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**An Investigation of Healthcare Utilisation and its
Association with Levels of Health Literacy in Individuals
with Chronic Pain.**

Abstract

Objective: Chronic pain patients are frequent and recurrent users of health services, which may impact on levels of health literacy (HL). Therefore, this study aims to investigate associations between healthcare utilisation and varying levels of HL in individuals with and without chronic pain.

Methods: A cross-sectional questionnaire was distributed in three pain clinics in Dublin, Ireland, comprising a demographic section, a validated HL assessment tool (NVS), and self-reported healthcare utilisation in the previous year (i.e. GP visits, A&E attendance, hospital services, and allied health services). Patients with chronic pain and a control group (no pain) were recruited.

Results: Overall, 262 participants were recruited: chronic pain (n=131), control (n=131). The chronic pain group were more likely to be female ($p=0.004$), have less education ($p=0.01$), be unable to work ($p<0.001$), have lower monthly income ($p=0.001$), more likely to have a medical card, i.e. free access to public health services ($p=0.002$), and a greater number of comorbidities ($p<0.0001$). Although bivariate analyses demonstrated increased healthcare utilisation in chronic pain patients (i.e. GP visits, hospital services, and allied therapies, $p<0.05$), there was no difference in HL levels between groups in multivariate analysis (chronic pain: 54%, n=71; control group 49%, n=64; $p=0.39$). Higher educational attainment, greater levels of income, and being younger remained independently associated with higher levels of HL.

Conclusions: Further research is needed to understand the nature of how HL is acquired, from both individual and organisational perspectives. Once this has been established, it may facilitate the development or advancement of current HL-sensitive management strategies.

Keywords: Chronic pain, healthcare utilisation, health literacy, self-management.

1. Introduction

Chronic pain is one of the leading causes of disability worldwide (GBD Collaborators, 2016), and presents significant challenges to health services (Bair et al., 2009).

Effective management of chronic pain requires a multidisciplinary approach, which involves frequent and recurrent utilisation of health services (Crowe, Whitehead, Jo Gagan, Baxter, & Panckhurst, 2010; Mann, LeFort, & VanDenKerkhof, 2013). In addition, best practice guidelines highlight the importance of maintaining prescribed interventions outside of the healthcare setting by recommending self-management strategies (Scottish Intercollegiate Guidelines Network, 2013), with the expectation that patients understand the complex neurobiological and psychological factors associated with its development. However, adherence to self-management strategies remains problematic, with patients reporting barriers such as lack of knowledge about suitable interventions (Barr, Brady, Hughes, & McElnay, 2014), or preferring a more passive approach to treatment (Blyth, March, Nicholas, & Cousins, 2005), i.e. medication to manage pain as opposed to graded physical activity.

Recently, a systematic review reported that low levels of health literacy (HL) had a detrimental impact on the development of self-management behaviours in conditions including diabetes, asthma, and rheumatoid arthritis (Mackey, Doody, Werner, & Fullen, 2016). However, due to a limited amount of available research, it was not possible to include chronic pain as a disease category in its own right. HL is defined as *'the personal, cognitive and social skills which determine the ability of individuals to gain access to, understand, and use information to promote and maintain good health'* (Nutbeam, 2000) and is increasingly considered an important health determinant for individuals with chronic diseases (Nielsen-Bohlman, Panzar, Hamlin, & Kinding, 2004).

Recent advances in the field of HL research have improved our understanding of the antecedents to HL development, in particular demographic characteristics such as age, educational attainment, and socioeconomic status (Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005; Protheroe et al., 2016). Furthermore, these advances have led to the formation of various HL models that depict the causal pathways between HL and health outcomes. For example, Paasche-Orlow and Wolf's (Paasche-Orlow & Wolf, 2007) model focusses on mediating factors between HL and health outcomes, such as disease-related knowledge, self-efficacy, and problem solving skills. Whereas Sorensen et al (Sorensen et al., 2012) illustrates the impact of HL within a broader public health perspective (e.g. the interaction between HL, societal factors and health service structures). However, Squiers et al (Squiers, Peinado, Berkman, Boudewyns, & McCormack, 2012) argue that these models do not demonstrate a comprehensive pathway from HL development to subsequent health outcomes, nor account for the dynamic nature of HL. Thus, they developed the 'RTI Health Literacy Skills Framework' that not only includes antecedents to HL development, potential moderating factors, broader ecological influences, and resulting health outcomes, but also clearly presents HL as a dynamic or modifiable characteristic that may be influenced by patients' experiences or treatment outcomes from their engagement with health services (See figure 1) (Squiers et al., 2012) . In their model, they show how health behaviours and outcomes, including interactions with the health care system over time, can influence an individual's knowledge about a particular health topic, which in turn influences their health literacy skills.

