HPJ HEALTHY POPULATIONS JOURNAL

Literature Review

Infographics and/or Pictograms and Medication Adherence: A Scoping Review

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DOI: 10.15273/hpj.v3i2.11553

Abstract

Introduction: Medication adherence is the act of following medication instructions from a health care provider. Infographics and pictograms are visual science communication tools that have been shown to improve medication adherence. **Objective:** To synthesize and critically evaluate literature surrounding the use of infographics and pictograms in medication adherence. **Methods:** We conducted a literature search on PubMed, Ovid MEDLINE, CINAHL, Web of Science, and PsycInfo with the purpose of identifying literature published between the years 2000 and 2022. Primary research articles were included for quantitative analysis if they explored/reported the following topics and/or outcomes: (a) infographics and/or pictograms as the exposure of interest and (b) adherence, comprehension, or health outcomes as the outcome measures. **Results:** 30 studies were included in the results. Outcome measures assessed included (a) comprehension and understanding of factors surrounding medication adherence, (b) medication adherence, and (c) health outcomes. Our review of the studies showed that 87.5% of studies measuring outcome (a), 78.2% of those measuring outcome (b), and 100% of those measuring outcome (c) found improvements when using infographics or pictograms. **Conclusion:** Our review supports the use of infographics and pictograms as a means of improving medication adherence among a diverse set of demographics, illnesses, and treatments. **Practice Implications:** Infographics and pictograms are useful tools to improve medication adherence. When these tools are designed carefully, they increase the accessibility of medication information in a wide range of patient populations.

Introduction

Medication adherence, also known as medication compliance, is the act of following medication instructions from a health care provider with respect to dosage, timing, and frequency (Cramer et al., 2008). Patient understanding is an important contributor to medication adherence (Ebrahimabadi et al., 2019). Despite numerous advancements in drug development, over 50% of patients with chronic illnesses fail to follow their medication regimen, resulting in substantial morbidity and mortality (Cutler et al., 2018). In addition to the detrimental effects on patient wellness, poor medication adherence to prescribed treatment for chronic illnesses costs up to $290 billion annually in the United States (Chongpornchai et al., 2021). Lack of patient understanding of how their prescribed medication works to combat their illness remains a significant contributor to medication nonadherence (Ebrahimabadi et al., 2019). For example, it is estimated that 20% of maternal deaths are caused by severe anemia (Galloway & McGuire, 1994). Programs to alleviate anemia have largely been ineffective due to poor adherence to iron supplementation (Galloway & McGuire, 1994).

Background

Many strategies have been implemented to increase patient understanding of factors related to adherence, including brief counselling time with a health care provider (De Tullio et al., 1987), use of electronic medication delivery devices for monitoring and feedback (Nides et al., 1993), and multi-component care plans involving a team of caregivers (Garcia-Aymerich et al., 2007). Garcia-Aymerich et al. found improvements when using a multi-component intervention involving the integration of education and treatment among levels of care with a team of caregivers. Furthermore, De Tullio et al. (1987) witnessed improvements in adherence when patients were provided with three- to five-minute in-person counselling sessions with a health care provider. Additionally, benefits in medication adherence were noted when using an electronic medication delivery device that provided patients with feedback on their medication-taking behaviour; brief sessions with health educators were administered prior to the use of these devices (Nides et al., 1993). These interventions highlight the importance of patient education in improving medication adherence, yet remain challenging to implement due to time constraints, budget considerations, possible language barriers, and health care and technology accessibility concerns.

Visual communication offers a promising method to provide cost-efficient, accessible patient information. Two commonly used visual communication tools include infographics (information graphics; graphics paired with short text) and pictograms (graphics to represent ideas or text; Chanzu et al., 2023). These tools harness the brain's ability to process visual information rapidly (Otten et al., 2015). Visual communication tools can communicate health risk data through graphs and illustrations, allow information to be visualized, and can be adapted to various formats (Ebrahimabadi et al., 2019), such as those of different cultural contexts, health care settings, and languages. They have been postulated to improve the recall of information and enhance comprehension when used as a tool to improve medication adherence, both in combination with text and independently (Dowse & Ehlers, 2005); however, a comprehensive scoping literature review on infographics and medication adherence was lacking, according to the first author's search. The objective of this scoping literature review is to summarize and observe trends in the available literature surrounding the use of infographics and/or pictograms in medication adherence.

Methods

Search Strategy

We conducted a scoping literature review on the use of infographics and/or pictograms and their impact on medication adherence. Our methods were guided by Arksey and O'Malley's (2005) scoping review framework. According to Munn et al. (2018), scoping reviews are useful for examining evidence on emerging topics, rather than on more established topics that can be addressed in the form of more specific questions. Given the emerging nature of the literature around the topic of using infographics and/or pictograms to increase medication adherence, a scoping literature review was deemed to be appropriate. The first round of literature searches was conducted in July 2020, using the search terms outlined in Table 1. An updated review was conducted in July 2022 by AC, with the inclusion of eligible articles published since the first round of searches in July 2020. We consulted a librarian at the University of Guelph to derive the search strings (Table 1).

