Published in final edited form as:

AIDS Behav. 2017 March ; 21(3): 812–821. doi:10.1007/s10461-016-1329-6.

A systematic review of health literacy interventions for people living with HIV

Joseph Perazzo¹, Darcel Reyes², and Allison Webel¹

¹Frances Payne Bolton School of Nursing, Case Western Reserve University, Cleveland, OH, USA

²School of Nursing, Rutgers University, Newark, NJ, USA

Abstract

Health literacy significantly impacts health-related outcomes among people living with HIV. Our aim was to systematically review current literature on health literacy interventions for people living with HIV. The authors conducted a thorough literature search following the PRISMA statement and the AMSTAR checklist as a guide, and found six studies that met inclusion/exclusion criteria. The majority of these interventions were designed to improve HIV treatment adherence as well as HIV knowledge and treatment-related skills, with one study focusing on e-Health literacy. Several of the studies demonstrated trends toward improvement in medication adherence, but most did not achieve statistical significance primarily due to methodological limitations. Significant improvements in knowledge, behavioral skills, and e-Health literacy were found following interventions ($p = 0.001–0.05$). Health literacy interventions have the potential to promote HIV-related knowledge, behavioral skills, and self-management practices. More research is needed to assess the efficacy of interventions to promote a variety of self-management practices.

Keywords

antiretroviral therapy; HIV; health literacy; interventions; self-management

INTRODUCTION

Antiretroviral therapy (ART) has made it possible for people living with HIV (PLWH) to achieve viral suppression and live longer than ever before. However, many PLWH are not achieving optimal treatment outcomes, and limited health literacy may be a contributing factor to this problem (1, 2). Interventions to promote health literacy in PLWH have been developed, but there is currently no published synthesis of these studies. The purpose of this article is to systematically review interventions aimed at promoting health literacy in PLWH.

Despite the promise of ART, less than half of the PLWH in the United States are achieving HIV viral suppression (3). The disparity between the number of people diagnosed with HIV and the number of people achieving viral suppression has been attributed to multiple factors,

Corresponding Author: Joseph Perazzo, 7828 Dearborn Ave, Cincinnati, OH 45236, (513) 227-7427, jdp118@case.edu.

Conflict of Interest: The authors declare that they have no conflict of interest.

including healthcare access disparities, treatment costs, patient-provider dynamics, issues with mental health and substance abuse, and poor HIV treatment adherence (4, 5). Although there is no single causal factor to suboptimal treatment outcomes, health literacy is a prominent factor in nearly all discussions of health outcomes (6, 7). Health literacy is defined as the degree to which an individual has the capacity to obtain, communicate, process, and understand health information and to make informed health decisions (8). Health literacy is influenced by reading ability, numeracy skills, the ability to comprehend health instructions, to navigate the healthcare system, and the ability to seek out, appraise, and apply health information, including information found online (e-Health) (6, 9, 10).

Approximately 90 million Americans do not possess the literacy skills necessary to process and act upon health information (11). Individuals with low health literacy encounter more medical complications, have more difficulty adhering to treatment regimens, and have a shorter life span compared to individuals with higher health literacy (9). Health literacy is crucial to PLWH for multiple reasons, including the chronic nature of HIV, the need for vigilance of health and risk behaviors, and the need for strict adherence to treatment regimens (12–16). Advances in treatment and self-management have led to longer life spans, resulting in many more people aging with HIV (17). They are at higher risk for chronic comorbidities and the resultant polypharmacy (18–21), and individuals with low health literacy encounter more disease-related complications, more symptoms, more difficulty understanding health-related instructions, and have poorer adherence to HIV medications (14–16, 22).

Scientists have developed health literacy measures (Table 1) that clinicians can use to identify individuals at risk for complications due to poor health literacy (23–25). While the measurement of general health literacy is crucial, it is insufficient in light of the nuances found in the management of specific chronic conditions. Disease-specific health literacy measures have also been developed (26) to determine functional understanding of specific diseases, including HIV (27). Health literacy interventions have been developed to address a variety of outcomes. Some health literacy interventions are designed to modify or change the level of an individual's health literacy, with the outcome measure being a health literacy measurement. Other health literacy interventions are designed to impact disease-specific outcomes (e.g. knowledge, medication adherence) among individuals of varying health literacy levels, and with specific levels of health literacy defining the target population as opposed to the outcome variable.

Analysis of health literacy interventions designed for PLWH, and their outcomes, is crucial to understanding the current state of the science. The objective of this review is to describe the aspects of HIV care and treatment that are being addressed by HIV health literacy interventions and to assess the effects of the interventions on outcome measures in samples of PLWH.