Traditionally, it has been reported that low HL is associated with increased healthcare utilisation, specifically increased emergency service usage and hospitalisations (Federman et al., 2014; Wu et al., 2013). However, taking the Squiers et al (Squiers et al., 2012) 'dynamic' HL model into consideration, it could be argued that chronic pain patients ought to have higher levels of HL than the general population, given their frequent and long-term use of a range of health services. For that reason, the current study aims to: 1) establish levels of HL and healthcare utilisation in chronic pain patients in comparison to a control group, and 2) investigate whether engagement with the healthcare system independently influences health literacy levels, using the RTI Health Literacy Skills Framework as a guide.

2. Methodology

2.1. Overview

A cross-sectional study with two separate groups, i.e. people with chronic pain ('chronic pain group') and a control group (CG) with no history of chronic pain was undertaken in three Dublin University hospitals. Full ethical approval was granted at all three sites prior to commencing the study, which was undertaken from February 2014 to May 2015.

2.2. Procedure and Participants

2.2.1. Recruitment

Chronic pain group: new patients on a waiting list to attend one of three pain clinics in university teaching hospitals were sent an information letter about the study. Following this, they were approached at their appointment in the clinic and asked if they were willing to participate.

Control group (CG): two recruitment strategies were employed: (i) a stand was set up in the lobby of a participating hospital advertising the study and asking volunteers to participate, and (ii) the information letter sent to patients also informed them that anyone accompanying them to their appointment would be invited to participate.

2.2.2. Procedure

Pain clinics (chronic pain group and CG): on the clinic appointment day potential participants, i.e. the newly referred patient and/or accompanying person were approached. Inclusion criteria were reviewed, and if suitable and willing to participate, written informed consent was obtained from one or both.

Hospital Lobby (CG): visitors to the hospital were approached in the lobby of one hospital site, and those who volunteered to participate were given an information sheet about the study. Once they had reviewed it and any queries were answered, the inclusion criteria were reviewed, and written consent was obtained.

Both groups were then asked to complete a battery of questionnaires that captured demographic characteristics, and health service utilisation in the last 12 months. In addition, the researcher administered a HL questionnaire, i.e. Newest Vital Sign (Weiss et al., 2005).

2.2.3. Inclusion criteria

Inclusion criteria for the chronic pain group stipulated that the patient must be willing and able to give informed consent, be a new referral to the pain service, have pain lasting longer than three months, have no cognitive deficits or active psychiatric illness, and be over 18 years of age. Inclusion criteria for the CG stipulated that they did not have a history of chronic pain (i.e. pain lasting >3 months), which was confirmed by the researcher prior to their completion of the questionnaires, that they were over 18 years, and had no cognitive deficits or active psychiatric illness.

2.2.4. Sample Size Calculation

Based on the HLS-EU report of inadequate HL at 40% (established using the Newest Vital Sign (Weiss et al., 2005)) in Ireland (European Health Literacy Consortium, 2012), sample size calculations were performed to estimate prevalence with a precision of $\pm 10\%$ and $\alpha = 0.05$. A pilot study (chronic pain group: $n=10$, CG:

n=10) was conducted which established at 20% difference in inadequate HL levels between groups (50% in the chronic pain group; 30% in the CG). For a minimum detectable difference of $\pm 20\%$, a minimum sample of 94 participants was required in each group, but recruitment targets were set at 130 per group as a contingency ($n > 1.96^2(0.5*0.5) / 0.1^2$).

2.3. Battery of Questionnaires

2.3.1. *Demographics and Health Related Questions*

The following demographic information and health related questions were included:

- (i) Demographic characteristics, i.e. age, gender, employment status, socioeconomic status, educational attainment, income, nationality, health insurance, and comorbidities. These core demographic characteristics were included as important confounders for consideration when assessing the quality of quantitative studies (Thomas, Ciliska, Dobbins, & Micucci, 2004).
- (ii) Health service utilisation in the previous 12 months (general practitioner visits, emergency service use, hospital services use, and allied health service use).

2.3.2. *Health Literacy Assessment - The Newest Vital Sign (NVS)*

The NVS was developed and validated by Weiss et al (Weiss et al., 2005) and more recently, the tool has been validated for use in a British population (Rowlands et al., 2013). It assesses prose literacy, document literacy and numeracy. Average time to complete the questions is three minutes. The NVS tool consists of six questions based on a nutritional label from an ice cream container. The researcher delivers

the six questions, giving the patient as much time as required to provide an answer. There is a maximum of six points. A score of 0-1 suggests a high likelihood of limited literacy, 2-3 indicates the possibility of limited literacy and a score of 4-6 indicates adequate literacy. Psychometric properties of the NVS have been reported in a review of HL assessment tools (Mancuso, 2009), and although criterion validity was poor ($r=0.59$) when determined against The Test of Functional Health Literacy in Adults (TOFHLA), test-retest reliability was acceptable ($\alpha=0.76$). Also, the area under receiver operating characteristic (AUROC) curves were plotted against the TOFHLA were good (sensitivity of scores $<4 = 100\%$; specificity of scores $<4 = 64\%$). A major advantage of the NVS in comparison to other HL assessment tools is that it has been validated for use in a British population (Rowlands et al., 2013), whereas the TOFHLA is better suited to the American health system, as its content includes a scenario of a Medicaid patient (Parker, Baker, Williams, & Nurss, 1995). In addition, the NVS can be completed in approximately three minutes, in comparison to the TOFHLA, which can take up to 20 minutes to complete. For the current study, the results of the NVS were dichotomised into adequate (score of 4-6), or inadequate (<4) scores, in line with other studies (Devraj, Herndon, & Griffin, 2013; Hudon, Fortin, Poitras, & Almirall, 2012).