Table 1
Search Strings for Literature Search

Database	Search String
PubMed	(infographic* OR pictogram* OR picto*) AND (adheren* OR complian*) AND (medic* OR drug* OR supplemen* OR pharmacotherap*)
Ovid MEDLINE	(infographic* OR pictogram* OR picto*) AND (adheren* OR complian*) AND (medic* OR drug* OR supplemen* OR pharmacotherap*)
CINAHL	(infographic* OR pictogram* OR picto*) AND (adheren* OR complian*) AND (medic* OR drug* OR supplemen* OR pharmacotherap*)
Web of Science	(infographic* OR pictogram* OR picto*) AND (adheren* OR complian*) AND (medic* OR drug* OR supplemen* OR pharmacotherap*)
PsycInfo	(infographic* OR pictogram* OR picto*) AND (adheren* OR complian*) AND (medic* OR drug* OR supplemen* OR pharmacotherap*)

Literature searches were conducted on the following databases: PubMed, Ovid MEDLINE, CINAHL, Web of Science, and PsycInfo. In the July 2020 search, the publication date filter range of 2000 to 2020 was set to isolate results to recent publications in the relatively new field of research on the uses and effects of infographics and/or pictograms, and to ensure relevance to currently accepted science communication, medical, and health care principles. The July 2022 search was limited to articles published since the July 2020 search to July 2022.

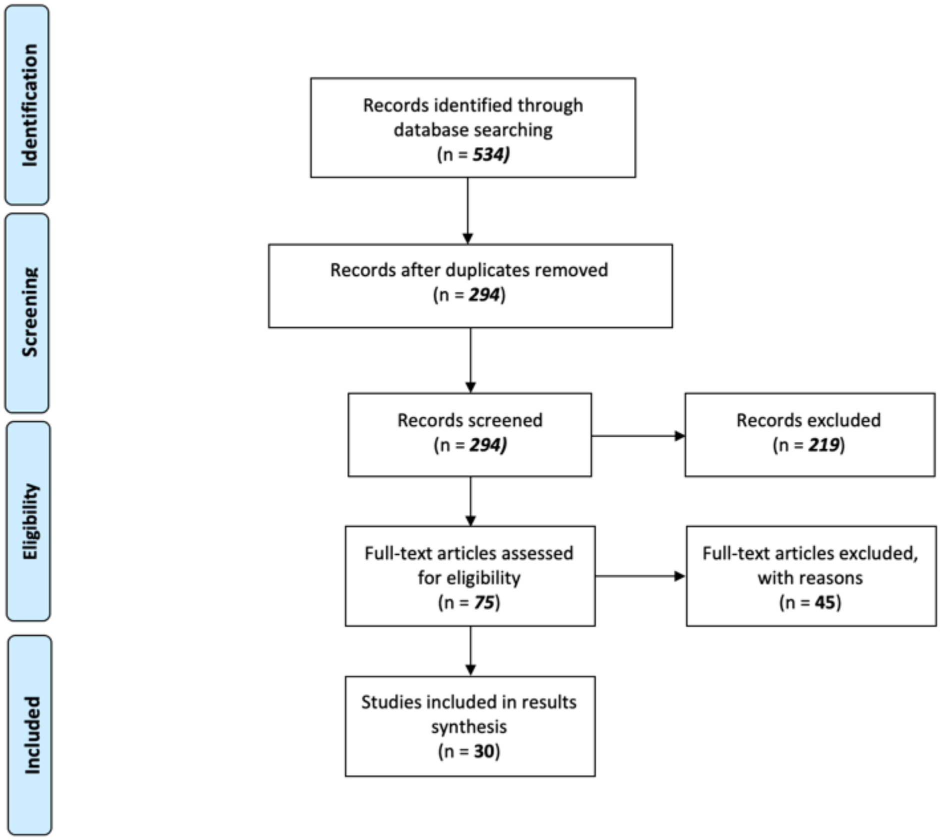
Selection Criteria & Data Extraction

Our search strategy initially yielded 534 results (436 in the July 2020 search, 98 in the July 2022 search; Figure 1). Mainly, Mendeley was used to remove duplicate articles, after which 294 results (201 from the July 2020 search, 93 from the July 2022 search) remained. Some databases did not permit limits on month of publication in searches—as a result, articles previously included and/or articles published between January 2020 and June 30, 2020, were manually removed after the second search, as they were already considered in the July 2020 search. Primary research articles were considered for inclusion if (a) infographics and/or pictograms were the exposure of interest and (b) adherence, comprehension, or health outcomes were an outcome of interest. After a full reading, quantitative studies were excluded if they lacked a control/comparator group. Data from qualitative studies were excluded to allow exploration of the statistical significance or insignificance of results from quantitative studies.

