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Review
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Review

Effectiveness of pictograms in patients or caregivers in healthcare settings: a systematic review

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Abstract

Objectives Pictorial representation has shown to be potential in enhancing patient knowledge. This study aimed to identify the usefulness of pictograms improving the knowledge of the patients or their caregivers.

Key findings The electronic databases such as PubMed, CINAHL, Embase and Scopus were searched for relevant studies. The Cochrane risk of bias tool was used to assess the quality of the included studies. The study was conducted following PRISMA guidelines. Pictograms were used alone or in combination with the text-based/written or verbal/ oral instructions of medication used in study intervention. All the included studies showed similar outcomes that had a positive impact on improving patient adherence and helped in decreasing the dosing error. Factors such as age, gender, literacy level had a negative impact on adherence. Pictograms had a positive impact on the adherence in patients with low health literacy levels than the written/oral interventions.

Summary The current review provided insights on the effectiveness of pictograms in patients or their caregivers of various age groups in healthcare settings. Future studies should be aimed to identify the knowledge gaps and barriers impacting the effectiveness of pictograms in various settings.

Keywords: pictograms; health literacy; medication adherence; knowledge

Introduction

The disease conditions are rapidly increasing in developing countries due to unhealthy lifestyles, stressful minds, physical inactivity and inadequate social and psychological well-being.[1] Drug resistance and unhygienic conditions lead to both communicable and non-communicable diseases. Prevention is a better way to stay healthy and safe.[2] Education has an essential role, not only in the development of the economy but also plays a crucial role in the healthcare sector. Health literacy is to acquire, identify, comprehend and utilize

the health data for making relevant decisions.[3] Improving the health responses in a low health literacy population has enormous potential to increase access to health care.[4] The patient's knowledge in understanding the medical terminologies and treatment plans in the day-to-day healthcare settings is minimal.[5] Patients with inadequate health literacy are mostly elderly people with cognitive impairment, low socioeconomic status and immigrants who cannot communicate in the local languages.[6] To improve the knowledge of diseases and medications, relying on patient parties to interpret health information is not optimal. The information may be omitted, added, or incorrectly substituted during the delivery of medical information from one person to another. Inadequate understanding of health information leads to the unsuccessful functioning of the pharmaceutical products designed for informed consumers.[7] Health-related information can be provided in many ways focusing on the low health literacy population for better understanding, using pictograms.[8] Pictograms are graphical symbols that convey information through illustrative representations. Pictograms can pass the information even to the patients with limited reading ability. It can surpass languages and can communicate equally and efficiently without any radical differences between cultures and languages.[9] Patients often face struggles in understanding the written instructions of medications, due to the complexity of its information. Pictograms can overcome the communication barriers along with counselling and provide the simplest as well as the necessary information for enhancing the patient–provider interaction. Pictograms can convey health information through customized illustrations of the intended drugs or diseases.

In a pre-designing phase, lay participants are given a more active role for their inputs in preparing the pictograms. As per the American National Standards Institute (ANSI), the individual pictograms of validation to reach the criteria of at least 85% correct of pictorial symbols in a comprehensive test. Pictograms can appeal to everyone with the ability of all reading levels that can make access to more health education.[10]

The pharmacists play a crucial role in delivering essential education for a better understanding of the medical instructions and precautions given to the patients.[11] The information usually provided in medication leaflets are of high readability level, which makes it difficult for the patients to interpret. Pharmacists utilize pictograms for improving the understanding of the drug and disease-related information which will increase medication knowledge and adherence.[12] Pharmacists use simple keywords with the pictograms in their counselling sessions to help alleviate the understanding of the use of medications.[13]

In the real world, even though pictograms have lesser effort in assessing the outcome but have proven to enhance patient knowledge.[14] The current systematic review was conducted to evaluate the effect of pictograms in enhancing patient knowledge and adherence.

