Effectiveness of using picture-based health education for people with low health literacy: An integrative review

Jungmin Park and Julie Zuniga

Abstract: Background: Level of health literacy affects health status. The purpose of this study was to examine and evaluate studies related to picture-based health education materials for people with low health literacy. Methods: Articles from 2001 through October 2015 were searched in the PubMed, CINAHL, and ERIC databases on the web, followed by manual searches of the references in those articles. Results: Of the 11 studies that met the inclusion criteria for this review, 10 showed a positive effect of increasing the health learning abilities of people with low health literacy using picture-based health education. Medication adherence was targeted most often. The majority of the studies measured health literacy using the Short Test of Functional Health Literacy in Adults, but the health literacy measurements in picture-based health education were nonetheless inconsistent. Discussion: Use of picture-based health education for people with low health literacy was limited. However, the majority of the studies did indicate a positive effect on learning.

Keywords: picture-based health education; low health literacy; cartoon; pictograph(s); illustration; integrative review

1. Introduction
Health literacy has been defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (Nielsen-Bohlman, NetLibrary, & Institute of Medicine (US) Committee on Health

ABOUT THE AUTHORS
Jungmin Park is a doctoral candidate in the University of Texas at Austin, School of Nursing. Her research interest includes disease self-management by people in the HIV-infected population who have co-morbid conditions. Her dissertation focuses on retention in care for elderly people with HIV and diabetes. Jungmin Park currently serves as a research assistant on a study regarding self-management education of diabetes in HIV-infected people under the supervision of Dr Julie Zuniga, an assistant professor in the University of Texas at Austin, School of Nursing. Also, Jungmin is currently conducting a qualitative study investigating type two diabetes self-management education using pictography with low health literacy funded by the Sigma Theta Tau, Epsilon Theta Tau.

PUBLIC INTEREST STATEMENT
Low health literacy affects to negative health outcomes. The purpose of this manuscript is to integrate studies related to picture-based health education materials for people with low health literacy. In this paper, we used the online database and searched articles manually from 2001 to October 2015 under the PRISMA guideline. Ten articles indicate that picture-based health education materials helps to increasing the health learning abilities of people with low health literacy.
Literacy, 2004). In the US, 36% of adults have no more than basic health literacy (Kutner, Greenburg, Jin, & Paulsen, 2006). Most of those with low health literacy are elderly (over 65 years old), belong to minority groups, are refugees or immigrants, have a low educational level, have a low socioeconomic status, or are nonnative speakers (U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010).

People with low health literacy have many difficulties in managing their health problems (Arcia, Bales, & William Brown, 2013; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005) and as a result experience longer hospitalizations and more frequent use of emergency care. This may be due in part to difficulty accessing the correct medication, and understand labels and health messages (Arcia et al., 2013; Berkman, Sheridan, Donahue, Holpern, & Cratty, 2011). Those with limited health literacy are therefore more likely to become ill than those with higher health literacy (Garcia-Retamero, Okan, & Cokely, 2012).

Health education materials, however, are not always appropriately written for those with low health literacy, and the materials that do take low health literacy into account are limited. Health education materials are often written for a 10th-grade reading level (Davis et al., 1993; Doak, Doak, Friedell, & Meade, 1998) but the reading ability of people with low health literacy can be below the 5th-grade level (Kirsch & Educational Testing Service, & National Center for Education Statistics, 1993). One way to address this health knowledge gap is to use picture-based educational materials.

The Mayer’s cognitive theory of multimedia learning (CTML) insisted three principles: (1) people process information through auditory and visual channels, (2) each channel has a limited amount of memory, and (3) learning consists of actively filtering and sorting information (Mayer & Ebooks Corporation, 2009). Given these principles, multimedia, which may be defined as the “combination of text and pictures,” should help improve an individual’s capacity to learn (Sorden, 2012), and the CTML is indeed based on the idea that learners can improve their learning abilities when they are presented with pictures as well as words (Choi, 2015; Mayer & Ebooks Corporation, 2009). Thus, the combination of pictures and words increases learning effectiveness (Mayer, 1947/2014; Sorden, 2012).

Following the Mayer’s CTML theory, pictographs may increase the effectiveness of educational materials for those who have low literacy (Garcia-Retamero et al., 2012) especially for complex health information (Austin, Matlack, Dunn, Kesler, & Brown, 1995; Delp & Jones, 1996). However, pictographs encompass many different picture-based educational materials in a diverse health education fields, such as simple black and white line drawings, pictures, and simple drawings with simple text. The purpose of this integrative review is to synthesize studies associated with pictographic education designed for people with low health literacy, describe the characteristics of pictographs use, assess the tools used to measure health literacy in picture-based health education studies, and integrating the effectiveness of picture-based health education for people with low health literacy.