Initial screening was conducted by the first author by reviewing titles and abstracts. Subsequent full readings were conducted by the first author to further refine the collection of included studies. Author, publication year, sample size, age range, study design, study setting/location, intervention, control, outcome, and statistical significance were extracted from each included article by AC. A Microsoft Excel spreadsheet was used to collect and analyze this data. Articles with outcome measures for the following (or synonymous terms) were collected for our analysis: adherence, comprehension/understanding, and health outcomes. In accordance with Arksey and O'Malley's (2005) scoping review framework, studies were not formally assessed for their quality.

Figure 1

PRISMA Flow Chart Showing the Process of Inclusion and Exclusion of Articles



Note. Flow chart adapted from Moher et al. (2009).

Results

Study Designs and Settings

We reviewed 30 studies that explored the impact of infographics or pictograms on medication adherence and that met our inclusion criteria. These studies were conducted in the following countries: Jordan, South Africa, Thailand, Indonesia, Canada, United States, Poland, Iran, India, Egypt, Pakistan, Germany, Australia, and Sweden, as well as the region of Korea. Almost one quarter (23.3%) were conducted in the United States. Studies were published between 2007 and 2022.

Study Outcomes

Measures of Adherence and Health Outcomes

Among the overall sample of studies, a variety of tools were used to measure medication or treatment adherence. Some studies utilized the 8-point Morisky Medication Adherence Scale (MMAS-8) which is based on yes/no questions and a 5-point Likert scale (Moon et al., 2017; see Appendix A). MMAS-8 is effective for measuring a patient's medication-taking behaviour, but not for providing an explanation of adherence or nonadherence (Tan et al., 2014). Due to the questionnaire method associated with MMAS-8, it is a simple and low-cost method for measuring patient adherence (Moon et al., 2017). However, this runs the risk of introducing biases associated with self-report measurement. Three studies (Chan & Hassali, 2014; Ebrahimabadi et al., 2019; Negarandeh et al., 2013) utilized MMAS-8 to measure treatment adherence. Among these studies, two (Ebrahimabadi et al., 2019; Negarandeh et al., 2013) out of three (66.7%) displayed improved adherence. A larger sample of studies utilizing MMAS-8 would be necessary to accurately measure the significance of this result.

Some studies utilized pill counts to measure adherence (Appendix A). Though there is a risk of someone tampering with the contents of the pill bottle without consuming the medication, this technique provides an objective measure of the amount of medication consumed over the treatment period. Finally, direct health outcome measures, such as blood tests, were used in some studies. These measures offer additional usefulness in measuring adherence by showing whether the predicted effects were observed. Five studies (Chongpornchai et al., 2021; Dowse & Ehlers, 2005; Kalichman et al., 2013; Maximos et al., 2021; Patiag et al., 2020) utilized pill bottle counts to measure medication adherence. Four (80%; Chongpornchai et al., 2021; Dowse & Ehlers, 2005; Kalichman et al., 2013; Patiag et al., 2020) of these studies showed improved adherence among participants. To accurately compare this measurement to the overall sample of studies, a larger sample of studies utilizing pill counts may be necessary.

Infographics and Pictograms Were Shown to Enhance Comprehension of Factors Surrounding Medication Adherence in Some Studies

Given the ability of visual tools to communicate complex information in an accessible way, we were interested in exploring whether comprehension or understanding of medication-related factors, such as medication side effects and regimen, improved in individuals exposed to infographics or pictograms. Eight of the included articles (Artmann et al., 2022; Branda et al., 2022; Browne et al., 2019; Dowse et al., 2014; Dowse & Ehlers, 2005; Hynes et al., 2022; Mohamed et al., 2021; Wilby et al., 2011) studied comprehension or understanding of these factors as an outcome measure in some capacity. Seven of these studies (87.5%; Branda et al., 2022; Browne et al., 2019; Dowse et al., 2014; Dowse & Ehlers, 2005; Hynes et al., 2022; Mohamed et al., 2021; Wilby et al., 2011) showed an overall improvement in comprehension or understanding when experimental groups receiving pictograms were compared against control groups.

Wilby et al. (2011) found that participants of the group receiving pictograms were able to report and recall information about their HIV medications significantly more frequently than their control counterparts. Furthermore, these levels of understanding were attributed to pictograms being provided in tandem with verbal explanation, highlighting that explaining the meaning of a pictogram optimizes its instructional effects (Wilby et al., 2011). This study emphasizes the relevance and importance of combining text and pictograms to communicate information.