METHODS

The authors conducted a systematic review to identify interventions aimed at promoting health literacy in PLWH. The extended guidelines of the Preferred Reporting Items for

Systematic Reviews and Meta-Analyses (PRISMA) statement (28) and A Measurement Tool to Assess Systematic Reviews (AMSTAR) checklist (29), which are gold standards for the procedures and reporting of systematic reviews, were used to guide the procedures of this systematic review.

Search Strategy

The authors used a variety of electronic databases, including PubMed, the Cochrane Library, PsycInfo, CINAHL, and Scopus, as well as a university library search engine that pulled from thousands of online peer-reviewed literature sources. The authors also searched for ongoing investigations through clinicaltrials.gov. Finally, the reference lists of the obtained literature were reviewed. Search terms were used in a variety of combinations and included “HIV,” “health literacy,” “intervention*,” “skill*,” “program*,” “education*,” “knowledge,” “develop*,” “pilot,” “qualitative,” “promot*”.

Eligibility

The literature search took place during October–December of 2015. Articles were included in the review if they were published between 1996 and 2015 in order to review investigations that have taken place since the introduction of highly active antiretroviral therapy (HAART), were published in English, contained at least one measurement of health literacy, had a target population of adults living with HIV, were intervention studies in which health literacy was a central factor of interest, and which included (a) intervention studies including a target sample of PLWH of varying health literacy levels, (b) intervention studies including PLWH in which changes in health literacy scores were an outcome measure, and (c) intervention studies including PLWH in which care and treatment-related outcomes were correlated to health literacy measures, and (d) studies that described the development of interventions designed to impact health literacy-related outcomes in people living with HIV. Studies were excluded if the intervention study sample did not include PLWH or if the study did not contain an intervention component (e.g. exploratory design studies).

RESULTS

Study Selection

Figure 1 provides a PRISMA diagram (28) of the study selection procedure. The review of clinicaltrials.gov did not reveal any ongoing or unpublished studies that fit the inclusion/exclusion criteria for this review. The authors used multiple electronic databases for the literature search. After narrowing the results to peer-reviewed publications published between 1996 and 2005, the results yielded a total of 12,663 potential studies. Irrelevant articles resulting from the keyword search ($n = 8,678$) were removed, leaving 3,985 potential articles. The first author screened titles and abstracts and removed all articles unrelated to health literacy ($n = 1,960$) and health literacy articles about diseases other than HIV ($n = 1,912$), resulting in 113 possible articles. Of these, 103 articles that were eliminated were related to health literacy and HIV disease, but did not include interventions and were exploratory, cross-sectional, or narrative works. The remaining ten articles were thoroughly reviewed. Four were studies describing various interventions, but did not include a health literacy measurement. The reference lists of the remaining articles were reviewed, but

provided no literature that had not already been obtained. A total of six ($n = 6$) articles were retained for the systematic review.

Methodological Quality

The quality of the studies selected for the review was evaluated using the Kmet's (30) *Manual for Quality Scoring of Quantitative Studies*. The manual provides a checklist and detailed instructions for scoring quantitative studies. Each study was evaluated and given a quality score, but no cut-off scores were used and all available relevant articles were included (Table 2).

Data Extraction

The authors created a data extraction form that was tailored to the present investigation using the guidelines outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (31). The authors thoroughly reviewed each study and extracted the following data: study design, sample characteristics, sample size, location of the study, intervention characteristics, aspect of HIV care addressed in the study, health literacy measures, outcome measures, psychometric properties of measures, and reported results (Table 2).

Data Synthesis

The high level of heterogeneity among the included studies made meta-analysis of study results not feasible. The studies varied in terms of outcome measures, intervention methods, and participant characteristics. The present analysis is a narrative analysis of the characteristics of a group of health literacy interventions for PLWH.

Characteristics of Selected Studies

Although no geographic or cultural parameter was set in the literature search, all of the studies obtained that met the inclusion/exclusion criteria were conducted in the United States. Across the studies, samples included men ($n = 500$), women ($n = 203$), and transgender individuals ($n = 3$) living with HIV, ranging in age from 20 to 78 years of age. Racial and ethnic backgrounds included Whites ($n = 50$), Blacks ($n = 538$), Latinos ($n = 85$), with the remaining 30 participants classified as "other" or "unknown". Participants' HIV risk factors included men who have sex with men (MSM; $n = 106$), injection drug users ($n = 22$), heterosexuals ($n = 83$), and 550 participants with unspecified HIV risk (the excess of total sample size reflects participants who identified with more than one exposure category when applicable). Other specific sample characteristics included individuals with verified literacy deficits confirmed through health literacy measurement, Spanish-speaking participants, and individuals with confirmed HIV medication adherence difficulties. Study designs included three formative studies piloting new interventions, one single-group pretest/posttest design, and one randomized control trial. Intervention strategies included in-person counseling, and interactive education and counseling experiences, as well as technology-assisted education.