2. Methods

2.1. Search strategy

For this study, we systematically reviewed articles found with two main search methods: (1) electronic searches using key words in library databases, and (2) subsequent manual searches for related references. On the Internet, we searched three databases: PubMed, the Cumulative Index of Nursing and Allied Health Literature (CINAHL), and the Education Resources Information Center (ERIC). Search terms were as follows: photo novella, education, cartoon, webtoon, pictograph, pictogram, illustration, picture, visualization, health, nonliterate, and literacy. The research on picture-based materials for health education is limited, so we did not limit the time period for the review. Through an ancestry search, additional research studies were identified by searching reference lists that had inclusion criteria and purposes that were related to those of this review. The search strategy and data extraction are illustrated in Figure 1.
2.2. Inclusion and exclusion criteria
This study was guided by inclusion and exclusion criteria: (1) English-based studies, (2) studies related to low health literacy, (3) studies use picture-based health education, (4) study participants are adults (over 18 years old), (5) studies are not reviews or meta-analyses, and (6) studies are not dental related.

2.3. Data extraction
Initially, the web-based search identified 70 articles in PubMed, CINAHL, and ERIC. Manual search of the references in those articles found an additional 22 articles, for a total of 92. After screening the 92 articles by title, key words, and abstract, 44 articles were excluded because they were editorials or presented only abstracts, were duplicates, were not written in English, applied to dental health of youth, were unrelated to health care, or did not consider participants’ levels of health literacy. Full texts of the remaining 48 articles were then read. Review of those 48 articles led to exclusion of 20 articles from the web-based search because (1) the participants were not adults (over the age of 18), or (2) the articles were reviews or meta-analyses. A total of 17 articles from the manual search were also excluded after applying the same inclusion and exclusion criteria.

3. Results
3.1. Study samples and settings
The web-based search and the manual search yielded a final total of 11 articles (six from the web-based search, five from manual search) that met the inclusion criteria (see Table 1). Although there was no limit on the time period for the studies, all 11 articles were published from 2001 to 2015. The studies’ sample sizes ranged from 6 to 500, and the samples included a broad range of participants. The final 11 articles included six cross-sectional descriptive studies (Choi, 2011, 2012, 2013; Chuang, Lin, Wang, & Cham, 2010; DeWalt et al., 2004; Kripalani et al., 2007) and seven interventions (Choi, 2015; DeWalt et al., 2004; Dowse & Ehlers, 2001, 2005; Kalichman et al., 2013; Kripalani et al., 2007; Mansoor & Dowse, 2003) with two of the articles presenting both descriptive studies and interventions (DeWalt et al., 2004; Kripalani et al., 2007) (see Table 2). The participants’ ethnicities were diverse: Hispanic/Latino, White, African American, and Asian. The most common educational level
| Study    | Purpose                                                                 | Setting       | Sample characteristics                                                                 | Design               | Disease focus     | Literacy measures | Key findings                                                                                     |
|----------|-------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------|----------------------|-------------------|-------------------|-----------------------------------------------------------------------------------------------|
| Choi (2011) | To develop and validate pictograph-based discharge instructions for older adults after hip replacement surgery | United States | Experts assess appropriateness, accuracy, relevance  
N = 5  
Age range: 39–51 years  
Clinical experience: 5–15 years  
2 White, 2 AA, 1 Asian | Tool development and evaluation | Hip replacement surgery | Not appropriate | Pictographs (simple line drawings) assist engagement and are easy to understand for low-literate immigrant refugees in discharge care actions |
| Choi (2012) | To develop breast healthcare instructions using pictographs             | United States | Immigrant women with low health literacy  
N = 6  
Age range: 37–55 years  
Living in US: ≥10 years (83.3%)  
Edu. level: high school (66.7%)  
Hispanic/Latino (66.7%)  
Asian (16.7%) | Tool development and evaluation | Breast healthcare | S-TOFHLA ≤ 22 | Pictographs (black and white simple line drawings) are effective regardless of race/ethnicity |
| Choi (2013) | To examine the acceptability and comprehension of instructions in 15 low-literate older adults | United States | Convenience sample N = 15 (82.4% women)  
Mean age 68.2 years  
Edu. level: ≤high school (80%)  
White (73%)  
S-TOFHLA M = 19.47 | Pilot study | Hip replacement surgery | S-TOFHLA ≤ 22 | Pictographs are effective for low-literate older adults' discharge instructions in acute healthcare |
| Choi (2015) | To examine the effect of pictograph-based discharge instructions on comprehension & recall of older adults with low health literacy | United States | Conv. sample ≥ 65 years w/LHL  
N = 42 (28 women, 66.7%)  
Mean age 67.59 years  
Edu. level: ≤high school (83.3%)  
White (69%)  
STOEFLA M = 17.02 (SD = 5.16)  
Intervention group N = 21 | RCT | Hip replacement surgery | S-TOFHLA ≤ 22 | Intervention group had significant improvement in scores on comprehension, t(35) = -2.29, p = 0.02, and recall, t(35) = -2.24, p = 0.03, vs. the comparison group |