Browne et al. (2019) conducted a study on limited literacy HIV patients in South Africa and noted a rise in mean side effect recognition from 45.9% to 95.7% of the experimental group participants in the three-month period when pictograms were administered. In contrast, the control group only presented a rise from 50.0% to 56.0% of group participants (Browne et al., 2019). Recognition of these side effects is crucial in maintaining adherence over an extended period.

Three studies (Dowse et al., 2014; Dowse & Ehlers, 2005; Mansoor & Dowse, 2006) considered the use of infographics or pictograms among the Xhosa population of South Africa. The Xhosa population has historically been classified as a limited literacy population (Dowse et al., 2014). For this reason, they were studied to explore the efficacy of pictograms as adherence-improving tools among limited literacy populations. All three studies showed that pictograms improved medication adherence (Dowse & Ehlers, 2005; Mansoor & Dowse, 2006) or self-efficacy (Dowse et al., 2014), which is a precursor to medication adherence, among the study samples. Two of the studies (Dowse et al., 2014; Dowse & Ehlers, 2005) showed that the use of infographics among the study sample led to statistically significant improvements in comprehension of medication and/or medication instructions. This provides further evidence that infographics and/or pictograms may offer benefit when treating populations with limited literacy levels. Further research on limited literacy populations could provide more conclusive evidence on the efficacy of pictograms and adherence in this scope.

Infographics or Pictograms Were Shown to Improve Medication Adherence in Some Studies

Twenty-three (Almomani et al., 2018; Braich et al., 2011; Chan & Hassali, 2014; Chongpornchai et al., 2021; Dowse et al., 2014; Dowse & Ehlers, 2005; Ebrahimabadi et al., 2019; Hynes et al., 2022; Kalichman et al., 2013; Mansoor & Dowse, 2006; Maximos et al., 2021; Merks et al., 2019; Merks et al., 2021; Mohamed et al., 2021; Monroe et al., 2018; Nahrisah et al., 2020; Näslund et al., 2019; Negarandeh et al., 2013; Park, 2011; Patiag et al., 2020; Phimarn et al., 2019; Shenoi et al., 2021; Yin et al., 2008) of the included studies considered medication adherence, or a similar term, as an outcome measure, with the exposure being infographics or pictograms in some capacity. Of these studies, 18 (78.2%) displayed significant improvements in adherence (Almomani et al., 2018; Braich et al., 2011; Chongpornchai et al., 2021; Dowse & Ehlers, 2005; Ebrahimabadi et al., 2019; Hynes et al., 2022; Kalichman et al., 2013; Mansoor & Dowse, 2006; Merks et al., 2021; Mohamed et al., 2021; Nahrisah et al., 2020; Näslund et al., 2019; Negarandeh et al., 2013; Phimarn et al., 2019; Shenoi et al., 2021; Yin et al., 2008), or improved self-efficacy (Dowse et al., 2014; Park, 2011), which is a precursor to adherence, among groups counselled with infographics or pictograms.

Braich et al. (2011) measured adherence to cataract medication following surgical procedures by conducting postoperative oral tests. On Test 3, conducted on the 28th day following surgery, experimental group 2, who received pictogram counselling and take-home pictograms, scored significantly better than both experimental group 1, who only received pictogram counselling, and the control group who received verbal counselling (Braich et al., 2011; see Appendix A for more details). This study supports pictograms as portable tools that can be used for patient education even outside of the clinical setting, in order to improve medication adherence over extended periods of time (Braich et al., 2011).

Seven studies (Almomani et al., 2018; Braich et al., 2011; Dowse & Ehlers, 2005; Kalichman et al., 2013; Monroe et al., 2018; Negarandeh et al., 2013; Phimarn et al., 2019) considered the use of pictograms among participants with marginal or low literacy levels. Five (71.4%) of these studies (Braich et al., 2011; Dowse & Ehlers, 2005; Kalichman et al., 2013; Negarandeh et al., 2013; Phimarn et al., 2019) showed that pictogram counselling was beneficial to improving adherence (or increasing intentions to partake in adherent behaviours) in participants with marginal or low literacy levels, when compared to groups that received usual counselling without the use of pictograms or infographics (see Appendix B for intervention and control/comparator groups).

Five of the 23 studies (Chan & Hassali, 2014; Maximos et al., 2021; Merks et al., 2019; Monroe et al., 2018; Patiag et al., 2020) (21.7%) under this category displayed marginal or insignificant improvements in adherence levels or medication-taking behaviours when the groups receiving pictograms were compared to controls. Monroe et al. (2018) found that adherence levels were higher for HIV medication compared to medication for comorbid hypertension or diabetes, though the sample size was too low to find a significant effect of pictograms on adherence. None of the studies showed that pictograms decreased adherence levels when compared with control or comparison groups.