Materials and Methods

The systematic review was conducted following Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.[15] Randomized controlled trials (RCTs) with blinded or open-label, parallel study designs were included. Studies including pictograms containing text or without text in the adult population were considered for the review. Systematic reviews, observational studies, case reports and narrative reviews were excluded from the review. The protocol was registered in PROSPERO (CRD42020188528).

Searching resources

A systematic search was conducted for articles following the RCT design. Studies reporting the use of pictograms in the improvement of medication adherence and knowledge were screened. The search was built using multiple keywords such as pictogram, pictographs, drug, medicine, medication and literacy combined with suitable Boolean operators. The search strategy was developed using the relevant keywords to search the electronic databases such as PubMed, Embase, CINAHL and Scopus with restrictions to the English language. The articles from inception till September 2019 were included in the search. A hand search of included articles and relevant comments of information that reclaim associated resources were considered. In the case of studies having pilot analysis, the primary article was used as the reference and secondary papers were utilized for deriving any additional information.

Assessment of risk of bias

The included studies were individually evaluated by two authors using Cochrane's risk of bias tool in a descriptive format.[16] The subsequent domains were estimated and recorded according to their indication of low (+), high (−) and unclear risk (?).

The risk of bias was classified into five subgroups as random sequence generation, allocation concealment, blinding of participants, incomplete outcome data and selective reporting. Reviewers thoroughly inspected selected studies for any duplication of data that attempted to minimize the potential impact on reporting bias. The discrepancies between the reviewers were sorted by discussion.

Results

A total of 965 articles were screened and 17 articles were excluded due to duplication. In total, 151 articles were excluded based on the abstract and title. In total, 782 articles were excluded based on intervention, irrelevance and outcomes. A total of 15 articles were considered for qualitative review. The PRISMA flowchart detailing the screening process for the studies included in the review is shown in Figure 1. The search provided 15 studies that fulfilled the inclusion criteria. The characteristics of each included study are described in Table 1.

Risk of bias

Cochrane collaboration for risk of bias tool was used to evaluate the quality of the studies by the reviewers. Significant studies were identified as open-label studies with high risk. Two studies reported performance bias as low risk. Thirteen trials were reported as high risk of detection bias because no blinding of participants and personnel was ensured. Five studies reported an unclear risk of selection bias (33.3%) as the allocation concealment method was not mentioned. A study showed a high risk of attrition bias for dropouts that were not mentioned. Three studies (20%) reported unclear risk due to a large number of dropouts, lost to follow-up reasons. A low risk of selection bias was noted in all selected studies. As seen in Figure 2, all the studies had at least one dimension with a high risk of bias, but all the assessed studies met the acceptable quality. The risk of bias of the studies is presented in Figure 3.

Study characteristics

The included studies design consisted of single-, double- and triple-blinded parallel-group studies. A total of 2974 patients were included

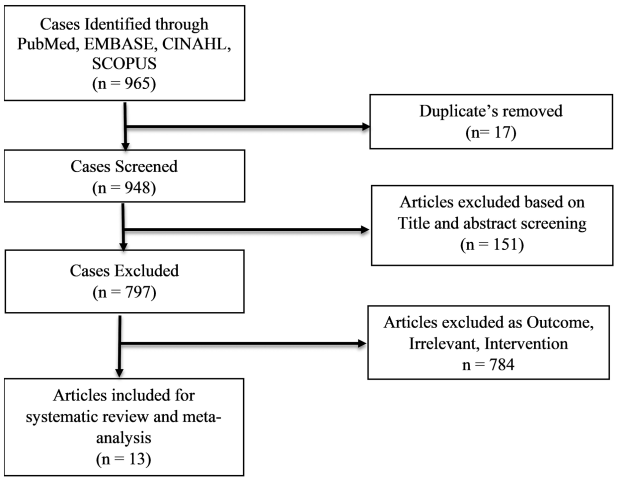

Figure 1 PRISMA flow chart.

in the analysis. The sample size of the included studies varied from 86 to 446 participants across the study groups. The included studies consisted of mixed population including low literate patients and caregivers. The interventions were pictograms, containing with or without text, compared with verbal instruction on medication use, medication labels with regular font text or simple text, counselling and traditional labels.