(Continued)
| Study                        | Purpose                                                                 | Setting                | Sample characteristics                                                                 | Design            | Disease focus | Literacy measures | Key findings                                                                 |
|-----------------------------|-------------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------|-------------------|---------------|-------------------|-----------------------------------------------------------------------------|
| Chuang et al. (2010)        | To compare low-literacy patients and medical staff for preference and comprehension of pictographs intended to illustrate medication use instructions for medical clinic ambulatory patients | South Taiwan          | Convenience sample $N = 500$                                                          | Prospective study | Medication    | Education level   | Patients and medical staff had significant differences in preferences for all categories of medical instruction pictographs and had significant differences in comprehension for the pictographs’ administration associated with meals. Patients’ preferences and comprehension of the medical instruction pictographs were age related |
| DeWalt et al. (2004)        | Development and pilot testing of a disease management program for heart failure patients with low literacy | United States         | $N = 23$                                                                               | Tool development and pilot test | Heart failure | REALM             | Heart failure management program leads to significant improvements in self-care behavior and heart-failure-related symptoms for patients with low literacy |
| Study                  | Purpose                                                                 | Setting        | Sample characteristics                                                                 | Design     | Disease focus | Literacy measures                        | Key findings                                                                 |
|-----------------------|-------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------|------------|--------------|------------------------------------------|------------------------------------------------------------------------------|
| Dowse and Ehlers (2001) | To evaluate the use of pharmaceutical pictograms in low-literate South Africans | South Africa   | Xhosa ethnic group who had attended school for no more than seven years                  | Pre-post test | Medication    | A short literacy test                     | Pictographs combined with text are effective for comprehension and recall |
|                       |                                                                         |                | N = 46 (35 women, 76.1%)                                                                |            |              | Education level ≤7 years schooling       |                                                                              |
|                       |                                                                         |                | Age 41–65 years (56.5%)                                                                 |            |              | Interviews                                 | Pictograms communicate medication information                                  |
|                       |                                                                         |                | Edu. level 5–7 years (55.3%)                                                            |            |              |                                          | Participants prefer local pictograms (p < 0.05)                                |
| Dowse and Ehlers (2005) | To determine the influence of medicine labels incorporating pictograms on the understanding of instructions & on adherence | South Africa   | Xhosa ethnic group attending an outpatient clinic, who had been prescribed a short course of antibiotics and had attended school for no more than 10 years | RCT        | Medication    | Education level ≤10 years                | Pictograms significantly increase patients' understanding of instructions and adherence (p < 0.01) |
|                       |                                                                         |                | N = 87                                                                                  |            |              | Within 3–5 days intervention              | Control group average for understanding, 69.5%                               |
|                       |                                                                         |                | Experimental (Text & pictogram labels)                                                   |            |              | Interviews                                 | Control group average adherence, 71.5%; experimental group, 89.6% (p < 0.01) |
|                       |                                                                         |                | n = 46 (62 women, 91.3%)                                                                |            |              |                                          |                                                                              |
|                       |                                                                         |                | Age 21–40 years; 45.7%                                                                  |            |              |                                          |                                                                              |
|                       |                                                                         |                | Edu. level 5–7 years (41.3%)                                                            |            |              |                                          |                                                                              |
|                       |                                                                         |                | Language: isiXhosa (80.4%), English (19.6%)                                             |            |              |                                          |                                                                              |
|                       |                                                                         |                | Control (text only)                                                                     |            |              |                                          |                                                                              |
|                       |                                                                         |                | n = 41 (38 women, 92.7%)                                                                |            |              |                                          |                                                                              |
|                       |                                                                         |                | Age 21–40 years (61%)                                                                   |            |              |                                          |                                                                              |
|                       |                                                                         |                | Edu. level 5–7 years (19, 36.6%)                                                        |            |              |                                          |                                                                              |
|                       |                                                                         |                | Language: isiXhosa (70.7%), English (34.1%)                                            |            |              |                                          |                                                                              |
|                       |                                                                         |                | Percentage for understanding instructions                                                |            |              |                                          |                                                                              |
|                       |                                                                         |                | Experimental group: 95%                                                                  |            |              |                                          |                                                                              |
|                       |                                                                         |                | Control group: 70%                                                                      |            |              |                                          |                                                                              |
| Kalichman et al. (2013) | To test the efficacy of a pictograph-guided adherence skills building counseling intervention for adults with limited literacy living with HIV | United States   | Have HIV & receiving antiretroviral therapy                                             | RCT        | HIV          | TOFHLA                                   | Interventions or adherence counseling may be required or beneficial for patients with low or marginal literacy skills regardless of their use of pictograms |