Infographics or Pictograms May Improve Health Outcomes

Improved health outcomes are the ultimate objective of improved adherence to medication. Six of the included studies (Bengtsson et al., 2021; Bhardwaj et al., 2022; Mohamed et al., 2021; Moin et al., 2021; Nahrisah et al., 2020; Näslund et al., 2019) measured health outcomes as a result of participants being exposed to infographics or pictograms. All these studies (100%) showed statistically significant improvements in health outcomes in the infographic or pictogram-exposed groups (refer to Appendix A for health outcomes studied). It is noted that, in the Bhardwaj et al. (2022) study, a statistically significant difference pre- and post-intervention was only noted in males, and not female participants.

Nahrisah et al. (2020) conducted a study in which all participants were pregnant women with anemia being administered iron tablets in the pre-test phase. In the post-test phase, 100% of women in the intervention group receiving infographic counselling recovered from anemia during the third trimester of pregnancy, while only 12.9% of women in the control group did (Nahrisah et al., 2020). This shows that the intervention group adhered to their supplementation more than the controls (Nahrisah et al., 2020). Nahrisah et al. outline evidence that infographics have efficacy specifically pertaining to an iron deficiency situation—that is, improved treatment adherence among patients using infographics could offer a direct benefit in improving health outcomes among patients with anemia.

Näslund et al. (2019) analyzed the effects of pictorial representations of asymptomatic atherosclerotic disease on the risk of adverse cardiovascular events, measured through the Framingham risk score (FRS) and European systematic coronary risk evaluation (Näslund et al., 2019). The FRS decreased in the intervention group, while increasing in the control group, suggesting that risk of cardiovascular disease decreased in the intervention group (Näslund et al., 2019). Total and low-density lipoprotein cholesterol levels, typically implicated in cardiovascular disease, showed greater reduction in the intervention group compared to the control group (Näslund et al., 2019). This study utilized an intervention of pictorial information accompanied with written text, which is analogous to the structure of an infographic.

Discussion

Our review reveals the benefits of using infographics and/or pictograms as a patient education tool to improve comprehension of health information and medication adherence and contribute to health outcomes. These findings align with the health belief model, which suggests that improving an individual's understanding of the perceived threats of an illness and benefits of treatment results in improving the likelihood of their engaging in health-promoting behaviour (Sacchetti et al., 2014). Implementing visual communication within educational tools further increases the likelihood of meaningful patient education, in accordance with cognitive load theory, which postulates that working memory has a finite capacity (Paas et al., 2010) and information presented through short text and images is better recalled than long text materials (Martin et al., 2019). Our review showed trends of improved understanding of illness-related factors leading to improved health behaviours, as included studies exhibit that groups counselled with infographics or pictograms displayed marked improvements in medication adherence compared to their respective control groups. These trends are consistent with other literature; for example, in their recent systematic review, Sletvold et al. (2020) found that pictograms significantly improved medication adherence among patients.

Our review suggests that including text in visual aids improves patient comprehension, as in some studies, pictograms alone were insufficient to improve patient understanding. Indeed, in a literature review on the use of pictorial aids in medication instructions, Katz et al. (2006) reported that using pictograms in conjunction with complementary textual or verbal instruction improves their efficacy. This was a consistent finding among our review and supports the use of infographics to pair accessible text with clear visuals rather than pictograms alone. We suggest that future studies explore this aspect by comparing images, images with text, and some form of control group to further understand if differences exist between these various categories.

Despite advances in the availability of health care information due to the internet, poor medication adherence remains a substantial and costly issue across health care settings. It has been shown that 10% of hospital visits among older adults are attributed to treatment nonadherence, with each patient requiring three extra hospital visits per year in the U.S. (Cutler et al., 2018). The resultant annual health care costs average $2000 per person, which can be a significant economic burden, particularly among patients of low socio-economic status (Cutler et al., 2018). Thus, visually effective patient educational tools such as infographics and/or pictograms could help with reducing the morbidity, mortality, and economic burden on patients. This would also result in time and cost savings across all levels of the health care system.

Current popular methods for improving medication adherence, such as multi-component care plans (Garcia-Aymerich et al., 2007) and electronic medication delivery devices (Nides et al., 1993), can be inaccessible and costly to patients of low socio-economic status. Our results suggested that pictograms were beneficial educational tools among those with marginal or low literacy levels, who have lower working memory capacities than those with higher literacy levels (Castro-Caldas et al., 1998). These improvements suggest that infographics and/or pictograms are a particularly useful tool for populations with low literacy levels in order to transcend health literacy barriers and mitigate the negative health outcomes associated with these barriers. Furthermore, infographics and pictograms offer a cost-effective and customizable method for health care providers to effectively communicate health information. For example, health care providers can create infographics themselves or work with a graphic designer to create them at a fraction of the cost of developing a mobile app or leading a patient counselling group.

