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Research Paper

Implementation of an animated medication information tool in community pharmacies, with a special focus on patients with limited health literacy

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Received February 3, 2021; Accepted June 10, 2021.

Abstract

Objectives The animated medication information tool ‘Watchyourmeds’ provides information in an accessible manner through animated videos and therefore appears to be especially suitable for people with limited health literacy. This study aimed to assess the implementation of this animated medication information tool in Dutch community pharmacies, with a special focus on patients with limited health literacy.

Methods A cross-sectional survey based on the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework was sent to approximately 75% of the ±1900 community pharmacies in the Netherlands through email newsletters of pharmacy networks.

Key findings 140 pharmacists (–10%) completed the survey and 125 of them (89%) indicated that they offered the animated medication information tool to their patients. 108 pharmacists indicated that the tool was offered to all patients, not only to patients with limited health literacy. The distribution method was primarily passive (patients were given a leaflet and were not explicitly pointed to or informed about the tool). Two frequently cited motivations for offering the tool were that it complemented other sources of information and that the health insurer provided a financial incentive. The main reasons patients refused to use the tool were that they had no access to or no affinity for the required technology.

Conclusions This study demonstrated that the tool is used in community pharmacies and that it is offered to all patients, regardless of their presumed health literacy level. A more active method of offering the tool may be warranted to better reach patients with limited health literacy.

Keywords: health literacy; medication information; community pharmacies

Introduction

To promote the appropriate and safe use of medication, patients need to be well informed about their medicines.^[1, 2] To improve patients' understanding of the expected benefits and risks, they should be provided with practical instructions as well as information about possible side effects, expected pharmacological action, and consequences of not taking the medication.^[3–6] Patients who are better informed about their treatment risks and benefits, and who understand how to use the medication, are more adherent,^[7] which leads to improved quality of life and reductions in drug-related problems, morbidity, mortality, healthcare utilization and healthcare costs.^[8, 9]

As medication experts, pharmacists have an important role to inform patients to consult the package information leaflet (PIL) when a medicine is collected from the pharmacy or delivered to them.^[10] However, for many patients the information in the PIL is difficult to understand or even unreadable.^[11] Besides the PIL, pharmacists offer cognitive pharmaceutical services, which include patient education, pharmacist-led clinical medication review, medication adherence counselling and individual-tailored prescription labels with instructions for medication use.^[12–15]

People with limited health literacy have difficulty understanding information about medication and medical terms.^[16–18] In the Netherlands, 36% of the population have limited health literacy.^[19] Health literacy 'encompasses people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course'.^[20] These patients are at higher risk of misinterpreting instructions for dosage, duration and frequency provided in the PIL as well as other written information or verbal pharmacist counselling.^[3, 21–23] The current cognitive pharmaceutical services may not be sufficiently tailored to the needs of people with limited health literacy.^[24]

Previous needs assessments regarding medication information for people with limited health literacy indicate that they need understandable, reliable and practical information focused on a single main message, which reduces cognitive load, resulting in better recall of information.^[25–29] Presenting information to people with limited health literacy in the form of narrated animations, illustrations or spoken text also helps promote understanding and recall of information.^[26, 27, 30–33]

In the Netherlands, an animated medication information tool called 'Watchyourmeds' is available. This online library contains more than 8000 animated videos which use lay language to explain the most important information from the PILs for more than 95% of all medicines dispensed in the Netherlands.^[34] Due to the method of presentation, this tool appears to be especially suitable for people with limited health literacy. The videos are personalized by gender, age and medication. The tool is available in different languages (Dutch, English, Turkish and Arabic) and can be offered by a pharmacist.

Since January 2019, the largest health insurer in the Netherlands recommends the use of the animated medication information tool as part of their quality improvement policy. Community pharmacies receive a financial incentive to provide this tool to their patients, with the aim of promoting proper use of medicines. Pharmacists were informed by 'Watchyourmeds' about the various ways the tool could

be offered to patients. It could be offered with an informational flyer, through a general web link to the tool or a medication-specific web link to the tool sent by email or text message, by allowing patients to view the tool in the pharmacy on a PC or tablet, or the patient can be referred to their pharmacy's patient portal in which the tool can be viewed. Some methods of offering the tool are more passive and provide general written information without explicitly pointing to the tool, while other methods are more active and tailored to the patient with explicit information about and direction to the tool. It is the pharmacists who decide how the tool is offered, to fit in with their own working practices. The aim of this study was to assess the implementation of the animated medication information tool in Dutch community pharmacies, with a special focus on patients with limited health literacy. The following research questions were explored:

1. To what extent and in what way do pharmacists offer the animated medication information tool to their patients and specifically to patients with limited health literacy?
2. Why do pharmacists offer the animated medication information tool to their patients?
3. According to pharmacists, what are the reasons patients accept or refuse to use the animated medication information tool?