The outcomes were measured using questionnaires, surveys and suitable electronic devices for the monitoring of medication adherence. In few studies, HIV RNA load or volumetric measurements were utilized to correlate the medication adherence. The number of prescription refill count were also considered in limited studies for measuring the medication compliance.

Medication adherence and compliance

Eight articles were conducted in the low health literacy populations among the included studies. In these studies, the pictograms were used as a tool for improving the healthcare services and to evaluate the impact on patient's understanding and adherence. Among the 15 RCTs, four studies were on anti-retroviral therapy (ARVT). Out of which two articles showed improved adherence when measured by pill count with patient information leaflet (PIL) with and without pictograms as intervention, compared with the usual care. The study conducted by Mansoor *et al.* with a sample size of 127 comprised of two intervention groups, which consisted of a complex PIL (group A) and simple PIL (group B). A mean adherence of 73.6% and 88.3%, respectively, were noted when compared with the control group (67.7%).[17] The study by Browne *et al.* with a sample size of 116 with medication information with a pictogram showed a mean percentage of understanding of 95.7% compared with standard care (56%) during the evaluation by interviewers.[18] Dowse *et al.* included PIL with pictogram and text as intervention that showed adherence of 94.4%, compared with standard care of adherence 76.1% when measured with the help of adherence self-efficacy scale in a population of 116 patients.[19] Kalichman *et al.* showed a mean adherence of 30 in pictograph-guided group and 28 in standard adherence group when compared with general health group (30) that was measured with the help of HIV load.[20]

A study conducted by Chan *et al.* on antihypertensive and antidiabetic medications with a sample size of 126 incorporated the medication labels with the enlarged font as one of the intervention arms and pictograms as another arm. The groups were compared with medication labels having regular font text without pictograms using the MMAS-8 (Morisky Medication Adherence Scale). The patients educated with medication labels with the enlarged font showed adherence of 6.32, compared with 6.66 in the pictogram arm and 6.14 in the control group.[21]

Two of the studies used pictograms in patients receiving cardiovascular medications. The study conducted by Murray exhibited poor outcomes according to the survey questionnaires. The intervention group consisted of text along with pictograms that showed mean adherence of 65.25 compared with usual care mean adherence of 64.18 in 314 patients.[22] The other article by Zerafa having similar intervention as the earlier study had mean compliance of 88.2% when compared with the control group (66.4%). Thus, the intervention group showed a substantial improvement in the patient compliance.[23]

A few articles assessed the patients' knowledge on liquid medications by incorporating pictograms. Yin evaluated adherence by interviews with the intervention group being medication instructions with pictograms and teach-back method as compared with the usual care,[24] whereas Braich *et al.* showed an increased adherence with bottle amount measurement using the pictograms as a education tool in clinics with a mean of 5.44 and at home 7.17 compared with verbal instruction (4.37).[25]

The study by Dowse and Ehlers discussed the patients taking antibacterial medications. The medication labels with text and pictogram were the intervention which showed an adherence of 89.6% compared with medication labels with only text (71.5%) when measured with pill count or volumetric measurement method.[26] Kripalani *et al.* included 435 patients with coronary heart disease who utilized the postcard reminders with pictograms as intervention compared with the usual care. The mean adherence was 49% in the intervention group compared with 53% in the usual care group.[27] Negarandeh *et al.* included diabetic patients with interventions as teach-back method and pictogram compared with the control group. The interventions were used as a education tool to assess the knowledge and adherence in 127 diabetic patients. The mean adherence were 7.03, 6.73 and 4.32 in the teach-back group, pictogram group and control group, respectively, measured using the MMAS-8 scale.[28] Another article by Yin with a sample size of 259 asthmatic patients in the intervention group of low literacy asthma action plan with pictograms showed a higher impact on adherence with the help of questionnaires with a mean of 39.89 compared with the standard care of adherence with a mean of 36.72.[29]