Health Literacy in the Selected Studies

Health literacy was measured in the selected studies using the Test of Functional Health Literacy in Adults (TOFHLA), the Rapid Estimate of Adult Literacy in Medicine (REALM), and the eHealth Literacy Scale (eHEALS), which measured an individual's perceived skills at obtaining, appraising, and applying eHealth information to health problems. Health literacy scoring was only an *outcome* measure in one of the investigations, (32) but guided the development of all of the interventions, and was a central factor of interest in all of the study results. In the investigations by Kalichman, Cherry, and Cain (33) and Kalichman et al. (34) for example, a deficit in health literacy (marginal to low health literacy) was an inclusion criterion to be in the study, which provided insight into the efficacy of the intervention for individuals of various literacy levels. In contrast, the study by Robinson and Graham (32) used differences in specific health literacy scores to determine the efficacy of an eHealth literacy intervention.

Quality

The six studies varied in overall quality. Strengths across studies included well-defined research objectives, detailed discussions of sample characteristics, and conclusions that closely matched the study outcomes. Limitations included small samples, lack of control condition and investigator/participant blinding, lack of control for confounding variables, and lack of report of psychometric properties of questionnaires, and failure to thoroughly discuss analytic methods.

The Interventions

A variety of interventions were described. The studies by Kalichman et al. (33, 34) included both a pilot study and a randomized clinical trial. The pilot study tested a pictograph-guided HIV adherence counseling intervention that was formed from interviews with HIV patients and targeted those who had limited literacy skills. The pictographic information (see the work by Kalichman et al. (34) original work for the graphic) contained visual information relevant to participants (e.g. color-coded schedules, minimal text, dosage information). The intervention was delivered in three sessions that addressed understanding HIV and HIV medication (Session 1), HIV medication and the health of participants (Session 2), and also included a booster session focused on maintaining adherence behaviors (Session 3/booster session). The authors followed the Doak et al. principles for health education, including setting realistic objectives, focusing on behaviors and skills, presenting context before new information, partitioning complex instructions, and using interactive instructions.

The second study by Kalichman et al. (33) involved the comparison of the aforementioned pictograph-guided adherence counseling to standard adherence counseling and general health improvement counseling, and was also completed in three sessions. Standard adherence counseling included the use of a brief verbal description and the use of a patient education flipchart, the distribution of a pillbox that could be used to improve adherence, and a booster session that included discussion of adherence challenges. The general health counseling intervention focused on nutrition, stress reduction, health and well-being, and a booster session to discuss problem-solving and barriers to health improvement goals.

Two articles by Van Servellen et al. (35, 36) were included to describe the development of the intervention *Es Por La Vida*. Using a multistep process, the authors reviewed current literature on predictors of health literacy, identified culture-specific attributes that were essential to success in the target population, and conducted provider focus groups that consisted of health educators, case managers, treatment advocates, nurse supervisors, social workers, and a director of psychosocial services within the institution. The result was a 5-week instructional support, modular program in which individual and group-level education on factors related to: (1) treatment regimens, (2) social and psychological factors, (3) institutional resources, and (4) personal attributes. The entire intervention was culturally and linguistically tailored to Spanish-speaking individuals living with HIV. The second article by van Servellen et al. (36) described the piloted intervention along with the 6-month follow up results (Table 2).

The Ownby et al. (37) intervention included multimedia representation of HIV and HIV treatment-related concepts (e.g. viral life cycle, misconceptions about medications, coping with stigma, mechanism of action of medications). The intervention was developed through analysis of patient education materials by an interdisciplinary team from medicine, nursing, psychology, pharmacy, and social work. The 1-hour multimedia intervention was delivered using a touchscreen computer and graphics, audio, video, and interactive multiple-choice questions related to the educational content.

Finally, Robinson and Graham (32) designed a 50-minute interactive class that combined basic computer training with skills necessary to seek out health-related information online. They formed an interdisciplinary team comprised of pharmacists and librarians, and hosted the classes in a university library computer lab where participants were able to use computers as an interaction component to the intervention. The team developed learning objectives, handouts, and PowerPoint presentations that were used for the intervention, and engaged library science students to assist with the presentations. Finally, in addition to the didactic and computer activities, the researchers gauged understanding of content through interactive question and answer sessions.

Efficacy of Interventions

The interventions were designed to address several major outcomes: HIV medication adherence, HIV knowledge and behavior skills, and eHealth literacy. Treatment adherence was measured through self-report, unannounced pill counts, medication event monitoring systems (MEMS), and surrogate inference based on HIV disease biomarkers (HIV-1 RNA). Knowledge and behavioral skills outcomes were measured using investigator-administered questionnaires, surveys, and measurement tools.