2.4. Statistical Analysis

All data were coded, entered in Statistical Package for the Social Sciences (SPSS, version 20) and subsequently cleaned, and HL scores were dichotomised into adequate (4-6), inadequate (<4) categories in line with other studies (Devraj et al., 2013; Hudon et al., 2012). Data were tested for normality using the Kolmogorov-

Smirnov test, and chi-square or Mann-Whitney tests were used to assess differences in demographic variables (i.e. age, gender, education, employment status, household income, social class, health insurance status, number of comorbidities), and healthcare utilisation, between the chronic pain group and the CG.

Following this, logistic regression analysis was performed to investigate possible interactions between levels of HL and healthcare utilisation, while controlling for pain status as a potential mediating factor, (i.e. chronic pain group and CG), and any significant demographic differences identified between the groups in bivariate analysis as potential confounders. This analysis was undertaken based on the positive feedback loop demonstrated in the RTI HL framework that links health outcomes (i.e. healthcare utilisation) to both HL levels and prior knowledge (Figure 1). Prior knowledge was not included in the framework for the current study, given that the CG had no prior experience of chronic pain. The variables that were included in the model are described in Figure 2. – a guide RTI HL skills framework developed for the current study.

3. Results

3.1. Overview

A total of 262 participants were included (chronic pain group: n=131; CG: n=131). Overall, 52% (n=135) of participants had inadequate HL, the mean age was 49 years (SD 16), 59% (n=156) were female, 26% (n=68) were either unemployed or unable to work, 31% (n=81) had completed third level education, and 46% (n=121) had a household income of less than €1350 per month. The average number of comorbidities per person was 1.2 (SD 1.2). Off the 131 chronic pain participants, all but two (1.8%) reported pain lasting longer than three months in areas other than the musculoskeletal system (i.e. stomach, n=1; breast, n=1). All other participants reported either one or multiple sites of chronic pain associated with the musculoskeletal system (i.e. head, neck, spine, pelvis, upper limbs, and lower limbs).

3.2. Health literacy

No significant difference was found between the groups regarding levels of HL in bivariate analysis (chronic pain group: 54%, n=71; CG 49%, n=64; 0.75, p=0.39).

3.3. Demographics

There were more females in the chronic pain group than in the control group (chronic pain group: 69%, n=90; CG: 50%, n=66; 9.17, p=0.002), more chronic pain patients reported being unemployed or unable to work (chronic pain group: 41%, n=53; CG: 11%, n=15; 34.33, p<0.001), and the CG had more third level graduates (chronic pain group: 23%, n=30; CG: 39%, n=51; 9.06, p=0.01). Over half of the chronic pain group had an income of less than €1350 (chronic pain group: 56%,

n=73; CG: 37%, n=48; 16.02, $p<0.001$), and were also less likely to have private health insurance (chronic pain group: 22%, n=29; CG: 42%, n=55; 12.77, $p=0.002$).

3.4. Health service utilisation in the previous 12 months

Bivariate analysis confirmed that the chronic pain group were significantly greater users of health services (table 1.), and after controlling for differences in demographic variables between groups, pain status remained independently associated with healthcare utilisation in that those with chronic pain were more likely to attend their GP ($B=4.12$, $SE = 0.87$, $p<0.001$), attend non-emergency hospital services ($B=1.68$, $SE = 0.6$, $p=0.006$), and access allied therapies ($B=3.26$, $SE = 1.0$, $p=0.001$).

3.5. Health literacy and health service utilisation

Logistic regression confirmed that there was no independent association between levels of HL and healthcare utilisation when controlling for pain status, gender, employment, education, income, health insurance, age, and number of comorbidities. However, HL remained independently associated with educational attainment, in that those who completed second (Exp (B), 5.99; 95% C.I, 1.53-23.47) or third (Exp (B), 7.26; 95% C.I, 1.6-32.8) level education were at higher odds of having adequate levels of HL. Also, those with a household income of $>€2950$ were almost three times more likely to have of adequate levels of HL (Exp (B), 2.89; 95% C.I, 1.07-7.75), and older age was associated with higher odds of having low HL (Exp (B), 0.95; 95% C.I, 0.92-0.93).