Given our findings, we encourage future studies on the effects of infographics on medication adherence and health outcomes when administered in a long-term manner through take-home infographics—specifically, printing and distributing the infographics to individuals and studying how they impact medication adherence when distributed to be utilized beyond the health care setting, following counselling. Additionally, we note that Bhardwaj et al. (2022) found gender differences in their study. We encourage future reviews and other studies to explore whether gender differences persist and the reasons for these differences.

Strengths and Limitations

Our review contributes to a topic that is currently lacking in literature. Our review also covered a vast array of literature spanning several geographical regions, cultures and demographics, and illnesses, showing that our results could be applied to many populations, treatments, and health care settings. Additionally, our review analyzed studies that used a variety of tools to measure their outcomes. This can be viewed as both a strength and a limitation. We excluded studies that did not have a control/comparator group, studies that presented qualitative data, and studies that were conducted in languages other than English. This may have resulted in reduced coverage of the body of literature. Furthermore, our review was conducted by a single reviewer (the first author)—dual independent reviewers are suggested for systematic reviews (Waffenschmidt et al., 2019), though the current body of literature does not make this suggestion specifically for scoping reviews. Future studies or reviews may benefit from a risk of bias assessment, though our review did not include one, since these assessments are typically not performed when conducting scoping reviews (Munn et al., 2018). Finally, as a consequence of following Arksey and O'Malley's (2005) scoping review framework, we did not assess the quality of the studies included in our review.

Conclusion

Infographics and pictograms offer great potential as a patient education tool for improving medication adherence among a diverse set of demographics, illnesses, and treatments. These visual communication tools are of particular benefit to improve illness and medication understanding among those with low literacy levels. Text and illustrations presented through infographics can also be adapted to various contexts, thus transcending culture and language barriers.

Practice Implications

The findings of our review have practical implications. Infographics are relatively new in the health care practice and serve as a novel way to address patient education issues such as literacy barriers and budget constraints. Our findings on the benefits of infographics on patient comprehension and understanding, medication adherence, and health outcomes suggest they could be a favourable and efficient way to improve medication adherence in various settings. Therefore, it is important that health care professionals and scientists devise ways to integrate infographics into standard clinical practice.

Acknowledgments

We would like to thank Jacqueline Kreller-Vanderkooy, a librarian at the University of Guelph, who was consulted during the creation of the search strategy.

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Appendix A

Characteristics of Included Studies

Study reference	***Study country***	***Study design***	***Sample size***	***Measures of adherence or other outcomes***	***Outcome***	***Significant? (p < 0.05)***
Almomani et al., 2018	Jordan	RCT	219; 109 interventio n, 110 control	Self-reported adherence scale	Significant improvement between intervention and control	Yes, p < 0.001 and p = 0.007
Artmann et al., 2022	Germany	RCT	60; 20 in each of three groups	Questionnaire	Visual representations were superior in terms of understandability of the numbers communicated, though not statistically significant	No
Bengtsson et al., 2021	Sweden	RCT	Pictorial informatio n group: 1749 Control group: 1783	FRS and SCORE for health outcomes on cardiovascular risk	FRS and SCORE improved	Yes, p = 0.047 and 0.022 for FRS and SCORE, respectively
Bhardwaj et al., 2022	India	RCT	Interventio n: 23 Control: 23	Health outcomes: endoscopic appearance, edema, other parameters	There was a negative correlation between the compliance of nasal saline irrigation with edema, crusting, and discharge	Yes, p < 0.0001
Braich et al., 2011	Canada	RCT	225; 75 in each group	Measurement of each patient's eyedrop bottle at baseline and on postoperative day 28	EG2 displayed long-term (measured at 28 days) improvements in treatment adherence, compared with EG1	Yes, p < 0.001
Branda et al., 2022	USA	RCT	Interventio n: 53 Control: 53	Patient knowledge, conflict with decision made	Patient knowledge of the expected survival benefit from taking medications was significantly higher in the intervention group compared to usual care (p < 0.0001)	Yes, p < 0.0001
Browne et al., 2019	South Africa	RCT	116	Interviews testing side effect	Improved side effect recognition	Yes, p < 0.0001