A study done on low literate and poor adherence population by Phimarn *et al.* with a sample size of 134 showed higher post-intervention mean adherence of 100 in the intervention group consisting of pictogram instructions when compared with traditional labels with a mean adherence of 97.10 with the help of brainstorming and interviews.[30] A study was done systematic approach of discussions and interviews by Kheir *et al.* with a sample size of 123 with the intervention group consisting of pictogram along with text showed mean adherence of 2.9 and pictograms alone showed adherence of 2.6 compared with the control group of text and verbal instructions with mean adherence of 1.6, showing better comprehension with the intervention.[31]

Discussion

Medication information is vital for better medication use and safety. Various literacy rates across the globe are a potential barrier in the interpretation of written information. The health literacy of patients

Table 1 Characteristics of studies included in this review ($n = 15$) including use of pictogram, comparator and outcomes

Study ID	Location	Study design	Sample Size	Population	Use of pictograms	Comparator	Outcomes measured	Conclusion
Braich 2011	India	Multicentre, single-blinded, randomized controlled trial	225	Patients of low literacy taking cataract eye drop medication post-operation	Education on the use of pictograms in clinics; pictograms in home	Verbal instructions on medication use	Bottle amount measurement of eye drops at baseline and 28-day post-operation	The intervention groups had notably increased adherence as concluded by measuring the percentage of eye drops used
Browne 2018	South Africa	Randomized controlled trial	116	Limited literacy HIV patients on ARVs	Medication information: standard care with illustrated information	Standard care	Recognition by a question at baseline, 1-month and the 3-month post-baseline interview	Significantly improved knowledge in the intervention group of post-baseline
Chan 2014	Malaysia	Randomized, parallel, open-label study	126	Patients taking antihypertensive and anti-diabetic medications	Medication labels: with enlarged fonts; and incorporating pictograms	Medication labels with regular font text and without pictograms	MMAS-8 at baseline and 4-week post-intervention	There was not much improvement in adherence among the study group
Dowse 2005	South Africa	Randomized, parallel, open-label study	87	Patients on antibacterial medication	Medication labels: text along with pictograms	Medication labels: text only	Pill count/volumetric measurement and self-reporting of adherence after 3–5 days of intervention, combined adherence result	There was a likely increase in adherence in the group with pictogram as compared with the control
Dowse 2014	South Africa	Randomized, parallel, open-label study	116	Patients under new ARVT	PIL with pictogram and text	Standard care	Adherence self-efficacy scale of HIV treatment at baseline and 1-, 3- and 6-month post-intervention	Not much difference was noted in self-efficacy among the groups involved in the study
Kalichman 2013	USA	Randomized, double-blinded, parallel study	446	HIV patients on ARVT from low health literacy background	Counselling on adherence: text with pictograms, aids of choice of adherence; standard adherence of text along with illustrations comic strips and pillbox of adherence tool	Counselling on general health improvement	HIV RNA load at baseline and 9-month post-intervention and monthly PIL count from the start of intervention for the next 9 months	Patients with marginal health literacy had significantly greater undetectable HIV viral load in intervention groups compared with a control group and patients from low health literacy background did not have a significant effect on interventions
Kheir 2014	Qatar	Randomized, parallel, open-label study	123	Population having cultural and ethnic diversity with limited literacy skills	Verbal instructions along with text; and pictographic instruction only	Pictogram along with verbal instructions	A systematic approach of group discussions and interviews	Pictorials supported with verbal instructions were comprehended and pictogram only labels are least comprehending
Kripalani 2012	USA	Randomized, double-blinded, parallel study	435	Patients with coronary heart disease	Postcard reminders of refill; illustrated schedule on medication with pictograms; a combination of both	Usual care	Reported CMG of electronic pharmacy refill records for 1-year follow-up post-intervention	There was not much improvement in the effect on adherence among the groups