(Continued)
| Study                  | Purpose                                                                 | Setting        | Sample characteristics                                                                 | Design      | Disease focus | Literacy measures | Key findings                                                                 |
|-----------------------|-------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------|-------------|---------------|-------------------|-----------------------------------------------------------------------------|
|                       |                                                                         | United States | N = 209                                                                                   | RCT         | Medication    | REALM             | Pill card improved medication management and understanding for those with limited health literacy, low levels of education, and cognitive function impairments (p < 0.05) |
|                       |                                                                         |                | Frequent use of pill card (83%)                                                            |             |               |                   |                                                             |
### Table 1. (Continued)

| Study               | Purpose                                              | Setting      | Sample characteristics | Design     | Disease focus | Literacy measures | Key findings                                                                 |
|---------------------|------------------------------------------------------|--------------|------------------------|------------|---------------|-------------------|------------------------------------------------------------------------------|
| Mansoor and Dowse (2003) | To access the effect of incorporating pictograms on understanding in low-literate participants | South Africa | Xhosa low-literacy participants with a maximum of 7 years of formal schooling | RCT        | Medication     | Education level ≤ 7 years schooling                                           | Text-and-pictogram-based information creates a significantly higher level of understanding than text-only information ($p = 0.05$) |

| AA, 191 (91.4%)               | Tool development and intervention                      | REALM: 87 inadequate, 41.6% | 3rd month interview |     |               |                                |                                                                           |
| Women, 122 (58.4%)            |                                                       | MMSE ≥ 24 (64.6%)            |                       |     |               |                                |                                                                           |
| Mean age 63.7 years          |                                                       | All patients had coronary heart disease, 99% had hypertension. |                       |     |               |                                |                                                                           |
| Edu. level ≥ 12 years (110, 52.6%) |                                                       | Diabetes mellitus: 46% |                       |     |               |                                |                                                                           |
| Edu. level ≥ 12 years (110, 52.6%) |                                                       | Hypercholesterolemia: 87% |                       |     |               |                                |                                                                           |
| Prescribed medications: 6    |                                                       |                           |                       |     |               |                                |                                                                           |

Notes: REALM—rapid estimate of adult literacy in medicine; TOFHLA—test of functional health literacy in adults; S-TOFHLA—short test of functional health literacy in adults; AA—African American; Edu.—education; MLHFO—minnesota living with heart failure questionnaire; MMSE—mini-mental state examination; SEAMS—self-efficacy for appropriate medication use scale.
was no more than high school (Choi, 2012, 2013, 2015). In 3 articles (Dowse & Ehlers, 2001, 2005; Mansoor & Dowse, 2003), the participants’ education levels were 5–7 years; in 1 article (Chuang et al., 2010), 61.6% of the participants had no schooling in a patients group and 86% had college degrees in a medical staff group; in another (Kripalani et al., 2007), 52.6% of the participants had more than 12 years of schooling. Seven of the articles (63.6%) (Choi, 2011, 2012, 2013, 2015; DeWalt et al., 2004; Kalichman et al., 2013; Kripalani et al., 2007) presented studies conducted in the US, and the remaining 4 (36.4%) (Chuang et al., 2010; Dowse & Ehlers, 2001, 2005; Mansoor & Dowse, 2003) presented articles conducted elsewhere (South Africa and South Taiwan).

3.2. Studies’ characteristics

Five descriptive studies (Choi, 2011, 2012, 2013; DeWalt et al., 2004; Kripalani et al., 2007) consisted of picture-based educational tool development and evaluations using interviews to determine whether a pictographic health education approach was effective or not for people with low health literacy. Of the 7 interventions, 5 (Choi, 2015; Dowse & Ehlers, 2005; Kalichman et al., 2013; Kripalani et al., 2007; Mansoor & Dowse, 2003) were randomized controlled trials; the other 2 (DeWalt et al., 2004; Dowse & Ehlers, 2001) were single-group pre-post studies. The total weighted mean age across the intervention studies was 49.4 years, based on the 3 articles (Choi, 2015; DeWalt et al., 2004; Kripalani et al., 2007) that provided the participants’ mean ages. Several different methods were used to collect data: 1 article (Kalichman et al., 2013) used audio-computerized self-interviews (ACASI), and 1 article (DeWalt et al., 2004) used paper self-report data collection. The interventions varied in length from 3 days to 3 months.

3.3. Study designs and picture-based development fields

There were four types of study designs: tool development (n = 4), tool development and evaluation by experts (n = 1), tool development and evaluation by patients (n = 3), and tool evaluation only (n = 7) (see Table 3). The health conditions focused upon in the picture-based development were medication adherence (n = 5), hip replacement surgery (n = 3), breast healthcare (n = 1), heart failure (n = 1), and human immunodeficiency virus (HIV; n = 1).

3.4. Characteristics of pictographs

Studies used pictographs for low health literacy people. The majority of the studies used simple black and white pictographs (n = 4). Five studies used pictographs to assist patients with their medications (Chuang et al., 2010; Dowse & Ehlers, 2001, 2005; Kripalani et al., 2007; Mansoor & Dowse, 2003). Most studies used pictographs were conducted in the US (n = 7). Ten of 11 articles were the positive effect of increase understanding health education materials.

