMJ (Online)* 340, no. 7746 (2010).

<sup>65</sup> M. J. Green and M. J. Green, "A Course on Comics and Medicine for 4th Year Medical Students," *Journal of General Internal Medicine* 26 (2011).

<sup>66</sup> M. J. Green, "Teaching with Comics: A Course for Fourth-Year Medical Students," *Journal of Medical Humanities* 34, no. 4 (2013).

<sup>67</sup> "Comics and Medicine: Peering into the Process of Professional Identity Formation," *Academic Medicine* 90, no. 6 (2015).

<sup>68</sup> M. Vaccarella, "Exploring Graphic Pathographies in the Medical Humanities," *Medical Humanities* 39, no. 1 (2013).

<sup>69</sup> C. S. Babaian and A. A. Chalian, "'The Thyroidectomy Story': Comic Books, Graphic Novels, and the Novel Approach to Teaching Head and Neck Surgery through the Genre of the Comic Book," *Journal of Surgical Education* 71, no. 3 (2014).

<sup>70</sup> D. R. George and M. J. Green, "Lessons Learned from Comics Produced by Medical Students: Art of Darkness," *JAMA* 314, no. 22 (2015).

<sup>71</sup> P. Tsao and C. H. Yu, "'There's No Billing Code for Empathy' - Animated Comics Remind Medical Students of Empathy: A Qualitative Study," *BMC Medical Education* 16, no. 1 (2016).

<sup>72</sup> J. S. Park, D. H. Kim, and M. S. Chung, "Anatomy Comic Strips," *Anatomical Sciences Education* 4, no. 5 (2011).

<sup>73</sup> D. S. Shin et al., "Evaluation of Anatomy Comic Strips for Further Production and Applications," *Anat Cell Biol* 46, no. 3 (2013).

<sup>74</sup> J. Kim et al., "The Use of Educational Comics in Learning Anatomy among Multiple Student Groups," *Anatomical Sciences Education* (2016).

<sup>75</sup> J. D. Overbay, "Comics and Childhood Development," *Nurse Educ* 26, no. 6 (2001).

that “in high-stress clinical situations, they were able to recall [comics] when discussing complex pathophysiologic concepts with clinical faculty”<sup>76</sup> With pre-medical students, Weber describes a course in which students used a digital comics creation tool (Pixton) to create a graphic narrative exploring medical ethics and reports that students, except for those encountering technical difficulties, enjoyed the experience<sup>77</sup>.

### **Patients**

We identified twenty-two articles that specifically addressed the use of comics with patients and/or their families, divided among children (10), adults (10), and families (2).

#### *Children*

Ten studies described interventions of comics reading with child and adolescent patients, including an uncommon for the field series of randomized studies evaluating compliance with occlusion therapy in young children<sup>78,79,80</sup>. Compliance was improved in all three studies at a significant rate, however it is difficult to evaluate the role of the comics in the improvement on their own as other interventions, such as a course on compliance, were also part of the intervention. A feasibility study from 2017 found a comic given in the emergency department to 50 injured children to be “likeable, easy to read, and provided important information to both children and their caregivers.”<sup>81</sup> Of particular note for this study is the comic was created by Gary Ashwal and Dr. Alex Thomas, founders of Booster Shot Media and the creators of *Iggy and the Inhalers*, making it a rare, clear example of professional comics creator involvement in a study.

#### *Adults*

Ten studies described comics reading interventions with adult patients, all of which focused on populations at risk of being underserved by modern medicine whether due to location or language barriers. Studies were primarily survey (4) or interview (4) based and involved small, specific populations making generalization difficult, however comics were rated highly favorable (93% in one study<sup>82</sup>) and changes to more healthy behavior were reported<sup>83</sup>. In one mixed-methods study evaluating the feasibility of decision aids for early stage breast cancer targeting low-SES patients, more than half of the

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<sup>76</sup> Mohamed Toufic El Hussein, Vincent Salyers, and Joseph Osuji, "Use of Visual Narrative Illustrations to Teach Pathophysiology Concepts to Nursing Students," *Journal of Nursing Education* 55, no. 2 (2016).

<sup>77</sup> Alan S. Weber, "Use of Cloud-Based Graphic Narrative Software in Medical Ethics Teaching," (International Association for Development of the Information Society, 2015).

<sup>78</sup> S. E. Loudon et al., "Predictors and a Remedy for Noncompliance with Amblyopia Therapy in Children Measured with the Occlusion Dose Monitor," *Invest Ophthalmol Vis Sci* 47, no. 10 (2006).