4. Discussion

4.1. Overview.

The prevalence of low HL and its role chronic pain outcomes is not well understood, despite its **known** impact on the development of self-management skills (Mackey et al., 2016) – a core component for **effective management of chronic pain** (Scottish Intercollegiate Guidelines Network, 2013). Evidence-based approaches that involves psychological, physical and medical management requires on-going engagement with a range of health services, for which chronic pain patients must navigate, and therefore, it is plausible that this positively impacts on their levels of HL. The 'RTI Health Literacy Skills Framework' (Squiers et al., 2012) was utilised as a guide to investigate this further, which conceptualises HL as a modifiable characteristic via interactions with health services, which increases disease-related knowledge and in turn, HL skills. Prose HL was assessed using the NVS (Weiss et al., 2005), pain status identified as a potential mediator, and healthcare utilisation as the health outcome. These variables and their placement in the RTI HL framework are presented in in figure 2.

4.2. Main Findings.

4.2.1. *Health Literacy and Healthcare Utilisation*

A total of 262 participants (chronic pain group: n=131, CG: n=131) completed a battery of questionnaires (i.e. demographics, healthcare utilisation, and HL assessment) confirming that the chronic pain group were significantly higher users of a range of health services. However, no differences in HL levels were observed between groups, which is in contrast with the RTI HL Skills framework. One possible explanation for this is that despite its known impact on health outcomes (Berkman,

Sheridan, Donahue, Halpern, & Crotty, 2011), **health services are not adequately addressing HL. For example**, resident physicians have been found to underestimate the prevalence of low HL in their patients (Bass, Wilson, Griffith, & Barnett, 2002), and in a study of healthcare professionals who attended an educational session on the topic, it was found that they initially overestimated their knowledge and understanding of HL (Mackert, Ball, & Lopez, 2011). Furthermore, it has been proposed that the persistence of the biomedical model in health settings hinders the incorporation of HL-sensitive approaches in clinical consultations (Freedman et al., 2009). The findings of the current study may reflect poor HL awareness amongst healthcare professionals, leading to poor management of low HL in clinical settings, which may explain the lack of impact of healthcare utilisation on HL levels in chronic pain patients who participated in the current study. Therefore, health services ought to consider providing resources to healthcare professionals for the inclusion HL-sensitive interventions in clinical settings, as research has shown that health outcomes and behaviours can be improved by such approaches in people with chronic diseases (Eckman et al., 2012; Kiser et al., 2012).

4.2.2. Health literacy interventions

The modifiable nature of HL as described by the RTI Health Literacy Framework (Squiers et al., 2012) must also be considered, given the non-significant findings regarding HL and healthcare utilisation observed in the current study. Considering that HL skills are associated with certain non-modifiable characteristics such as age and gender (Paasche-Orlow et al., 2005; Protheroe et al., 2016), it is plausible that HL skills may also be predetermined. However, there is very little research available on observed changes in HL levels post HL-sensitive interventions to confirm this, and

given that the findings from the current study identified education as the strongest independent predictor of HL, which has the potential be influenced and modified throughout the course of an individual's life, it is possible that HL could also be influenced via health-based educational interventions. Of the limited research available on this, one study has reported significant differences in HL levels at a nine-month follow-up in HIV patients who attended a HL-sensitive intervention in comparison to a usual care group (Kalichman et al., 2013). However, the overwhelming majority of studies investigating the impact of HL-sensitive interventions assess HL at baseline only, and then focus solely on assessing improvements in health outcomes and behaviours post intervention, e.g. changes in medication adherence (Noureldin et al., 2012) or diabetes knowledge retention post HL-sensitive interventions (Kandula, Malli, Zei, Larsen, & Baker, 2011). Furthermore, many intervention studies implement interventions that simplify health-related information, thus treating HL as a risk factor, as opposed to a personal asset, where HL skills could be developed through educational interventions that focus on improving health-related knowledge, and self-efficacy for example. Nevertheless, further research is needed to understand the nature of HL regarding its modifiability over time in individuals with chronic diseases, when exposed to HL-sensitive interventions. Once this has been established, HL may be then grouped as a risk factor or a personal asset as described by Nutbeam (Nutbeam, 2008). If HL is to be viewed as a personal asset, then health services must develop their practices accordingly, and provide the supports and tools that develop such HL skills in patients. However, if HL is found to be less modifiable than previously thought, health services must consider HL a risk factor, and adapt the environment to minimise the risks associated with low HL. In essence, understanding the scope of

individual versus organisational responsibility will determine the nature of HL-sensitive interventions and inform the development of policies to address HL in both the clinical setting and community.