Treatment Adherence

Kalichman, Cherry, and Cain's (33) adherence improvement intervention resulted in significant decreases in total medication nonadherence events ($p < .01$) between baseline to 3-month follow-up in a sample of individuals with limited health literacy ($n = 30$). In the later randomized clinical trial by Kalichman et al. (34), the pictograph-guided adherence intervention demonstrated increased levels of adherence among individuals with marginal

health literacy (TOFHLA score between 85%–90%), although the results were not statistically significant. Low-health literacy participants (TOFHLA score <85%) did not demonstrate increased adherence following exposure to the intervention. Investigators also measured changes in HIV biomarkers and found a significant interaction effect between type of HIV adherence counseling and literacy group (low, marginal, and proficient). Individuals with marginal health literacy were more likely to transition from detectable to undetectable viral load in pictograph and standard adherence counseling conditions ($p < 0.05$) compared to individuals of low health literacy in those groups.

The intervention created by Ownby, Waldrop-Valverde, Caballero, and Jacobs (37) resulted in significantly higher adherence by individuals with low numeracy skills ($p < 0.03$). Due to high baseline adherence (> 95%) by the majority of the sample, the investigators were able to determine a trend of adherence improvement, but were not able to achieve statistical significance. Finally, in the Van Servellen et al. (36) modular education program, participants in the intervention group demonstrated a trend toward better adherence than the control group at 6-week and 6-month follow-up, but it was not statistically significant.

HIV Knowledge and Behavioral Skills

In Ownby, Waldrop-Valverde, Caballero, and Jacob's (37) investigation, participants completed the LifeWindows Information Motivation Behavior (IMB) Scale to measure their knowledge and behavioral skills, including disease-specific knowledge and strategies to cope with stigma and remembering medications, at baseline and follow-up visits. Increases in LifeWindows scores indicate a greater level of the skills needed to perform health behaviors. Participants self-reported increase in knowledge was significant for the information subscale ($p = 0.02$) and the behavior subscale ($p = 0.02$). Changes in information predicted medication adherence among participants in the study ($p = 0.001$).

Kalichman, Cherry, and Cain (33) administered questionnaires to measure IMB as part of an adherence improvement counseling intervention, including HIV disease knowledge (CD4+ count, viral load), treatment adherence intention, and self-efficacy. Participants had significant increases in AIDS-related knowledge at the first, second, and third month follow-ups ($p < 0.01$). A significantly greater number of participants understood viral loads at 1- and 3-month follow-ups ($p < 0.05$), and CD4 counts at the first, second, and third month followup visit ($p < 0.05$). Treatment adherence intention was significantly increased at all three follow-ups ($p < 0.05$), and intention to have nearby medication, increased at the second and third follow-up from baseline ($p < 0.05$).

In the Van Servellen et al. (36) study, participants completed the HIV Illness and Treatment Knowledge Misconception Scale, a measure developed by the investigators that demonstrates HIV-specific knowledge across five specific measures: HIV disease/treatment knowledge, HIV treatment-related knowledge subscale, recognition of HIV terms, understanding HIV terms, and knowledge of risk of getting sicker. At the 6-week follow-up, participants scored significantly higher in global knowledge ($p = 0.03$), recognition of HIV terms ($p < 0.0001$), understanding of HIV terms ($p < 0.0001$), and significantly higher in recognition of terms ($p < 0.0001$) and understanding of terms ($p < 0.0001$) at the 6-month follow-up. The Van Servellen et al. (36) investigation targeted Spanish-speaking patients

with adherence problems and focused on improving communication between clinicians and Spanish-speaking patients. The intervention group had significant increases in communication with staff and HIV physicians throughout the study ($p < 0.001$).

Finally, Robinson and Graham (32) used an instrument to measure changes in eHealth literacy in a group of PLWH. Following the intervention, an in-person educational program on computer skills and eHealth evaluation, participants completed the measure immediately and again 3 months later. Participants overall scores on the eHEALS significantly increased between baseline and the evaluation directly following the intervention (total score increase: 19–32; $p < 0.01$). Scores between baseline and three month follow-up had higher variability and did not achieve statistical significance (total score increase: 19–29; $p < 0.08$). Nearly half ($n=8$) of the participants did not complete the 3-month follow-up, which likely diminished the ability to achieve statistical significance in the final follow-up measure compared with baseline scores.

DISCUSSION

The purpose of this systematic review was to identify, appraise, and synthesize current published literature on health literacy interventions designed for PLWH. This review builds upon previous reviews of the impact of health literacy on HIV patients and is, to our knowledge, the first to synthesize and critically appraise published literature specifically about health literacy interventions designed for PLWH. Each study team provided a strong rationale for developing interventions tailored to PLWH.