<sup>79</sup> A. M. Tjiam et al., "An Educational Cartoon Accelerates Amblyopia Therapy and Improves Compliance, Especially among Children of Immigrants," *Ophthalmology* 119, no. 11 (2012).

<sup>80</sup> A. M. Tjiam et al., "Randomised Comparison of Three Tools for Improving Compliance with Occlusion Therapy: An Educational Cartoon Story, a Reward Calendar, and an Information Leaflet for Parents," *Graefes Arch Clin Exp Ophthalmol* 251, no. 1 (2013).

<sup>81</sup> A. Hanson et al., "The Feasibility of Utilizing a Comic for Education in the Emergency Department Setting," *Health Commun* 32, no. 5 (2017).

<sup>82</sup> G. B. Piccoli et al., "Patient Knowledge and Interest on Dialysis Efficiency: A Survey," *Int J Artif Organs* 25, no. 2 (2002).

<sup>83</sup> M. S. Dworkin et al., "Efficacy of a Food Safety Comic Book on Knowledge and Self-Reported Behavior for Persons Living with Aids," *PLoS ONE* 8, no. 10 (2013).



participants found the comic style option “insensitive and/or trivializing”, which may raise questions about the appropriateness of comics in certain situations<sup>84</sup>. It is notable that there was not a trained cartoonist involved in this study.

### *Families*

Two studies, by the same research team, describe evaluating comics as a tool for obtaining informed consent from family members in emergency stroke care<sup>8586</sup>. The studies were carried out in Japan, with manga-style comics, where comics have a long history of acceptance, and results showed that 93.8% of responders would prefer the use of comics in medical situations.

### **Consumers**

We identified sixty-two articles that specifically addressed the use of comics to reach consumer audiences divided among the following populations: children (22), adults (24), and other groups (16).

### *Children*

Twenty-two studies examined the use of comics with a specifically child and/or adolescent consumer in mind, however twelve of these presented no data on impact or effectiveness and a further three were paired with other interventions (including coursework and videos) and present no way to evaluate the impact of the comics intervention on its own. Nine studies from the 1990’s focus on HIV/AIDS education and describe the key component of comics interventions being the involvement of the target population in the comics development, which is discussed at length in three studies<sup>878889</sup>.

Viruses and HIV in particular are popular targets of health education comics. Following in the footsteps of the studies of the 90’s, a comic titled *AIDS in the End Zone* was developed in 2012/13 and tested with at-risk teenagers in South Carolina to determine potential as a prevention resource<sup>90</sup>. Another describes the development and initial testing of a series of comics titled *The World of Viruses* that were tested alongside traditional essays to determine if comics would be more effective at reaching younger audiences<sup>91</sup>. Both of these studies found that post-exposure knowledge was marginally improved – and on par with those reading a traditional essay – but importantly, the comics had the effect of encouraging further interest in the topic.

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<sup>84</sup> S. Alam et al., "Assessing the Acceptability and Feasibility of Encounter Decision Aids for Early Stage Breast Cancer Targeted at Underserved Patients," *BMC Medical Informatics and Decision Making* 16, no. 1 (2016).

<sup>85</sup> Y. Furuno et al., "Informed Consent Using Medical Comics for a Stroke Patient's Family," *Cerebrovascular Diseases* 35 (2013).

<sup>86</sup> George and Green, "Lessons Learned from Comics Produced by Medical Students: Art of Darkness."

<sup>87</sup> J. Harvey, "Design of a Comic Book Intervention for Gay Male Youth at Risk for Hiv," *J Biocommun* 24, no. 2 (1997).

<sup>88</sup> T. Toroyan and P. Reddy, "Evaluation of a Learner-Produced Photocomic in South Africa," *Int Q Community Health Educ* 17, no. 4 (1997).

<sup>89</sup> "Participation of South African Youth in the Design and Development of Aids Photocomics," *International Quarterly of Community Health Education* 17, no. 2 (1997).

<sup>90</sup> Kendra S. Albright and Karen Gavigan, "Information Vaccine: Using Graphic Novels as an Hiv/Aids Prevention Resource for Young Adults," *Journal of Education for Library and Information Science* 55, no. 2 (2014).

<sup>91</sup> J. Diamond et al., "Museum Monsters and Victorious Viruses: Improving Public Understanding of Emerging Biomedical Research," *Curator-the Museum Journal* 58, no. 3 (2015).