Table 1 Continued

Study ID	Location	Study design	Sample Size	Population	Use of pictograms	Comparator	Outcomes measured	Conclusion
Mansoor 2006	USA	Randomized, parallel, open-label study	127	Patients on ARVT from low health literacy groups	PIL: with and without pictograms	Usual care	PIL count and self-declaration with a set of questions approximate 14 day post-intervention	Notably increased adherence on PIL count and questionnaire of intervention compared with the control group
Murray 2007	USA	Randomized single-blinded study	314	Patients with heart failure on cardiovascular drugs	The intervention of the pharmacist: textual information also containing pictograms	Usual care	Utilizing records of prescription and self-reported MEMS and questionnaires	Significant effect on overall adherence between intervention and control group in the period after the intervention. Insignificant effect on adherence between the study groups
Negarandeh 2013	Kurdistan	Randomized, open-label, parallel study	135	Patients with T2DM with low health literacy	Medication intervention education: teach-back method; and with pictograms	Usual care	MMAS-8 at baseline 6 weeks after intervention	Higher incidence of adherence in the intervention group as opposed to the control group. But no adherence between intervention groups
Phimarn 2018	Thailand	Randomized, parallel, open-label study	134	Low literate and poor adherence	Pictogram instructions	Traditional labels	Brainstorming, interviews and pilot evaluation	The experimental group had a significantly higher post-intervention understanding score than the control group
Yin 2008.	USA	Randomized, parallel, open-label study	245	Parents/caretakers of children on liquid medications	Medication counselling: with mediation instruction sheets; pictograms; and teach-back	Usual care	Self-declared adherence on interviewing at baseline 3–5 days after medicine dispensing	There was an increase in adherence in the intervention group as compared with the control group
Yin 2017	USA	Randomized, parallel, triple-blinded study	259	Low literate parents of children with asthma	Low literacy asthma action plan along with pictograms	Standard care plan	Questionnaire to assess error in knowledge	The intervention group had a significantly higher impact than the control group
Zerafa 2011	Malta	Randomized controlled trial	86	Patients that underwent cardiac surgery on medications	The intervention of pharmacist: with textual medication information sheets and pictograms	Usual care	Questionnaire of patient adherence after 8-week post-surgery discharge	Higher patient compliance in the intervention group with the control group

ARV: anti-retroviral drugs; MMAS-8: Morisky Medication Adherence Scale; ARVT: anti-retroviral therapy; PIL: patient information leaflet; CMG: cumulative medication gap; MEMS: medication event monitoring system; T2DM: type 2 diabetes mellitus.

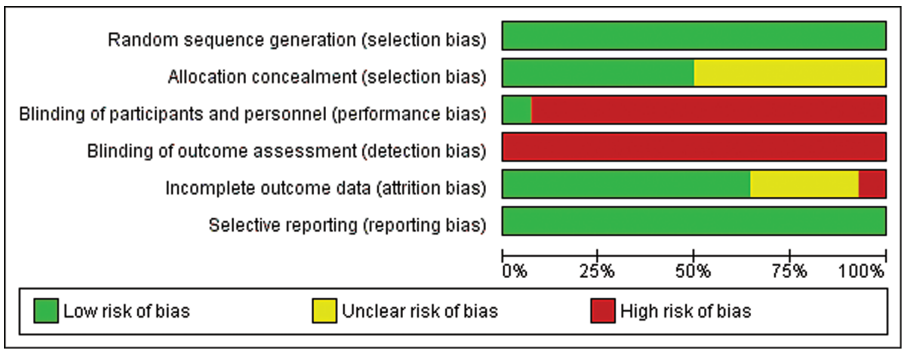

Figure 2 Risk of bias.