Although multiple studies in this review did not provide robust results of statistical significance due to limitations, all of the studies addressed issues of clinical significance. Many PLWH are not achieving optimal treatment outcomes, and high levels of medication adherence are needed to prevent viral resistance and to decrease the risk of HIV transmission (38). Five studies were conducted with an aim of improving medication adherence, but only one of the studies resulted in statistically significant changes in adherence. As demonstrated in the investigation by Kalichman et al. (39), the efficacy of adherence interventions can vary based on differences in literacy level, including specific differences among individuals with less than proficient health literacy. Clinicians should assess health literacy of patients and tailor the intensity of adherence counseling efforts accordingly.

Robinson and Graham (32) addressed the unique outcome measure of eHealth literacy. The Internet is increasingly being used as source of health-related information by the public. However, the reliability and accuracy of the information that they are able to obtain is questionable, and clinicians have the ability to mitigate exposure to inaccurate, misleading, and even dangerous information by providing PLWH with the tools to obtain and evaluate reliable online health information. PLWH should be encouraged to explore these resources, where available, to promote education and care engagement.

The most significant results in the present review came from studies in which HIV-specific knowledge and behavior skills were outcome measures. As demonstrated in the study by Ownby et al., knowledge about HIV as an illness and skills such as developing strategies to

adhere to medications significantly increased after exposure to an intervention designed, in part, to provide disease-specific education. Changes in these variables also predicted medication adherence over the course of the study, demonstrating the potential impact of dynamic patient education in the clinical environment. Clinicians should tailor their approaches to disease/health-specific education based on the health literacy level and leverage visual and technological resources to increase the intensity and efficacy of patient education.

The heterogeneity of the interventions makes it difficult to determine the efficacy across interventions. Despite methodological limitations, the investigators were able to demonstrate a benefit of interventions for PLWH, specifically gaining knowledge and strategies aimed at performing health behaviors. The IMB model can aid investigators in the development of health literacy interventions designed to increase knowledge and behavioral skill. There is insufficient evidence to arrive at a strong conclusion about the benefit/effect of any specific intervention. Three of the studies were in formative stages and only one study was an RCT. Methodological limitations impeded the ability of multiple investigators to achieve statistical significance on all measures. Several studies had small samples and did not employ control groups or randomization, which limited the scope of conclusions made by the authors.

This review also has limitations. The authors were limited to articles that were published in the English language. The studies in this review were all conducted in the United States and the majority of study participants were African American, limiting the global generalizability of the results. The small sample of articles that fit the inclusion/exclusion criteria, coupled with the heterogeneity across the selected studies, limited the ability of the authors to synthesize the findings of the study and to draw conclusions about intervention efficacy. These limitations mirror the limitations discussed in larger-scale reviews of health literacy interventions, such as the problem of small samples, lack of control over confounding variables, and the limited number of intervention studies available to draw conclusions about health literacy and its mediators (11).

The National HIV/AIDS Strategy for the United States and the Services (40) have established goals to improve outcomes for PLWH and to improve prevention and treatment of HIV-associated comorbidities and coinfections. More research is needed to determine the influence of health literacy as a process variable that influences the ability for PLWH to manage their health. Future research should include studies that replicate the designs of the reviewed studies while addressing methodological shortcomings, such as the need for larger samples and randomized control designs. In addition, future research should include global research efforts to determine cultural influences on the success of health literacy interventions and to inform the development of culturally appropriate interventions. Researchers should use rigorously developed, disease-specific health literacy instruments, such as the HIV Health Literacy Scale (27), in addition to reliable measures of general health literacy skills to accurately identify health literacy deficits. Finally, since PLWH are living longer lives and encountering multimorbidity at higher rates than people not living with HIV, future research efforts should examine the broad spectrum of literacy-related problems that accompany management of multimorbidity among PLWH.