4.3. Limitations

Due to the cross-sectional nature of the current study, caution must be taken when assuming direct causal relationships, and it must be noted that information regarding participants' utilisation of health services was reliant on retrospective recall. Also, while the list of demographic characteristics examined in the current study was not exhaustive, they were chosen based on the EPHPP quality assessment tool that identifies important confounders for consideration when determining the overall quality of a study. The current study utilised components of the RTI Health Literacy Skills Framework only, in that communication and information seeking skills (i.e. other components of HL) were not considered, the number of mediating factors was limited to pain status, and healthcare utilisation was the only health outcome included in the framework. Also, prior knowledge was not included, which the model suggests would have been influenced by experience with the health care system. However, the aim of this study was to explore the association between HL and healthcare utilisation in a chronic pain cohort, who are significant users of health services in comparison to those with no chronic pain.

Furthermore, while prose literacy only was assessed, written documentation remains the main source of supplemental information provided by healthcare professionals to support patients outside of the healthcare setting. Books such as 'Explain Pain by Butler and Moseley (Butler & Moseley, 2013) are used to describe

the mechanisms of chronic pain development to patients, and computer software such as PhysioTools® that generates paper-based exercise and rehabilitation programmes is commonly used in physiotherapy settings. In addition, healthcare professionals are increasingly relying on online resources to provide education and facilitate the maintenance of self-management strategies for chronic pain patient (Martorella et al., 2017), all of which require adequate levels of prose literacy for effective engagement. Nevertheless, while prose literacy is vital to accessing and engaging the aforementioned resources, future studies must consider all components of HL, including the impact of communication and information seeking skills on health outcomes in chronic pain patients, and how HL-sensitive interventions can foster their development.

4.4. Conclusions

Increased healthcare utilisation was not associated with higher HL levels in individuals with chronic pain. Reasons for this are not clear, although a lack of attention to HL-sensitive approaches, or a lack of understanding regarding the development or dynamic nature of HL may potentially explain the findings of the current study. Further intervention studies with long-term follow up are required to determine whether HL can be embedded at individual level, if health organisations must adapt their approach to cater to a low health literate population, or whether a combination of both is needed to maximise health outcomes for patients.

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6. Conflicts of Interest

The authors declare that there is no conflict of interest

7. References

- Bair, M. J., Matthias, M. S., Nyland, K. A., Huffman, M. A., Stubbs, D. L., Kroenke, K., & Damush, T. M. (2009). Barriers and facilitators to chronic pain self-management: a qualitative study of primary care patients with comorbid musculoskeletal pain and depression. *Pain Medicine*, 10(7), 1280-1290. doi:10.1111/j.1526-4637.2009.00707.x
- Barr, P. J., Brady, S. C., Hughes, C. M., & McElnay, J. C. (2014). Public knowledge and perceptions of connected health. *Journal of Evaluation in Clinical Practice*, 20(3), 246-254. doi:10.1111/jep.12118
- Bass, P. F., Wilson, J. F., Griffith, C. H., & Barnett, D. R. (2002). Residents' ability to identify patients with poor literacy skills. *Academic Medicine*, 77(10), 1039-1041.
- Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K. (2011). Low health literacy and health outcomes: an updated systematic review. *Annals of Internal Medicine*, 155, 97-107.
- Blyth, F. M., March, L. M., Nicholas, M. K., & Cousins, M. J. (2005). Self-management of chronic pain: a population-based study. *Pain*, 113(3), 285-292. doi:10.1016/j.pain.2004.12.004
- Butler, D. S., & Moseley, G. L. (2013). *Explain Pain*: Noigroup Publications.
- Crowe, M., Whitehead, L., Jo Gagan, M., Baxter, D., & Panckhurst, A. (2010). Self-management and chronic low back pain: a qualitative study. *Journal of Advanced Nursing*, 66(7), 1478-1486. doi:10.1111/j.1365-2648.2010.05316.x
- Devraj, R., Herndon, C. M., & Griffin, J. (2013). Pain awareness and medication knowledge: a health literacy evaluation. *Journal of Pain & Palliative Care Pharmacotherapy*, 27(1), 19-27. doi:10.3109/15360288.2012.751955

- Eckman, M. H., Wise, R., Leonard, A. C., Dixon, E., Burrows, C., Khan, F., & Warm, E. (2012). Impact of health literacy on outcomes and effectiveness of an educational intervention in patients with chronic diseases. *Patient Education and Counseling*, 87(2), 143-151. doi:10.1016/j.pec.2011.07.020
- European Health Literacy Consortium. (2012). Comparative report of health literacy in eight EU member states. The European health literacy survey HLS-EU. Retrieved from <http://www.health-literacy.eu> (Accessed August 2016)
- Federman, A. D., Wolf, M. S., Sofianou, A., O'Connor, R., Martynenko, M., Halm, E. A., . . . Wisnivesky, J. P. (2014). Asthma outcomes are poor among older adults with low health literacy. *Journal of Asthma*, 51(2), 162-167. doi:10.3109/02770903.2013.852202
- Freedman, D. A., Bess, K. D., Tucker, H. A., Boyd, D. L., Tuchman, A. M., & Wallston, K. A. (2009). Public health literacy defined. *American Journal of Preventive Medicine*, 36(5), 446-451. doi:10.1016/j.amepre.2009.02.001
- GBD Collaborators. (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*, 388, 1545-1602. doi:10.1016/S0140-6736(16)31678-6
- Hudon, C., Fortin, M., Poitras, M. E., & Almirall, J. (2012). The relationship between literacy and multimorbidity in a primary care setting. *BMC Family Practice*, 13(33). doi:10.1186/1471-2296-13-33
- Kalichman, S. C., Cherry, C., Kalichman, M. O., Amaral, C., White, D., Grebler, T., . . . Schinazi, R. F. (2013). Randomized clinical trial of HIV treatment adherence counseling interventions for people living with HIV and limited health literacy.