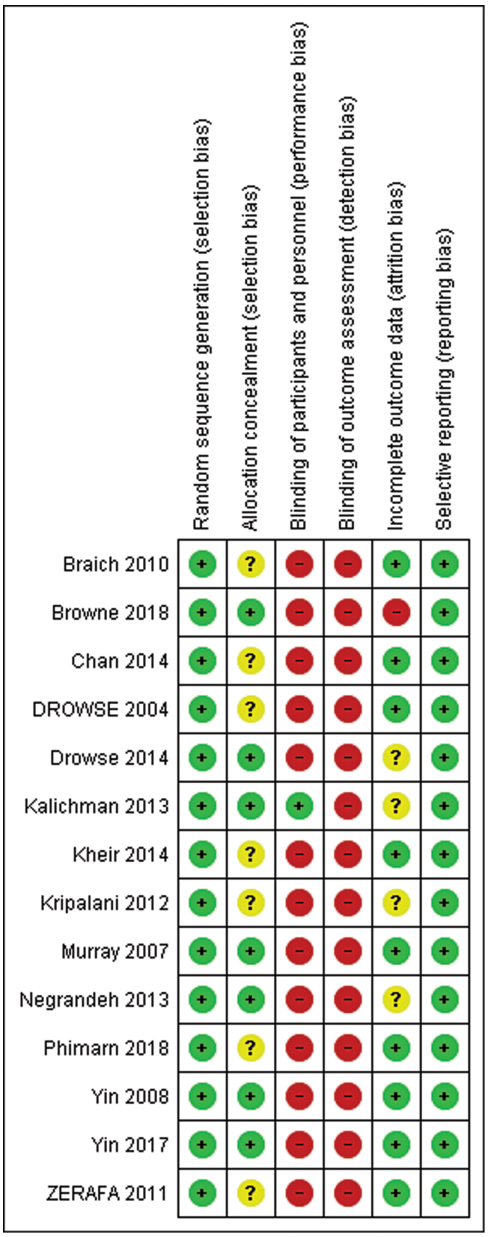

Figure 3 Risk of bias graph.

provides relevance in the development of information tools to provide adequate understanding.[25] Various studies have tested the effectiveness of pictograms in different settings, to identify the improvement of patient's understanding among various literacy groups.[32] Pictograms play an evident role in transforming medical information to improve understanding, adherence and medication recalling. Even though various forms of pictograms have been developed and tested, the efficacy remains questionable in improving medication-related parameters. This can be overcome by providing dedicated patient counselling with the use of pictograms for better medication use. A validated model for the design and interpretation of pictograms is the need for the hour in imparting health information and for providing better patient care.[33] Pictorial aids are also effective in caregivers to assist in the administration of certain dosage forms of medications. Usage of pictograms will improve the understanding of medication instructions, the dosing accuracy, and help in recalling the information in the caregivers. Incorporating pictograms into verbal instructions or counselling on medications or the text instructions was more beneficial than to be used alone. The health literacy of caregivers will also get enhanced effectively by the use of pictorial aids. Population with low literacy remains to be a concern, considering the low education level and socioeconomic status. Successful establishment of medication safety programs is essential for the development of healthcare settings through the reduction of cost and for delivering better patient care. The increase in the rate of the right interpretation of pictograms can be of utmost use whenever provided as a replacement to instructions in verbal form. The impact of pictograms in preventing medication administration errors in a healthcare setting and in improving clinical outcomes needs to be reviewed and studied spontaneously to explore future outcomes of pictograms.[34]

The current systematic review aimed to evaluate the likely effect on patient medication adherence towards the therapies based on collecting and summarizing the shreds of evidence depending on specific inclusion and exclusion criteria of pictograms. It is usually hard for patients to retain verbally communicated information, for which, a short systematic review conducted by van Beusekom *et al.* aimed to evaluate the scope and effects of involving the patients in designing and the development of the pictograms for written information of drugs. This review included 73 articles that were published between 1993 and 2018. The review focused on two groups, one being the patient party and the other being the non-patient party that helped in the development of the pharmaceutical pictograms. It showed that the involvement of the lay participants in the process of designing the pictograms that were preferred in the specified target group. The involvement of lay participants also showed to consistently lead to a positive effect on patients' understanding. Overall, this review showed the involvement of the non-participants in the process of development of these pictograms and provided evidence that involving lay end users in the design process helped in the better understanding of the pictograms and in recalling the drug information. The results of this study gave a mixed perception of the patients

and their caregivers in understanding the effectiveness of pictograms. It is also necessary to involve participants that meet the targeted group criteria for the assessment of pictograms, as different groups of people perceive information differently.[14]