References

1. CDC. HIV Care Saves Lives. 2014. [cited 2015 July 15, 2015]. Available from: <http://www.cdc.gov/vitalsigns/HIV-AIDS-medical-care/>
2. Institute of Medicine. Health literacy: A prescription to end confusion. National Academies Press; 2004.
3. United States Department of Health and Human Services. HIV/AIDS Continuum of Care. 2015. Available from: <https://www.aids.gov/federal-resources/policies/care-continuum/>
4. Holtzman CW, Brady KA, Yehia BR. Retention in care and medication adherence: Current challenges to antiretroviral therapy success. *Drugs*. 2015; 75(5):445–54. [PubMed: 25792300]
5. Gardner, McLees MPP, Steiner JF, del Rio C, Burman WJ. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clinical Infectious Diseases*. 2011; 52(6):793–800. [PubMed: 21367734]
6. Paasche-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Bohlman LT, Rudd RR. The prevalence of limited health literacy. *Journal of General Internal Medicine*. 2005; 20(2):175–84. [PubMed: 15836552]
7. Baumann KE, Phillips AL, Arya M. Overlap of HIV and low health literacy in the southern USA. *The Lancet HIV*. 2015; 2(7):e269–e70. [PubMed: 26423251]
8. Centers for Disease Control and Prevention. Health Literacy. 2015. [cited 2015 August 24, 2015]. Available from: <http://www.cdc.gov/healthliteracy/learn/>
9. McCray AT. Promoting health literacy. *Journal of the American Medical Informatics Association*. 2005; 12(2):152–63. [PubMed: 15561782]
10. Norman CD, Skinner HA. eHealth literacy: essential skills for consumer health in a networked world. *Journal of medical Internet research*. 2006; 8(2)
11. Berkman, ND., Sheridan, SL., Donahue, KE., Halpern, DJ., Viera, A., Crotty, K., et al. Health literacy interventions and outcomes: an updated systematic review. Rockville, MD: Agency for Healthcare Research and Quality; Mar. 2011 Evidence Report/Technology Assessment No. 199. (Prepared by RTI International–University of North Carolina Evidence-based Practice Center under contract No. 290-2007-10056-I. AHRQ Publication Number 11-E006)
12. Graham J, Bennett IM, Holmes WC, Gross R. Medication beliefs as mediators of the health literacy–antiretroviral adherence relationship in HIV-infected individuals. *AIDS and Behavior*. 2007; 11(3):385–92. [PubMed: 17053858]
13. Kalichman SC, Pope H, White D, Cherry C, Amaral CM, Swetzes C, et al. Association between health literacy and HIV treatment adherence: further evidence from objectively measured medication adherence. *Journal of the International Association of Physicians in AIDS Care (JIAPAC)*. 2008; 7(6):317–23. [PubMed: 19056866]
14. Kalichman SC, Ramachandran B, Catz S. Adherence to combination antiretroviral therapies in HIV patients of low health literacy. *Journal of General Internal Medicine*. 1999; 14(5):267–73. [PubMed: 10337035]
15. Kalichman SC, Rompa D. Functional health literacy is associated with health status and health-related knowledge in people living with HIV-AIDS. *Journal of Acquired Immune Deficiency Syndromes (1999)*. 2000; 25(4):337–44. [PubMed: 11114834]
16. Wolf MS, Davis TC, Osborn CY, Skripkauskas S, Bennett CL, Makoul G. Literacy, self-efficacy, and HIV medication adherence. *Patient Education and Counseling*. 2007; 65(2):253–60. [PubMed: 17118617]
17. Önen NF, Overton ET, Seyfried W, Stumm ER, Snell M, Mondy K, et al. Aging and HIV infection: a comparison between older HIV-infected persons and the general population. *HIV Clinical Trials*. 2010; 11(2):100–9. [PubMed: 20542846]
18. Ball SC. The aging HIV population. *Clinical Practice*. 2014; 11(2):221–31.
19. Holtzman C, Armon C, Tedaldi E, Chmiel JS, Buchacz K, Wood K, et al. Polypharmacy and risk of antiretroviral drug interactions among the aging HIV-infected population. *Journal of general internal medicine*. 2013; 28(10):1302–10. [PubMed: 23605401]
20. Centers for Disease Control and Prevention. HIV among people 50 and older. 2015. [cited 2015 11/02/2015]. Available from: <http://www.cdc.gov/hiv/group/age/olderamericans/index.html>