				and illness-related knowledge—intended to simulate a busy, under-resourced clinic where informational material could be handed to a patient with little or no explanation		
Chan & Hassali, 2014	Malaysia	RCT	110 (35 in standard group, 40 in font-enlarged group, 35 in pictogram-incorporated label group)	8-item Morisky Medication Adherence Scale (MMAS-8) – using a 5-point Likert scale for a variety of questions	Did not find significant improvements in patient adherence	No, p = 0.010 within-group; p = 0.573, 0.069 between-group
Chongpornchai et al., 2021	Thailand	Randomized experimental study	Intervention: 44 Control: 44	Knowledge questionnaire and self-reported adherence questionnaire	Higher knowledge and higher percentage of medical adherence than those in the control group in all tests	Yes, through pill count method
Dowse et al., 2014	South Africa	RCT	116 at baseline, 64 at six-month follow-up	22-question knowledge test evaluating information about medication	Improved comprehension	Yes, p = 0.022
Dowse & Ehlers, 2005	South Africa	RCT	87; 41 in control group and 46 in experimental group	Self-reported adherence and pill count (with greater emphasis on pill count in the overall calculation of adherence)	Improved medication adherence and understanding of instructions	Yes, p < 0.01 for medication adherence and for understanding
Ebrahimabadi et al., 2019	Iran, USA	RCT	80	8-item Morisky Medication Adherence Scale (MMAS-8)—using a 5-point Likert scale for a variety of questions	Infographic group displayed improved long-term medication adherence, compared to video group	Yes, p < 0.05

Hynes et al., 2022	USA	RCT	Intervention: 22 Control: 23	Medication adherence: electronic monitoring sensor attached to the youth's prescribed daily controller medication	Youth AAP knowledge was higher for the pictorial AAP (intervention) group compared to the written AAP (control) group	Yes, $p = 0.017$
Kalichman et al., 2013	USA	RCT	446 (148 in pictograph-guided group, 157 in standard adherence group, 141 in general improvement group)	HIV RNA viral load and monthly-unannounced telephone-based pill counts	Those with low marginal literacy levels scored better in adherence tests	Yes, $p < 0.05$
Mansoor & Dowse, 2006	South Africa	RCT	120	Self-reported adherence and tablet count (heavily weighted toward the tablet count measure)	Significant improvements in medication adherence in the short term	Yes, $p < 0.05$
Maximos et al., 2021	Canada	RCT	Intervention: 37 Control: 26	Patient understanding: Medication Understanding and Use Self-Efficacy Scale (MUSE) Adherence: number of doses taken of a prescribed agent divided by the number of doses prescribed, expressed as a percentage Pill counts were utilized	No significant difference in adherence, perceived regimen complexity, or MUSE between intervention and control	No
Merks et al., 2019	Poland	RCT	64 (32 in control group, 32	Semi-structured interview based on questionnaires	No significant improvement in adherence in intervention group	No, $p < 0.34$

			in study group)			
Merks et al., 2021	Poland	Multi-centre, prospective study with control arm	Pictogram group (intervention): 104; Standard care (control): 117	Questionnaire about medication behaviour	Use of pictograms significantly improved medication adherence in the following areas: not omitting doses, not crushing tablets, number of tablets per day	Yes, not omitting doses ($p < 0.00001$), not crushing tablets ($p = 0.004$), number of tablets/day ($p = 0.49$), time of use ($p = 0.001$)
Mohamed et al., 2021	Egypt	Cluster RCT	Intervention-first group: 46 Usual care-first group: 48	Health outcomes measured through clinical and physical activity assessments; Adherence and knowledge through questionnaire	With intervention: significant decrease in SBP, DBP, waist circumference, BMI, FBG, HbA1C, total cholesterol, LDL, and triglyceride levels. Significant improvements in score of knowledge and adherence	Yes, $p = 0.008$ and 0.04 for SBP and DBP, respectively $p = 0.001$ for waist circumference, BMI, total cholesterol, LDL, triglyceride levels $p < 0.001$ for FBG and HbA1C $p < 0.020$ for knowledge $p < 0.001$ for adherence
Moin et al., 2021	Pakistan	RCT	Group 1 (pictorial): 20 Group 2 (video): 20 Group 3 (control): 19	Plaque and gingival scores in all participants in the three groups	Significant reduction in mean gingival score for all groups (preintervention vs. postintervention) Among males—larger reduction in pictorial group than video and control group	Insignificant between groups in females ($p = 0.095$) Significant between groups in males ($p = 0.001$)
Monroe et al., 2018	USA	RCT	46; 23 per group	Adherence to Refills and	Statistically insignificant improvement in	No, $p = 0.07$