3.4.1. Health literacy assessment tools

Four different tools were used to assess health literacy: the Test of Functional Health Literacy in Adults (TOFHLA; n = 1), the Short Test of Functional Health Literacy in Adults (5-TOFHLA; n = 4), the Rapid Estimate of Adult Literacy in Medicine (REALM; n = 2), and the Short Literacy Test (n = 1), along with education level (n = 5).

| Study | Research design | N | References* |
|-------|----------------|---|-------------|
| Descriptive | Cross-sectional | 6 | Choi (2011, 2012, 2013), Chuang et al. (2010), DeWalt et al. (2004), Kripalani et al. (2007) |
| Intervention | RCT | 5 | Choi (2015), Dowse and Ehlers (2005), Kalichman et al. (2013), Kripalani et al. (2007), Mansoor and Dowse (2003) |
|          | Pre-post test | 2 | DeWalt et al. (2004), Dowse and Ehlers (2001) |

*References include duplicate studies.
The reading levels in the studies that used the S-TOFHLA were reported as marginal or inadequate (S-TOFHLA ≤ 22) in the majority of the studies. If the researchers used years of education, the variables were dichotomized, using the cut off of elementary, less than middle school, or less than high school.

3.5. **Relationship between pictography and health education effect**

All of the articles described the effectiveness of using pictographs for health education for those with low health literacy. Studies measured effectiveness by using interviews, paper-based self-reports, and questionnaire surveys. Pictography made low health literacy people easy to understand. Ten of the 11 articles (Choi, 2011, 2012, 2013, 2015; Chuang et al., 2010; DeWalt et al., 2004; Dowse \& Ehlers, 2001, 2005; Kripalani et al., 2007; Mansoor \& Dowse, 2003) found a positive effect of

---

**Table 3. The analysis of study components**

| Feature                                           | Articles* (N = 11) | References*                                  | Participants** (N = 1,439) |
|---------------------------------------------------|-------------------|---------------------------------------------|---------------------------|
| **Study design**                                  |                   |                                             |                           |
| Tool development and evaluation by experts       | 1                 | Choi (2011)                                 | 5                         |
| Tool development and evaluation by patients      | 3                 | Choi (2012), DeWalt et al. (2004), Kripalani et al. (2007) | 238                       |
| Only tool evaluation                             | 7                 | Choi (2013, 2015), Chuang et al. (2010), Dowse and Ehlers (2001, 2005), Kalichman et al. (2013), Mansoor and Dowse (2003) | 1,196                     |
| **Health literacy measurement**                  |                   |                                             |                           |
| TOFHLA                                            | 1                 | Kalichman et al. (2013)                     | 446                       |
| S-TOFHLA                                          | 4                 | Choi (2012, 2013, 2015), DeWalt et al. (2004) | 86                        |
| REALM                                             | 2                 | DeWalt et al. (2004), Kripalani et al. (2007) | 232                       |
| Education level                                  | 5                 | Chuang et al. (2010), DeWalt et al. (2004), Dowse and Ehlers (2001, 2005), Mansoor and Dowse (2003) | 716                       |
| Not present                                       | 1                 | Choi (2011)                                 | 5                         |
| Short literacy test                              | 1                 | Dowse and Ehlers (2001)                     | 46                        |
| **Study setting**                                 |                   |                                             |                           |
| United States                                     | 7 (63.6%)         | Choi (2011, 2012, 2013, 2015), DeWalt et al. (2004), Kalichman et al. (2013), Kripalani et al. (2007) | 746                       |
| Other countries                                   | 4 (36.4%)         | Chuang et al. (2010), Dowse and Ehlers (2001, 2005), Mansoor and Dowse (2003) | 693                       |
| **Study fields**                                  |                   |                                             |                           |
| Hip replacement surgery                           | 3 (27.3%)         | Choi (2011, 2013, 2015)                     | 62                        |
| Breast healthcare                                 | 1 (9.1%)          | Choi (2012)                                 | 6                         |
| Medication                                        | 5 (45.4%)         | Chuang et al. (2010), Dowse and Ehlers (2001, 2005), Kripalani et al. (2007), Mansoor and Dowse (2003) | 902                       |
| Heart failure                                     | 1 (9.1%)          | DeWalt et al. (2004)                        | 23                        |
| HIV                                               | 1 (9.1%)          | Kalichman et al. (2013)                     | 446                       |
| **Health education materials format**             |                   |                                             |                           |
| Only text based                                   | 0                 | None                                        | 0                         |
| Only pictography based                           | 0                 | None                                        | 0                         |
| Simple text and pictography based                | 11 (100%)         | Choi (2011, 2012, 2013, 2015), Chuang et al. (2010), DeWalt et al. (2004), Dowse and Ehlers (2001, 2005), Kalichman et al. (2013), Kripalani et al. (2007), Mansoor and Dowse (2003) | 1,439                     |

Notes: TOFHLA—test of functional health literacy in adults; S-TOFHLA—short test.
*References include duplicated studies.
**Number of participants studied, whether participants were experts or patients.
pictographic educational materials on health self-management, regardless of race/ethnicity and country of origin. However, in Kalichman et al. (2013) the pictograph and adherence to counseling did not improve outcomes in persons with low literacy, though it was effective in persons with moderate health literacy. They surmised that patients with low literacy will need more intense interventions than a brief counseling session to overcome this barrier.