21. Centers for Disease Control and Prevention. HIV among older Americans. 2015. [cited 2015 11/02/2015]. Available from: http://www.cdc.gov/hiv/pdf/library_factsheet_HIV_AmongOlderAmericans.pdf
22. Osborn CY, Paasche-Orlow MK, Davis TC, Wolf MS. Health literacy: an overlooked factor in understanding HIV health disparities. *American Journal of Preventive Medicine*. 2007; 33(5):374–8. [PubMed: 17950402]
23. Murphy PW, Davis TC, Long SW, Jackson RH, Decker BC. Rapid estimate of adult literacy in medicine (REALM): a quick reading test for patients. *Journal of Reading*. 1993; 37(2):124–30.
24. Parker RM, Baker DW, Williams MV. The test of functional health literacy in adults. *Journal of General Internal Medicine*. 1995; 10(10):537–41. [PubMed: 8576769]
25. Weiss BD, Mays MZ, Martz W, Castro KM, DeWalt DA, Pignone MP, et al. Quick assessment of literacy in primary care: the newest vital sign. *The Annals of Family Medicine*. 2005; 3(6):514–22. [PubMed: 16338915]
26. Altin SV, Finke I, Kautz-Freimuth S, Stock S. The evolution of health literacy assessment tools: a systematic review. *BMC Public Health*. 2014; 14(1):1207. [PubMed: 25418011]
27. Ownby RL, Waldrop-Valverde D, Hardigan P, Caballero J, Jacobs R, Acevedo A. Development and validation of a brief computer-administered HIV-related health literacy scale (HIV-HL). *AIDS and Behavior*. 2013; 17(2):710–8. [PubMed: 22961499]
28. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine*. 2009; 151(4):264–9. [PubMed: 19622511]
29. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC medical research methodology*. 2007; 7(1):10. [PubMed: 17302989]
30. Kmet, LM., Lee, RC., Cook, LS. Standard quality assessment criteria for evaluating primary research papers from a variety of fields. Alberta Heritage Foundation for Medical Research; 2004.
31. Higgins, JP., Green, S. *Cochrane handbook for systematic reviews of interventions*. Wiley Online Library; 2008.
32. Robinson C, Graham J. Perceived Internet health literacy of HIV-positive people through the provision of a computer and Internet health education intervention. *Health Information & Libraries Journal*. 2010; 27(4):295–303. [PubMed: 21050372]
33. Kalichman SC, Cherry J, Cain D. Nurse-delivered antiretroviral treatment adherence intervention for people with low literacy skills and living with HIV/AIDS. *Journal of the Association of Nurses in AIDS Care*. 2005; 16(5):3–15.
34. Kalichman SC, Cherry C, Kalichman MO, Amaral C, White D, Grebler T, et al. Randomized clinical trial of HIV treatment adherence counseling interventions for people living with HIV and limited health literacy. *Journal of acquired immune deficiency syndromes (1999)*. 2013; 63(1):42. [PubMed: 23337369]
35. Van Servellen G, Carpio F, Lopez M, Garcia-Teague L, Herrera G, Monterrosa F, et al. Program to enhance health literacy and treatment adherence in low-income HIV-infected Latino men and women. *AIDS patient care and STDs*. 2003; 17(11):581–94. [PubMed: 14746666]
36. Van Servellen G, Nyamathi A, Carpio F, Pearce D, Garcia-Teague L, Herrera G, et al. Effects of a treatment adherence enhancement program on health literacy, patient-provider relationships, and adherence to HAART among low-income HIV-positive Spanish-speaking Latinos. *AIDS Patient Care & STDs*. 2005; 19(11):745–59. [PubMed: 16283835]
37. Ownby RL, Waldrop-Valverde D, Caballero J, Jacobs RJ. Baseline medication adherence and response to an electronically delivered health literacy intervention targeting adherence. *Neurobehavioral HIV medicine*. 2012; 4:113. [PubMed: 23293544]
38. Cohen MS, McCauley M, Gamble TR. HIV treatment as prevention and HPTN 052. Current opinion in HIV and AIDS. 2012; 7(2):99. [PubMed: 22227585]
39. Kalichman SC, Cherry C, Kalichman MO, Amaral C, White D, Grebler T, et al. Randomized Clinical Trial of HIV Treatment Adherence Counseling Interventions for People Living With HIV and Limited Health Literacy. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 2013; 63(1):42–50. [PubMed: 23337369]

40. United States Department of Health and Human Services. The National HIV/AIDS Strategy for the United States. 2015. [updated July, 2015; cited 2015 August 13]. Available from: <https://www.aids.gov/federal-resources/national-hiv-aids-strategy/nhas-update.pdf>

Figure 1.
The Literature Search

Table 1

Health Literacy Measures

Health Literacy Measures	
Instrument	Measurement
Test of Functional Health Literacy in Adults (TOFHLA)	Measures health literacy through reading comprehension. Individuals review information in a written passage and answer questions and are scored between zero (inadequate Literacy) and 100 (Adequate Literacy).
Rapid Estimate of Adult Literacy in Medicine (REALM)	Measures health literacy through word recognition. Individuals are given a list of 66 words to read to the person administering the measure. Each word is scored as “1”; scores range from 0 (third grade reading level or below), to 66 (highschool reading level).
Newest Vital Sign (NVS)	Measures health literacy through reading and interpreting the information on a nutrition label. Individuals refer to the label and answer six questions that measure reading comprehension and numeracy. Each correct answer is scored as “1”; scores range from 0 (likely to have low literacy) to 6 (unlikely to have low literacy).