### Adults

Twenty-four studies examined the use of comics with a specifically adult consumer in mind, however eight of these presented no data on impact or effectiveness and four were paired with other interventions with no way to evaluate the impact of the comics intervention on its own. All but two studies specifically targeted populations considered to be underserved in modern medicine, with the major focus being on those at risk of low-literacy (immigrants, non-English speaking groups, etc.). Five studies involved the target populations in both the creation and reading of the comic, all of which found the inclusion of the community important for creating a culturally appropriate and interesting tool. A worker produced comic and a Somali immigrant informed *historietas* are two notable examples<sup>92,93</sup>.

There are some unique studies in this study category that deserve special attention because they raise hard questions for the field. The largest study found, with 35,000 potential readers, was a skin cancer education comic (the campaign also included other interventions) distributed in Hawaii in the 1980's that showed modest increases in reader knowledge in a pre/posttest survey<sup>94</sup>. In an effort to improve cervical screening in South Africa, a study evaluated the impact of photo-comics (and a radio-drama) on uptake of the screening and found that the comic only inspired 1% more women to action<sup>95</sup>. This study, published in 2004, matches up with decades of research indicating that knowledge alone does not lead to behavior change. In a study designed to test various HPV education strategies in Columbia, researchers found that a comic was the most frequently remembered intervention, but it was the love story that was remembered, not necessarily the health information<sup>96</sup>.

### Other Groups

Sixteen further consumer studies were identified that target wider groups than simply children/adolescents or adults, with major focuses being on "development" and family units. Development studies are focused on so-called developing nations and range from two studies from 1978 and 1980 arguing for the use of comics/fotonovelas based on their appeal to a review study by Barbara Barnett that highlights the fundamental flaw in comics education studies to date: their lack of impact data<sup>97,98,99</sup>. This lack of data is evident here as ten of the sixteen studies do not offer effectiveness or impact data. Most recently, a 2016 study, continuing the trend of studies that confirm comics appeal in health education settings, found that fotonovelas designed to raise awareness of eating disorders in the

<sup>92</sup> D. L. Roter et al., "Worker Produced Health Education Material for the Construction Trades," *Int Q Community Health Educ* 7, no. 2 (1986).

<sup>93</sup> S. D. Jacoby et al., "A Mixed-Methods Study of Immigrant Somali Women's Health Literacy and Perinatal Experiences in Maine," *Journal of Midwifery and Women's Health* 60, no. 5 (2015).

<sup>94</sup> G. L. Putnam and K. L. Yanagisako, "Skin Cancer Comic Book: Evaluation of a Public Educational Vehicle," *Cancer Detection and Prevention* 5, no. 3 (1982).

<sup>95</sup> L. Risi et al., "Media Interventions to Increase Cervical Screening Uptake in South Africa: An Evaluation Study of Effectiveness," *Health Education Research* 19, no. 4 (2004).

<sup>96</sup> Lizeth K. Barrera-Clavijo, Carolina Wiesner-Ceballos, and Lina M. Rincón-Martínez, "Evaluation of Human Papilloma Virus Communicative Education Strategies: A Pilot Screening Study for Cervical Cancer," *Health Education Journal* 75, no. 4 (2016).

<sup>97</sup> E. A. Opilas, "Comics: A Medium for Today's Development Messages," *Initiatives in population* 4, no. 1 (1978).

<sup>98</sup> Ronald Parlato and et al., "Fotonovelas and Comic Books--the Use of Popular Graphic Media in Development," (1980).

<sup>99</sup> Barbara Barnett, "Emma Says: A Case Study of the Use of Comics for Health Education among Women in the Aids Heartland," *Feminist Media Studies* 4, no. 2 (2004).

US Latino community sparked interest and could present a new avenue for communication on this topic<sup>100</sup>.

### **Other**

We identified eight articles that addressed populations that do not fit within our pre-established groupings, divided among the following populations: practitioners (7) and active military (1).