3.6. Effectiveness of pictography for health education
All of the articles (Choi, 2011, 2012, 2013, 2015; Chuang et al., 2010; DeWalt et al., 2004; Dowse & Ehlers, 2001, 2005; Kalichman et al., 2013; Kripalani et al., 2007; Mansoor & Dowse, 2003) combined simple text and pictography. The most common pictographic health education materials featured black and white simple-line drawings with simple text (Choi, 2011, 2012, 2013, 2015). These pictographic health education materials helped to make the information understandable and successfully conveyed healthcare messages to people with health literacy (Choi, 2011, 2012, 2013, 2015).

For heart failure patients, the pictographic health education improved self-care behavior (DeWalt et al., 2004). In the medication studies, pictographs with simple text increased the recall of instructions (Chuang et al., 2010), were successful in communicating medication information (Dowse & Ehlers, 2001), were easy to understand (Dowse & Ehlers, 2005; Kripalani et al., 2007; Mansoor & Dowse, 2003) and helped patients remember medication information (Kripalani et al., 2007).

4. Discussion
The 11 articles in this integrative review focused primarily on health literacy measurements, specific health conditions, and the picture-based format of health education materials for people with low health literacy. The review suggests several key findings.

First, communication about health-related subjects with those who have low health literacy is challenging (Arcia et al., 2013). Pictographic representation, however, is beneficial for comprehension and communication in health care (Arcia et al., 2013). Nevertheless, the areas of healthcare that currently use picture-based education for people with low health literacy are limited. In addition, although limited health literacy is affected by age, no studies have focused on the use of pictographic education for the aging population. There is need for more diverse health-related research studies using pictography-based health education materials for elderly.

Currently there are no standard tools for the assessment of health literacy, thus it is difficult to compare levels of health literacy across the studies reviewed here (Berkman et al., 2011). Several of the studies used the dichotomous variable of years of education, but that is not always an appropriate measurement. Health literacy measurements may focus on assessing reading, comprehension, and numeracy (Jordan et al., 2013), but years of education do not provide an accurate measurement of those components. To accurately measure health literacy, future researchers will need more meaningful and consistent health literacy assessment tools.

Finally, picture-based educational materials significantly improved participants’ understanding of their health. Most of the studies reported positive results for using pictographic educational materials in healthcare. All 11 of the articles demonstrated the effectiveness of pictographic health education materials increasing patients’ learning abilities in different countries, and one article directly pointed out that pictographic health education is effective regardless of race/ethnicity (Choi, 2012). However, one article of HIV education indicated that using picture-based materials did not result in any difference, because people with low health literacy may need more intensive approaches to improving their health. Overall, most of the health education materials currently available are not appropriate for people with a low health literacy level, so improved materials are highly needed.

This integrative review determined what health focus areas were addressed by picture-based health education, the trends that exist in picture-based health education for people with low health literacy, the best health literacy measurements for people with low health literacy, and the
effectiveness of picture-based health education for improving the health status of people with low health literacy.

5. Conclusions
In the US, substantial numbers of adults find it difficult to understand data about their health (Arcia et al., 2013). People's levels of health literacy affect their health and their health management in many ways (U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010). Low health literacy can lead to greater chances of missing crucial information and therefore causes higher error rates in patients’ judgments and decisions about their illnesses (Garcia-Retamero et al., 2012). This results in a direct influence on the status of their illness (Garcia-Retamero et al., 2012). There is a positive relationship between understanding one’s health data and improving one’s health self-management (Arcia et al., 2013). However, despite attempts to address patients’ low health literacy, the majority of materials provided to people with low health literacy are written by people with a high reading level (Badarudeen & Sabharwal, 2008; Goodfellow, Trachimowicz, & Steele, 2008; Helitzer, Hollis, Cotner, & Oestreicher, 2009; Hill-Briggs & Smith, 2008; U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010) and healthcare experts have followed only some of the recommendations made for working with people who have low health literacy (Schwartzberg, Cowett, VanGeest, & Wolf, 2007; U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010). In this integrative review, we sought to explore which areas of healthcare have used picture-based health education for those with low health literacy and, ultimately, how effective those materials have been. So far, the areas of healthcare using picture-based health education for people with low health literacy have been limited, although the majority of studies indicated a positive effect on learning ability.