Table 2

Health Literacy Interventions for People Living with HIV

Author(s)/Design/Sample Characteristics (Sample Size)	Intervention (HIV Care Aspect)	HL Measure/Outcome Measures	Results
Kalichman et al., 2013 Randomized Control Trial Men and Women living with HIV receiving ART who scored <90% correct on test of functional health literacy (n= 446) Quality Score 28/28	Adherence Counseling: Pictograph-guided (n=148); Standard (n=157); General Health Improvement (n=141) Baseline + 9 mo. Follow up (<i>HIV treatment adherence</i>)	TOFHLA HIV RNA Viral Load ART Adherence	Viral Load: No main effect of counseling condition (CC) or literacy group (LG) Significant CC/LG interaction for achieving undetectable viral load at follow-up (P<0.01). Detectable at Baseline/Undetectable at Follow-up Marginal Literacy Participants Pictograph (40%), Standard (45%), Control (33%) Treatment Adherence (>95% Adherence) Marginal Literacy Participants: No added benefit of pictograph over standard counseling Low Literacy Participants: No positive outcomes for pictograph or standard counseling
Robinson & Graham, 2010 Single-group pre-test/post-test design Convenience sample of PLWH receiving care from three treatment locations (n=18) Quality Score: (21/28)	50- Minute interactive class on eHealth Pre-test Post-test (immediate) Post-test (three months) (<i>Unspecified; health information seeking</i>)	e-Health Literacy (Norman & Skinner, 2006)	e-Health Literacy Pre/Post-Intervention Surveys: Overall Score increase from 19–32 between baseline and immediate follow-up= statistically significant increase in perceived eHealth literacy levels (P<0.01) Post-Intervention- Three Month Follow-up Survey: Overall Score increase from 19 (baseline) – 29 (3 month follow up; Overall decrease from 32 (immediate follow up) to 29 (3-month follow up; P<0.08)
Ownby, Waldrop-Valverde, Cabellero, & Jacobs, 2012 Formative investigation of intervention Development, Usability and Acceptability Patients with HIV on ART recruited from the practices of local clinicians treating HIV (n=118) Quality Score 26/28	One hour touch-screen computer program. Content developed by multidisciplinary team and guided by current patient education materials. <i>HIV Medication Adherence</i> <i>HIV-related psychosocial coping strategies</i>	TOFHLA Medication Adherence Knowledge and Behavioral Skills	Medication Adherence: Approached statistically significant improvement in adherence post-intervention; Many high-adherers at baseline (ceiling effect); Lower statistical power in smaller/highly variable lower-adherence subsample ; Significant improvement in adherence by individuals with low numeracy skills (P<0.03) Knowledge and Behavioral Skills: Significant increase in self-reported knowledge and behavioral skills over study time period Effect of time for information: F[2,96]=4.25; P=0.02 Effect of time for behavioral skills F[2,96] = 4.17; P = 0.02 Change in information during study was significant predictor of medication adherence: X ² =7.35; df= 1; P= 0.001
Kalichman, Cherry, & Cain, 2005 Two-phase intervention development and pilot study [present data reflect Phase II: Pilot Study for feasibility and potential efficacy of intervention] PLWH, currently on combination ART, and scored <80% on the TOFHLA (n=30) Quality Score 26/28	Two-session + one booster session of an adherence improvement counseling intervention (<i>HIV Medication Adherence</i>)	TOFHLA Information, motivation, and behavioral skills Treatment Adherence	Information, Motivation, Behavioral Skills Significant increases (p,.01) in AIDS-related knowledge, significant increase in understanding of viral load, significantly greater understanding of CD4+ counts; Increased motivation to not miss any doses of drugs, increase behavioral skills, self-efficacy for understanding HIV disease, taking medication without missing a dose, and taking medications on time. Treatment Adherence Non adherence reductions noted at each follow up.

Author(s)/Design/Sample Characteristics (Sample Size)	Intervention (HIV Care Aspect)	HL Measure/Outcome Measures	Results
<p>van Servellen et al., 2003 & van Servellen et al. 2005</p> <p>Randomized Control Trial; pilot testing adherence program</p> <p>Spanish speaking HIV clinic patients with adherence problems, some with detectable viral load on ART for at least 3 months</p> <p>(n= 85)</p> <p>Quality Score (24/28)</p>	<p>Modular education program</p> <p>Baseline data collected</p> <p>6 weeks: Modular education program on HIV knowledge and skills given to pilot group</p> <p>6 months</p> <p>End of follow-up efforts</p> <p>(HIV Medication Adherence: Relationships with Care staff)</p>	<p>Modified REALM</p> <p>HIV illness and treatment knowledge and misconception scale</p> <p>Relationship and communications with healthcare providers scale</p> <p>Treatment Adherence Self report</p>	<p>69 (81%) of participants remained in the study through completion</p> <p>Statistically significant differences between groups on viral load criterion (more than 400 copies per milliliter) and absolute CD4+ count</p> <p>Intervention group scored significantly higher on HIV 3 of 5 health literacy measures at 6 week</p> <ul style="list-style-type: none"> Global knowledge (t=2.22; p=0.03) Recognition of terms (t=-2.97, p<0.0001) Understanding of HIV terms (t=-3.52, p<0.0001) <p>And 2 of 5 measures at 6 months:</p> <ul style="list-style-type: none"> Recognition of terms (t=-3.16, p<0.0001) Understanding of terms (t=-3.93; p<0.0001) <p>Intervention group communications with medical staff/HIV physicians significantly increased (p<0.001); No significant change in comparison group</p> <p>No significant difference in self-reported adherence</p>