Journal of Acquired Immune Deficiency Syndromes, 63(1), 42-50.

doi:10.1097/QAI.0b013e318286ce49

Kandula, N. R., Malli, T., Zei, C. P., Larsen, E., & Baker, D. W. (2011). Literacy and retention of information after a multimedia diabetes education program and teach-back. *J Health Commun*, 16 Suppl 3, 89-102.

doi:10.1080/10810730.2011.604382

Kiser, K., Jonas, D., Warner, Z., Scanlon, K., Shilliday, B. B., & DeWalt, D. A. (2012). A randomized controlled trial of a literacy-sensitive self-management intervention for chronic obstructive pulmonary disease patients. *Journal of General Internal Medicine*, 27(2), 190-195. doi:10.1007/s11606-011-1867-6

Mackert, M., Ball, J., & Lopez, N. (2011). Health literacy awareness training for healthcare workers: improving knowledge and intentions to use clear communication techniques. *Patient Education and Counseling*, 85(3), e225-228. doi:10.1016/j.pec.2011.02.022

Mackey, L. M., Doody, C., Werner, E. L., & Fullen, B. M. (2016). Self-management skills in chronic disease management: what role does health literacy have? *Medical Decision Making*, 36(6), 741-759.

Mancuso, J. M. (2009). Assessment and measurement of health literacy: an integrative review of the literature. *Nursing & Health Sciences*, 11(1), 77-89. doi:10.1111/j.1442-2018.2008.00408.x

Mann, G. M., LeFort, S., & VanDenKerkhof, E. G. (2013). Self-management interventions for chronic pain. *Pain Management*, 3(3), 211-222.

Martorella, G., Boitor, M., Berube, M., Fredericks, S., Le May, S., & Gelinas, C. (2017). Tailored Web-Based Interventions for Pain: Systematic Review and Meta-

Analysis. *Journal of Medical Internet Research*, 19(11), e385.

doi:10.2196/jmir.8826

Nielsen-Bohlman, L., Panzar, A. M., Hamlin, B., & Kinding, D. A. (2004). *A prescription to end confusion*: Institute of Medicine.

Noureldin, M., Plake, K. S., Morrow, D. G., Tu, W., Wu, J., & Murray, M. D. (2012).

Effect of health literacy on drug adherence in patients with heart failure.

Pharmacotherapy, 32(9), 819-826.

Nutbeam, D. (2000). Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International*, 15(3), 259-267.

Nutbeam, D. (2008). The evolving concept of health literacy. *Social Science and Medicine*, 67(12), 2072-2078. doi:10.1016/j.socscimed.2008.09.050

Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T., &

Rudd, R. R. (2005). The prevalence of limited health literacy. *Journal of*

General Internal Medicine, 20(2), 175-184. doi:10.1111/j.1525-

1497.2005.40245.x

Paasche-Orlow, M. K., & Wolf, M. S. (2007). The causal pathways linking health literacy to health outcomes. *American Journal of Health Behavior*, 31(Suppl 1), S19-26.

Parker, R. M., Baker, D. W., Williams, M. V., & Nurss, J. (1995). The test of functional health literacy in adults. *Journal of General Internal Medicine*, 10(10), 537-541.

Protheroe, J., Whittle, R., Bartlam, B., Estacio, E. V., Clark, L., & Kurth, J. (2016).

Health literacy, associated lifestyle and demographic factors in adult

population of an English city: a cross-sectional survey. *Health Expect.*

doi:10.1111/hex.12440

Rowlands, G., Khazaezadeh, N., Oteng-Ntim, E., Seed, P., Barr, S., & Weiss, B. D.

(2013). Development and validation of a measure of health literacy in the UK: the newest vital sign. *BMC Public Health*, 13, 116. doi:10.1186/1471-2458-13-116

Scottish Intercollegiate Guidelines Network. (2013). Management of chronic pain:

SIGN publication no.136. Retrieved from

<http://www.sign.ac.uk/pdf/SIGN136.pdf> (Accessed August 2016)

Sorensen, K., Van den Brouke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., &

Brand, H. (2012). Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health*, 12(80), doi: 10.1186/1471-2458-1112-1180.