#### *Practitioners*

Seven studies describing comics reading for healthcare practitioners were identified, all published since 2012, with three seeking to improve knowledge, three building a case for comics use, and one surveying practitioners willingness to use comics with patients. The survey is a follow-up to the previously discussed ocular therapy comics studies and describes the mixed-feelings of practitioners about implementation, with negative feelings stemming from the time investment required<sup>101</sup>. This is an important finding, as other studies have not addressed whether comics, even when proven valuable, will be adopted by practitioners and future studies are needed. Also notable is a study that examines the use of a comic teaching tool to engender empathy during a clinical encounter for both patient and practitioner; unfortunately no data was collected, but this highlights an exciting possibility for comics as a co-learning tool<sup>102</sup>

#### *Active Military*

One study was found that discusses the development of comics for use in education around mental health and coping strategies for members of the Navy and Marine Corps<sup>103</sup>. The study provides a valuable contribution to the field of graphic medicine by outlining a clear path for the development of medical comics, including discussion around the inclusion of the target population in story and artwork development. The feedback, including suggestions such as keeping artwork realistic and minimizing onomatopoeia, is applicable to populations far beyond active military.

### **Discussion**

Our review identified 167 articles that discuss the explicit use of the comics medium to educate a population about an aspect of health. These articles begin to paint a picture of the role comics have had in health education and can be used to draw a rough timeline of the emergence of the field of graphic medicine. This timeline begins with an outlying article in 1958 about using comics to impact mental health attitudes of high school students<sup>104</sup>, then jumps to the late 1970's, through the 1980's, and into the mid-1990's with a strong focus on development educational programs, primarily focused on

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<sup>100</sup> M. L. Reyes-Rodríguez et al., "Development of Fotonovelas to Raise Awareness of Eating Disorders in Latinos in the United States," *Revista Mexicana de Trastornos Alimentarios* 7, no. 1 (2016).

<sup>101</sup> A. M. Tjiam et al., "Implementation of an Educational Cartoon ("the Patchbook") and Other Compliance-Enhancing Measures by Orthoptists in Occlusion Treatment of Amblyopia," *Strabismus* 24, no. 3 (2016).

<sup>102</sup> P. F. Anderson, E. Wescom, and R. C. Carlos, "Difficult Doctors, Difficult Patients: Building Empathy," *Journal of the American College of Radiology* 13, no. 12 (2016).

<sup>103</sup> L. Hourani et al., "Graphic Novels: A New Stress Mitigation Tool for Military Training: Developing Content for Hard-to-Reach Audiences," *Health Commun* (2016).

<sup>104</sup> Rose, "Mental Health Attitudes of Youth as Influenced by a Comic Strip."

immunization<sup>105106</sup> and HIV/AIDS prevention<sup>107108</sup>. The focus on HIV/AIDS prevention is a hallmark of educational comics in the West as well during this time, coinciding strongly with the underground comics movement<sup>109110</sup>. In the late 1990's and early 2000's, comics use becomes more sporadic, but studies during this time begin focusing on the value of comics as both a tool able to address cultural barriers, as well as health literacy. One notable example of this was in the use of a comic book to improve knowledge of and reduce stigma related to filariasis in Egyptian children<sup>111</sup>.

Then, in 2007, the year the term graphic medicine was coined<sup>112</sup>, the proverbial floodgates opened: of the 167 studies included, 97 of them have been published since 2007. While comics targeting consumers continued, they become a minority after 2007, as comics studied with patients (17 since 2007; 5 prior), K-12 students (33 since 2007; 17 prior), and college and nursing students (6 since 2007; 1 prior) rose dramatically. Every study identified involving medical students (17) was published in 2010 and later.

In thinking about comics in medical education, as well as in other formal educational settings, the relative youngness of the field in these populations raises interesting questions that deserve attention. Why the rapid emergence of the field now? Will this growth be maintained or are we witnessing an educational fad? At present, few articles addressing comics creation in the classroom include a cartoonist-as-teacher – what role should they play and should we push for that expertise to be present in classrooms? What can comics as a health education tool learn from other educational comics programs? Of all included articles, only 33 (19.7%) describe comics creation as an aspect of the intervention – why might this be? And, of particular importance, the question of how the use of comics, particularly in the medical school environment, is to be evaluated and reported on cries out for an answer.

On the question of impact, a quote from a 1998 article describing a comic book that promotes good eating habits, captures the current state of research: “no quantifiable way to measure the results... however, feedback has been overwhelmingly positive”<sup>113</sup>. We find that there is more than sufficient evidence that comics are an appealing medium for presenting health information in educational settings and recommend that future studies focus on proving their ability to impact knowledge transfer, empathy development, and behavioral change. An important note on appeal however, is that in many cases, “the study participants clearly stated that although a comic may be about health promotion, they

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<sup>105</sup> I. Rana, "Immunization in India: How Comic Books Can Teach Children What They Need to Know," *World Health Forum* 7, no. 3 (1986).

<sup>106</sup> Indi Rana, "Comics for Health," *Development Communication Report* 59 (1987).