5.1. Strengths and limitations
Most studies indicated that using picture-based health education materials for people with low health literacy had a positive effect on health care. But few picture-based health education studies met the inclusion criteria for this integrated review. In addition, the studies were reviewed by only two authors, which may have led to bias; however, the two authors did review the studies three separate times and also subjected their process to review by peer colleagues. There were not many studies that have been done so far; any generalizability of the findings might be limited. Moreover, there were few intervention studies and few participants for assessing the effectiveness of pictographic health care education. In the future, more intervention studies and greater numbers of participants would enable generalizability. In addition, most of the pictographic health care education focused on medication; few studies addressed other healthcare areas. In the future, more research needs to be done on picture-based education in additional areas of healthcare and on a wider range of diseases in order to evaluate its effectiveness.

5.2. Practice implications
In order to address low health literacy needs, healthcare professionals should evaluate their current patient education for reading level and low-literacy acceptability. Reading levels can be assessed using the health measurements tools such as S-TOFHLA, and REALM. Patient education handouts should be on a reading level below 5th-grade level (Kirsch & Educational Testing Service, & National Center for Education Statistics, 1993). If there is a lack patient education materials tailored for low health literacy, healthcare professionals can create patient education material using picture-based information. Pictures should be simple, clear, and culturally tailored for easy to understand. Appropriate picture-based health education materials would make it easier for such people to understand health information, as opposed to text-based health education materials alone.
Acknowledgements

I wish to take this opportunity to express my deep regard to Dr Sharon A. Brown, PhD, RN, FAAN, for imparting her expert knowledge about literature reviews and guiding me in this research. Editorial support with manuscript development was provided by the Cain Center for Nursing Research and the Center for Transdisciplinary Collaborative Research in Self-management Science (P30, NR015335) at The University of Texas at Austin, School of Nursing.

Funding

The authors received no direct funding for this research.

Competing Interests

The authors declare no competing interests.

Author details

Jungmin Park1
E-mail: jungminpark@utexas.edu
Julie Zuniga1
E-mail: jzuniga@nursing.utexas.edu

1 School of Nursing, The University of Texas at Austin, 1700 Red River St., Austin, TX 78701, USA.

Citation information

Cite this article as: Effectiveness of using picture-based health education for people with low health literacy: An integrative review, Jungmin Park & Julie Zuniga, Cogent Medicine (2016), 3: 1264679.

References

Arata, A., Boles, M. E., & William Brown III, M. C. (2013). Method for the development of data visualizations for community members with varying levels of health literacy. AMIA Annual Symposium Proceedings, 2013, 51–60.

Austin, P. E., Matlock, R., Dunn, K. A., Kesler, C., & Brown, C. K. (1993). Discharge instructions: Do illustrations help our patients understand them? Annals of Emergency Medicine, 25, 317–320.

Badarudeen, S., & Sobharwal, S. (2008). Readability of patient education materials from the American academy of Orthopaedic surgeons and pediatric orthopaedic society of north america web sites. The Journal of Bone and Joint Surgery-American Volume, 90, 199–204.

Berkman, N. D., Sheridan, S. L., Donohue, K. E., Halpern, D. J., & Cratty, K. (2011). Low health literacy and health outcomes: An updated systematic review. Annals of Internal Medicine, 155, 97–107.

doi:10.7266/0003-4819-155-2-201107190-00005

Choi, J. (2011). Pictograph-based discharge instructions for low-literate older adults after hip replacement surgery: Development and validation. Journal of Gerontological Nursing, 37, 47–56.

doi:10.3928/00989134-20110706-03

Choi, J. (2012). Development and pilot test of pictograph-enhanced breast health-care instructions for community residing immigrant women. International Journal of Nursing Practice, 18, 373–378.

doi:10.1111/j.1440-172x.2012.02051.x

Choi, J. (2013). Older adults’ perceptions of pictograph-based discharge instructions after hip replacement surgery. Journal of Gerontological Nursing, 39, 48–54.

doi:10.3928/00989134-20130415-02

Choi, J. (2015). Effect of pictograph-based discharge instructions on older adults’ comprehension and recall: A pilot Study. Research in Gerontological Nursing, 9, 66–71.

doi:10.3928/19404921-20150513-05

Chuang, M.-H., Lin, C.-L., Wang, Y.-F., & Cham, T.-M. (2010). Development of pictographs depicting medication use instructions for low-literacy medical clinic ambulatory patients. Journal of Managed Care Pharmacy, 16, 337–345.

doi:10.1085/jmcp.2010.16.3.337

Davis, T. C., Long, S. W., Jackson, R. H., Mayeux, E., George, R. B., Murphy, P. W., & Crouch, M. A. (1993). Rapid estimate of adult literacy in medicine: A shortened screening instrument. Family Medicine, 25, 391–395.