Squiers, L., Peinado, S., Berkman, N., Boudewyns, V., & McCormack, L. (2012). The

health literacy skills framework. *J Health Commun*, 17 Suppl 3, 30-54.

doi:10.1080/10810730.2012.713442

Thomas, H., Ciliska, D., Dobbins, M., & Micucci, S. (2004). A process for systematically

reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews Evidence-Based Nursing*, 1(3), 176-184.

Weiss, B. D., Mays, M. Z., Martz, W., Castro, K. M., DeWalt, D. A., Pignone, M. P., . . .

Hale, F. A. (2005). Quick assessment of literacy in primary care: The Newest Vital Sign. *The Annals of Family Medicine*, 3(6), 514-522.

Wu, J. R., Holmes, G. M., DeWalt, D. A., Macabasco-O'Connell, A., Bibbins-Domingo,

K., Ruo, B., . . . Pignone, M. (2013). Low literacy is associated with increased risk of hospitalization and death among individuals with heart failure. *Journal*

of General Internal Medicine, 28(9), 1174-1180. doi:10.1007/s11606-013-2394-4

8. Tables

Table 1: Participant Characteristics and Bivariate Analysis

Demographics	Chronic Pain Group (N=131)	Control Group (N=131)	Test statistic	p-value
Age, Mean (sd)	48.45 (14.83)	49.81 (16.47)	-6.36†	0.053
Gender, N (%)			9.17*	0.004
Male	41 (31.3)	65 (49.6)		
Female	89 (67.9)	65 (49.6)		
Missing data	1 (0.8)	1 (0.8)		
Employment, N (%)			34.33*	<0.001
Employed	60 (45.8)	82 (62.6)		
Unemployed	17 (13)	10 (7.6)		
Unable to Work	36 (27.5)	5 (3.8)		
Retired	17 (13)	34 (26)		
Education, N (%)			9.06*	0.011
Primary Level	23 (17.6)	22 (16.8)		
Secondary Level	78 (59.5)	56 (42.7)		
Third Level	30 (22.9)	51 (38.9)		
Nationality, N (%)			-0.75†	0.452
Irish	120 (91.6)	116 (88.5)		
Lithuanian	2 (1.5)	-		
Filipino	1 (0.8)	2 (1.5)		
British	3 (2.3)	6 (4.6)		
Polish	-	4 (3.1)		
South African	-	1 (0.8)		
Swedish	1 (0.8)	-		
Dutch	1 (0.8)	-		
Romanian	2 (1.5)	1 (0.8)		
Missing data	-	1 (0.8)		
Income (household)			16.02*	0.001
<€1350	73 (55.7)	48 (36.6)		
€1350-€2400	28 (21.4)	28 (21.4)		
>€2450	22 (16.8)	50 (38.2)		
Missing data	8 (6.1)	5 (3.8)		
Social Class			4.54*	0.10
Low	14 (10.7)	6 (4.6)		
Middle	107 (81.7)	124 (94.7)		
High	2 (1.5)	1 (0.8)		
Missing data	8 (6.1)	-		
Health Insurance			12.77*	0.002
Private	29 (22.1)	55 (42.0)		
Medical Card	79 (60.3)	54 (41.2)		
None	23 (17.6)	22 (16.8)		
Number of Comorbidities			-5.22†	<0.001
Mean (sd)	1.62 (1.29)	0.82 (0.87)		
Health Literacy Scores				
NVS, N (%)			0.75*	0.39
Adequate	60 (45.8)	67 (51.1)		
Inadequate	71 (54.2)	64 (48.9)		
Health Service Utilisation				
Health Service Use			15.15*	<0.001
Yes	128 (97.7)	113 (86.3)		
No	1 (0.8)	17 (13)		
GP Visits, Mean (sd)	8.28 (8.18)	3.41 (4.19)	-7.25†	<0.001
Emergency, Mean (sd)	0.56 (1.26)	0.22 (0.65)	-2.29†	0.02

Hospital, Mean (sd)	3.41 (4.78)	1.64 (4.19)	-5.12 [†]	<0.001
Other (Allied health), Mean (sd)	4.47 (9.33)	1.2 (4.68)	-4.14 [†]	>0.001

†: Mann Whitney-U test; *: Chi-Square test; n: number; (sd): standard deviation; NVS: Newest Vital Sign; GP: general practitioner.

Table 2: Logistic regression model to determine independent predictors of levels of adequate health literacy (dependent variable).