<sup>107</sup> Mary R. Gillmore and et al., "The Process and Pitfalls of Developing a Culturally Relevant Curriculum to Reduce Aids among Sexually Active Teenagers: The Take 5 Project," (1992).

<sup>108</sup> K. Cash, B. Anasuchatkul, and W. Busayawong, "'Lamyai' Teaches Young Thai Women About Aids and Stds," *AIDS health promotion exchange / World Health Organization, Global Programme on AIDS, Health Promotion Unit*, no. 1 (1994).

<sup>109</sup> P. A.Gillies, A. Stork, and M. Bretman, "Streetwise Uk: A Controlled Trial of an Aids Education Comic," *Health Education Research* 5, no. 1 (1990).

<sup>110</sup> Harvey, "Design of a Comic Book Intervention for Gay Male Youth at Risk for Hiv."

<sup>111</sup> M. A. el-Setouhy and F. Rio, "Stigma Reduction and Improved Knowledge and Attitudes Towards Filariasis Using a Comic Book for Children," *J Egypt Soc Parasitol* 33, no. 1 (2003).

<sup>112</sup> Williams, "Why 'Graphic Medicine'".

<sup>113</sup> J. Herreria, "Hospital's Comic Book Promotes Benefits of Good Eating Habits. Grocery Chain Joins Campaign with 'Cancer Day' Promotion. Parkview Hospital, Fort Wayne, In," *Profiles Healthc Mark* 14, no. 2 (1998).

did not want it to blatantly educate the reader"<sup>114</sup>. Future studies may wish to take the idea of "hidden education" into consideration when developing comics and when evaluating their effectiveness.

A few observations about the state of publishing this field bear stating. Just over half (54%) of the included articles failed to make available any example of the comics being studied, whether as part of the published article or available through other means. This makes the evaluation of results difficult, particularly in cases where questions of appeal are concerned, as the quality of the comic may impact the results. Few studies describe in detail the process of development of the comic, furthering a knowledge gap for those unfamiliar with cartooning. A notable exception being a 2016 article devoted entirely to the development process<sup>115</sup>. As discussed in our methodology, it is worth repeating that the terminology of comics creates significant problems in discoverability. It is the authors suggestion that all future publications in this area include the word "comic" in the title, abstract, and/or keywords to improve discoverability and help eliminate confusion surrounding the medium.

All studies are inherently limited and ours is no different, including biases toward English language articles and articles published from Western countries – common limitations throughout all North American scholarship.<sup>116</sup> In addition, as is evidenced by the wealth of information on GraphicMedicine.org, comics involvement in health education is significantly broader than what is captured through a review of the published, scholarly literature. One such example, physician and cartoonist Benjamin Schwartz is noted to have taught comics at Columbia as part of their Narrative Medicine program, but no scholarly publications were found detailing this work.<sup>117</sup> Numerous other examples of courses like this exist. The other notable limit stems from our choice of definition for "comics", which excluded single panels. Other studies may wish to examine this area further.

## Conclusion

Comics have a long history of use in consumer health education and recent years have seen a dramatic increase in their use in both classroom and clinical settings. Despite this long history of use, and sufficient evidence of their appealing nature, there remains a need for compelling research to determine their impact on knowledge transfer, empathy gain, and behavioral change. Future research should consider the separate impacts that comics creation and comics reading may have on participants, and when considering comics creation, we suggest the inclusion of practicing cartoonists whose expertise is invaluable. Publications detailing the process of creating educational comics, the pedagogy of teaching cartooning in the health sciences, and explorations of clinical uses of comics are particularly rich areas for exploration. It is the authors' hope that this review serve as a starting point for this future research, so that efforts can be focused on looking forward and building on the work of the past – without necessarily having to go searching for it.

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<sup>114</sup> Leung et al., "Fight for Your Right to Fruit."

<sup>115</sup> L. A. Willis et al., "Developing a Motion Comic for Hiv/Std Prevention for Young People Ages 15-24, Part 1: Listening to Your Target Audience," *Health Commun* (2016).

<sup>116</sup> Michelle Baildon, "Extending the Social Justice Mindset: Implications for Scholarly Communication," *2018* 79, no. 4 (2018).

<sup>117</sup> Walyce Almeida, "Dr. Benjamin Schwartz, Cartoonist, Draws on Medical Training," Columbia University, <http://news.columbia.edu/content/dr-benjamin-schwartz-cartoonist-draws-medical-training>.

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