				Medications Scale (ARMS)	comorbid medication adherence	
Nahrisah et al., 2020	Indonesia	Quasi-experimental pretest-posttest control group design	140	Objective measurements of hemoglobin and hematocrit concentrations	Improved hemoglobin and hematocrit levels, knowledge of anemia score, and other measures (i.e., improved health outcomes and adherence)	Yes, p < 0.001
Näslund et al., 2019	Sweden	RCT	3532; 1783 in control group, 1749 in intervention group	Blood samples of various risk factors of cardiovascular disease, FRS, SCORE	Improved measures of health outcomes—e.g., reduced poor cholesterol levels	Yes, p = 0.0017 FRS, p = 0.0010 SCORE
Negarandeh et al., 2013	Iran	RCT	127; 40 in control group, 44 in pictorial group, 43 in teach back group	8-item Morisky Medication Adherence Scale (MMAS-8)—using a 5-point Likert scale for a variety of questions	Improved adherence compared to control	Yes, p < 0.001
Park, 2011	Korea	Quasi-experimental pretest-posttest design	136	Self-Efficacy for Appropriate Medication Use Scale (SEAMS)	Significantly increased self-efficacy scores	Yes, p < 0.001
Patiag et al., 2020	USA	Quasi-experimental pretest-posttest design	18 in pretest phase; 11 in posttest phase	Medication adherence score sheet involving pill count, as well as differences in prescribed and consumed doses	No significant improvement in medication dose adherence	No, p > 0.05
Phimarn et al., 2019	Thailand	Four-phased (Phase IV was an RCT)	21 in phase I; 20 in phase II; 30 in phase III; 67 each in experimental and control group	Amount of medication remaining compared against amount prescribed	Improved medication adherence and understanding	Yes, p < 0.033

Shenoi et al., 2021	India	Clinical trial	39	Closed-ended questionnaire	Compliance was significantly higher among Group B (intervention) than Group A (control)	Yes, $p < 0.0001$
Wilby et al., 2011	Canada	RCT	72; 39 in control group, 33 in treatment group	Patients were asked the question "What can you tell me about this medication?" and evaluated on their response	Improved comprehension and recall	Yes, $p < 0.0001$
Yin et al., 2008	USA	RCT	227; 113 in interventio n group, 114 in control group	Participants were asked to measure the dose as they would at home—deviation from prescribed dose by 20% or more was marked as nonadherent	Adherence was highest in intervention group	Yes, $p = 0.002$ and 0.006

Appendix B

Intervention and Control/Comparator

Study reference	***Intervention***	***Control/comparator***
Almomani et al., 2018	Inhaler with pictogram	Inhaler without pictogram
Artmann et al., 2022	Visualized representations (pictogram or cube diagram)	Text representation
Bengtsson et al., 2021	Pictorial information with additional prevention materials provided to participants and physicians	No pictorial information provided to participants and physicians
Bhardwaj et al., 2022	Verbal explanation and practical demonstration, pictorial handouts	Verbal explanation and practical demonstration
Braich et al., 2011	EG1—taught with pictograms in the clinic EG2—taught with pictograms in the clinic and given take-home pictograms	Verbal instruction only
Branda et al., 2022	Acute myocardial infarction choice conversation tool (including pictograms)	Usual care
Browne et al., 2019	Standard care plus pictograms for side effect information	Standard care
Chan & Hassali, 2014	Pictogram-incorporated drug label	Text-only drug label
Chongpornchai et al., 2021	Motion infographic media	No motion infographic media
Dowse et al., 2014	Standard care + illustrated pictogram information sheet	Standard care
Dowse & Ehlers, 2005	Medicine labels incorporating pictograms	Text-only medicine labels
Ebrahimabadi et al., 2019	Infographic for people with asthma	Video for people with asthma
Hynes et al., 2022	Pictorial asthma action plan	Written asthma action plan
Kalichman et al., 2013	Pictograph-guided counselling	Standard adherence counselling (not pictograph-guided)
Mansoor & Dowse, 2006	Patient medicine information leaflet containing pictograms	Patient medicine information leaflet without pictograms
Maximos et al., 2021	Routine care with picture-based medication calendar	Routine care without picture-based calendar

Merks et al., 2019	Antibiotic with pictogram instructions on external label	Antibiotic with usual pharmacy instructions on external label
Merks et al., 2021	Patient counselling with pictograms	Standard care
Mohamed et al., 2021	Pictorial training for 45 minutes in first visit, and 15 minutes in weekly visits	Usual care
Moin et al., 2021	Group 1: Pictorial educational information for brushing techniques Group 2: Video education information for brushing techniques	Group 3: No education information for brushing techniques
Monroe et al., 2018	Pictorial aid for comorbid medication	Standard clinic visit discharge medication list
Nahrisah et al., 2020	Pictorial handbook for pregnant women with iron deficiency anemia	Routine antenatal care (without pictorial handbook)
Näslund et al., 2019	Pictorial representations of ultrasound results and nurse call to confirm understanding	Not informed
Negarandeh et al., 2013	Pictogram education tool	Teach back education or no education
Park, 2011	Interactive pictorial education	No intervention
Patiag et al., 2020	Pictorial medication card for patients with cognitive challenges	Preintervention: no pictorial medication card for patients with cognitive challenges
Phimarn et al., 2019	Pictogram for low literate Thai patients	Standard medication label
Shenoi et al., 2021	Verbal + pictorial postoperative care instructions	Verbal postoperative care instructions
Wilby et al., 2011	Pictogram-enhanced medication information for HIV medications	Standard counselling
Yin et al., 2008	Pictogram medication counselling	Standard medication counselling