	B	S.E.	P value	Exp(B)	95% C.I. for EXP(B)	
Pain status	-0.372	0.400	0.353	0.353	0.315	1.512
<u>Demographics</u>						
Gender	0.522	0.362	0.150	1.685	0.828	3.428
No. of co-morbidities	0.140	0.179	0.434	1.151	0.810	1.635
Age	0.047	0.016	0.003	0.954	0.925	0.928
<u>Employment</u>						
Unemployed	0.133	0.450	0.767	1.143	0.473	2.762
Retired	-0.499	0.602	0.456	0.639	0.196	2.027
<u>Education</u>						
Secondary level	1.791	0.696	0.01	5.998	1.533	23.471
Third level	1.983	0.769	0.01	7.264	1.608	32.804
<u>Income</u>						
€1350-€2400	0.485	0.428	0.284	1.581	0.684	3.658
>€2400	1.059	0.504	0.036	2.885	1.074	7.748
<u>Health insurance</u>						
Medical Card	-0.391	0.482	0.417	0.676	0.263	1.739
None	-0.193	0.504	0.702	0.825	0.307	2.213
<u>Healthcare utilisation</u>						
General Practitioner	0.024	0.029	0.401	1.025	0.968	1.085
Emergency services	-0.289	0.214	0.177	0.749	0.492	1.139
Hospital services	0.002	0.044	0.973	1.002	0.918	1.093
Allied health services	0.003	0.024	0.904	1.003	0.956	1.052

9. Figures

Figure 1: The RTI Health Literacy Skills Framework

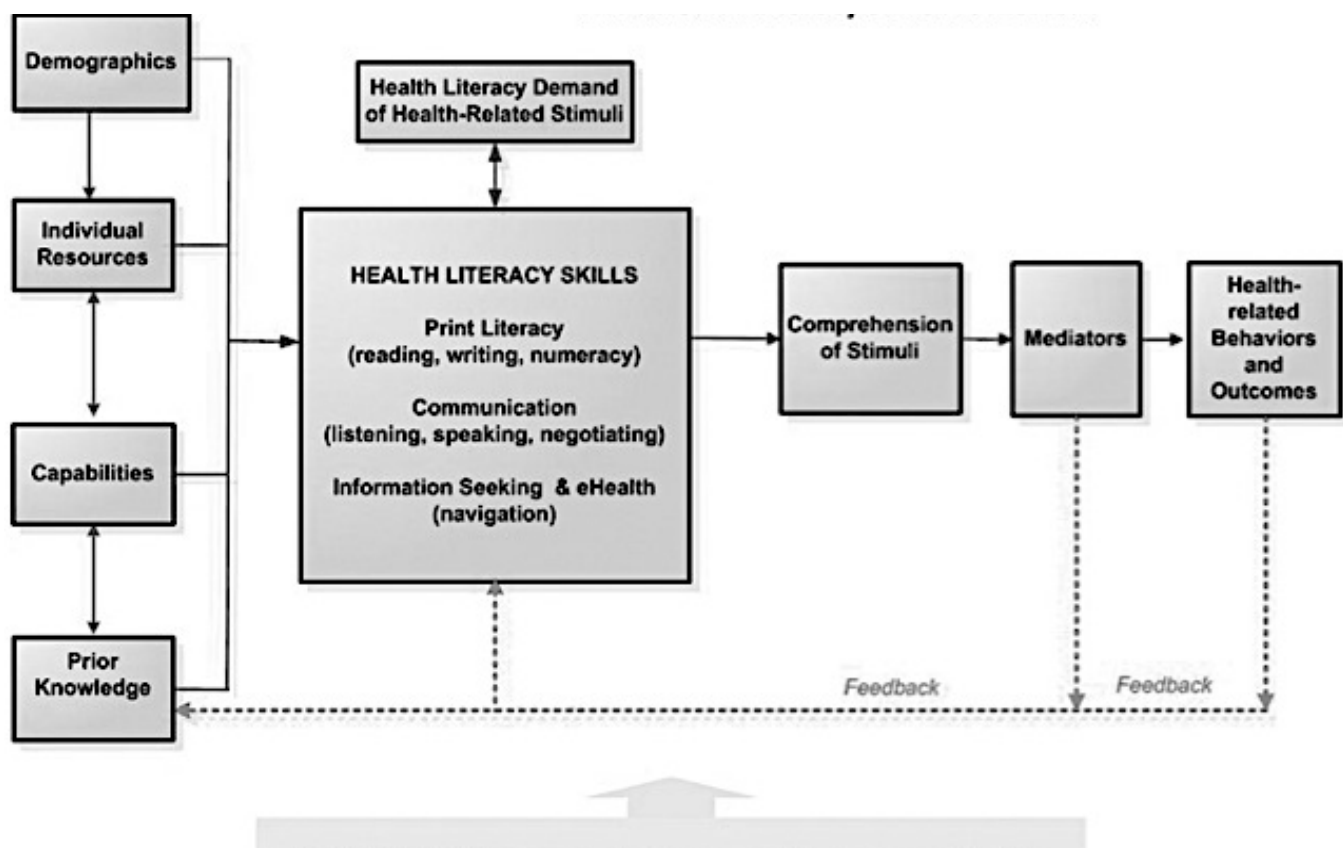


Figure 2. RTI Health Literacy Framework Guide for Current Study