Delp, C., & Jones, J. (1996). Communicating information to patients: The use of cartoon illustrations to improve comprehension of instructions. Academic Emergency Medicine, 3, 264–270.

doi:10.1111/j.1553-2712.1996.tb03431.x

DeWolt, D. A., Pignone, M., Malone, R., Rawls, C., Kosnar, M. C., George, G., ... Angel, B. (2004). Development and pilot testing of a disease management program for low literacy patients with heart failure. Patient Education and Counseling, 55, 78–86.

doi:10.1016/j.pec.2003.06.002

Doak, C. C., Doak, L. G., Friedell, G. H., & Meade, C. D. (1998). Improving comprehension for cancer patients with low literacy skills: Strategies for clinicians. CA: A Cancer Journal for Clinicians, 48, 151–162.

doi:10.3322/canjclin.48.3.151

Dowse, R., & Ehlers, M. (2001). The evaluation of pharmaceutical pictograms in a low-literate South African population. Patient Education and Counseling, 45, 87–99.

doi:10.1016/S0738-3991(00)00197-X

Dowse, R., & Ehlers, M. (2005). Medicine labels incorporating pictograms: Do they influence understanding and adherence? Patient Education and Counseling, 58, 63–70.

doi:10.1016/j.pec.2004.06.012

Garcia-Retamero, R., Okan, Y., & Cokely, E. T. (2012). Using visual aids to improve communication of risks about health: A review. The Scientific World Journal, 2012, 562637.

doi:10.1155/2012/562637

Goodfellow, G. W., Trachimowicz, R., & Steele, G. (2008). Patient literacy levels within an inner-city optometry clinic. Optometry-Journal of the American Optometric Association, 79, 98–103.

doi:10.1016/j.optmj.2007.03.015

Heitzer, D., Hollis, C., Cothen, J., & Oestreich, N. (2009). Health literacy demands of written health information materials: An assessment of cervical cancer prevention materials. Cancer Control, 16, 70–78.

Hill-Briggs, F., & Smith, A. S. (2008). Evaluation of diabetes and cardiovascular disease print patient education materials for use with low-health literate populations. Diabetes Care, 31, 667–671.

doi:10.2337/dc07-1365

Jordan, J. E., Buchbinder, R., Briggs, A. M., Eisworth, G. R., Busija, L., Batterham, R., & Osborne, R. H. (2013). The Health Literacy Management Scale (HeLMS): A measure of an individual’s capacity to seek, understand and use health information within the healthcare setting. Patient Education and Counseling, 91, 228–235.

doi:10.1016/j.pec.2013.01.013

Kalichman, S. C., Cherry, C., Kalichman, M. O., Amaral, C., White, D., Grebler, T., ... Schnaiﬁ, R. F. (2013). Randomized clinical trial of HIV treatment adherence counseling interventions for people living with HIV and limited health literacy. AIDS Journal of Acquired Immune Deﬁciency Syndromes, 63, 42–50.

doi:10.1097/QAI.0b013e118286ecd9

Kirsch, J. S., Educational Testing Service, & National Center for Education Statistics. (1993). Adult literacy in America: A first look at the results of the national adult literacy survey. Washington, DC: Office of Educational Research and Improvement, US Dept. of Education.

Kripalani, S., Robertson, R., Love-Ghaffari, M. H., Henderson, L. E., Prasok, J., Strawder, A., ... Jacobson, T. A. (2007). Development of an illustrated medication schedule as a low-literacy patient education tool. Patient Education and Counseling, 66, 368–377.

doi:10.1016/j.pec.2007.01.020

Kutner, M., Greenburg, E., Jin, Y., & Paulsen, C. (2006). The health literacy of America’s adults: Results from the 2003 national assessment of adult literacy. NCES 2006-483. Washington, DC: National Center for Education Statistics.
Mansoor, L. E., & Dowse, R. (2003). Effect of pictograms on readability of patient information materials. The Annals of Pharmacotherapy, 37, 1003–1009. doi:10.1345/aph.1C449

Mayer, R. E. (1947/2014). The Cambridge handbook of multimedia learning (pp. 43–71, 2nd ed.). New York, NY: Cambridge University Press.

Mayer, R. E., & Ebooks Corporation. (2009). Multimedia learning (2nd ed.). Leiden: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511811678

Nielsen-Bohlman, L., NetLibrary, I., & Institute of Medicine (US) Committee on Health Literacy. (2004). Health literacy: A prescription to end confusion. Washington, DC: National Academies Press.

Paasche-Orlow, M. K., Parker, R. M., Gazmarranian, J. A., Nielsen-Bohlman, L. T., & Rudd, R. R. (2005). The prevalence of limited health literacy. Journal of General Internal Medicine, 20, 175–184. doi:10.1111/j.1525-1497.2005.40245.x

Schwartzberg, J. G., Cowett, A., VanGeest, J., & Wolf, M. S. (2007). Communication techniques for patients with low health literacy: A survey of physicians, nurses, and pharmacists. American Journal of Health Behavior, 31, 96–104. http://dx.doi.org/10.5993/AJHB.31.s1.12

Sorden, S. D. (2012). The cognitive theory of multimedia learning. In B. Iby, G. H. Brown, R. Lara-Alecio, & S. A. Jackson (Eds.), Handbook of educational theories (p. 1). Charlotte, NC: Information Age Publishing.

U.S. Department of Health and Human Services, & Office of Disease Prevention and Health Promotion (2010). National action plan to improve health literacy. Washington, DC.