Another review led by Sletvold and Sagmo focused on the impact of pictograms on medication adherence in low health literacy patients. In total, 17 articles were included for analysis after excluding the others based on duplication and the inclusion criteria. The population under study had varied disease conditions also in terms of age, treatment regimens and the level of health literacy. From included studies, 10 articles reported a remarkable effect of pictograms, though most of them were along with text-based or verbal instructions. Patient-related factors such as age, chronic medication use and comorbidities led to poor medication adherence. The pictograms developed were focused on the target population leading to better understanding, adherence and recollection of medication information.[12] In context to the above study, our study search was conducted till September 2019, and few articles were added, which increased the sample population of the present review to give more vivid results.

A systematic review based on Magnay *et al.* was concerned with the validation process or development of methods for assessing menstrual blood loss (MBL), which was on the different strategies used to develop National Institute of Clinical Excellence (NICE) guidelines. It was used to differentiate between the normal and heavy blood flow (HBF), the suitable diagnosing procedures for heavy menstrual bleeding (HMB) and the routine clinical practices. This review showed that every accessible method cannot estimate MBL. A pictorial representation showed a balance in easy interpretation. Pictograms in MBL determination in each way using quality of life (QoL) in both clinical and research settings were found to be useful.[35] This study focused on a single population and condition, whereas our study had various interventions and the target population. The interventions were mainly focused on the low literacy population and keenly designed to improve the adherence and the knowledge in the specific population.

Another review conducted by Chan *et al.* included studies that incorporated pictorial representations of liquid medication and calculated its dosing precision, understanding of instruction, adherence and recollection of information of caregivers. A vast range of liquid formulations was studied, which mostly included prescription and over-the-counter (OTC) drugs. Regarding dosing errors, pictograms were given to one half of the population, and the other half received text information. It was seen that the group which received pictograms showed fewer mistakes in dosing errors. As for the recall of medication, one-half received pictograms while the other half received the non-pictogram intervention. The group that received pictograms recalled their instructions better as compared with the other group. When all the criteria were combined, it was seen that pictorial representations are useful interventions based on the results. The study had a direct comparison analysis.[36] The study intervention included only pictograms as intervention, whereas our study was based on the pictogram alone or with text. The outcome measures were medication adherence more precisely than other outcomes relating to dosing and dosage forms. Only a few studies among the included studies were reviewed for dosage forms where pictograms were efficiently used and served the purpose.

Limitations

This systematic review includes 15 studies. Each of the studies was an RCT. The trials differed based on the design of blinding, where few studies were blinded, and many were open-label. These led to a high amount of heterogeneity across the studies. The outcomes were reported in various data forms, which were a drawback in conducting a meta-analysis. The intervention yielded a mixed response since the pictogram and text were utilized in the included studies. Future studies focusing on pictograms alone and outcomes measured using a uniform tool should be targeted for the design of meta-analysis to determine the effectiveness of pictograms in various healthcare settings.

Conclusion

This review provided insights on the effectiveness of pictograms in healthcare settings among patients or their caregivers. Certain number of studies did not show significant changes, due to the knowledge gaps and barriers impacting the effectiveness of pictogram. Pictograms are a useful tool for communication among patients speaking different languages and belonging to various literacy groups. The designed pictogram for disease as well as drug should meet the minimal criteria and serve as an effective tool for providing better patient education and medication adherence.

Author Contributions

Initiating the idea of the manuscript: R.V. and E.A.R. Writing the first draft: D.D.M., J.M.J., A.P. and S.A.R. Reviewing and approving the final draft: J.B.K., R.V. and E.A.R. R.V. was the guarantor of the manuscript.

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Conflict of Interest

The authors declared no conflict of interest.

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