Method

Study design and setting

A cross-sectional study was performed using an online survey of community pharmacists. The survey was conducted from September 2019 to February 2020. Pharmacists were invited to complete the survey through email newsletters from three professional networks: the Utrecht Pharmacy Practice network for Education and Research (UPPER), the network of the foundation 'Watchyourmeds' and the pharmacy network of Groningen University. The invitation to the UPPER network was repeated once in the newsletter. Combined, these networks reach approximately 75% of the ±1900 pharmacies in the Netherlands. In the Netherlands, completing a survey does not fall under the scope of the Dutch Medical Research Involving Human Subjects Act, therefore, a medical ethics review of the study was not required.^[35] All respondents participated on a voluntary basis.

Survey

The survey (Supplementary Appendix S1) was developed by researchers of the Netherlands Institute for Health Services Research (Nivel). The questions were checked for comprehensibility, feasibility and completeness (options that are correct in pharmacy practice and that no answers were missing) by a pharmacist and an independent researcher. Only minor textual changes were made. The survey consisted of five multiple choice questions regarding the characteristics of the pharmacies and 16 multiple choice questions about the implementation of the tool derived from the RE-AIM framework.^[36] The RE-AIM framework comprises five dimensions for evaluating the public health impact of interventions (Table 1). Effectiveness was not assessed in this study because the survey was distributed only to pharmacists and focused on the implementation of an intervention, whereas the effectiveness of an intervention must be measured in patients. In the results section, we linked our results to the dimensions of the RE-AIM framework by placing the corresponding dimension in brackets.

Analysis

Only completed surveys, without missing variables, were included in the analysis. Data was held in an SPSS database (SPSS Statistics for Windows, version 25.0 (SPSS Inc)).

Results

Participant characteristics

In total, 172 pharmacists started the online survey and 140 (81%) of them completed it. 45% of the pharmacists estimated that their patient population was predominantly older and 31% of the pharmacists estimated that their patient population had a low education level (Table 2). About one-third (35%) of the pharmacists estimated that a relatively high number of their patients had a limited health literacy level; 18% reported having a patient population with predominantly adequate health literacy.

To what extent and in what way do pharmacists offer the animated medication information tool to their patients and specifically to patients with limited health literacy? Of the 140 pharmacists who completed the survey, 89% indicated that they currently offered the animated medication information tool to their patients (*adoption*), 7% indicated that they had offered it but stopped, and 4% of the pharmacists never offered it to their patients. 42% of the pharmacists indicated that the tool was included in the usual routines of the pharmacy (*maintenance*). Of the 125 pharmacists currently offering the tool, 86% of them offered the tool to all patients and 14% offered it to specific groups based on presumed health literacy

level, education level, type of medicine or age of the patient (*reach/implementation*). 61% of the pharmacists indicated that they actively offered the tool to their patients by explicitly recommending it, and 39% of the pharmacists indicated that they passively offered it (*reach*). Table 3 shows the various ways the responding pharmacists reported offering the medication tool. This was mainly passively using a flyer (65%) or with a general web link to the tool (33%). The other more active methods of distribution were less used, such as the medication-specific web link (26%) or referral to the pharmacy patient portal (21%), and only 2% of the pharmacies offered access to the tool on a PC or tablet in the pharmacy. Table 3 illustrates the distribution of the animated medication information tool by the pharmacists to patient populations with different levels of health literacy. Pharmacists whose patients were predominantly of limited health literacy distributed the tool relatively frequently, using a medication-specific web link, compared to the other two patient populations (Table 3). In the other four distribution methods, there were minor differences between the three patient populations.

Why do pharmacists offer the animated medication information tool to their patients?

Figure 1 provides an overview of motivating factors for pharmacists ($n = 125$) to offer the animated medication information tool (*implementation/adoption*). Two factors frequently reported were that it complements other sources of information and that the health insurer offers a financial incentive; 73% of all pharmacists gave a score of 6 or higher in the question whether they would recommend

Table 1 The five dimensions of the RE-AIM framework^[36]

Dimension	
Reach	Number of patients reached, which patients are reached and how many patients are offered the tool when dispensing the medication
Effectiveness	Assessment of the positive and negative consequences of the tool
Adoption	Proportion of pharmacies willing to offer the tool
Implementation	Extent to which pharmacies offer the tool to all patients who could benefit from it
Maintenance	Extent to which the tool becomes part of daily routine in the pharmacy

Table 2 Pharmacy characteristics and their patient population ($n = 140$)

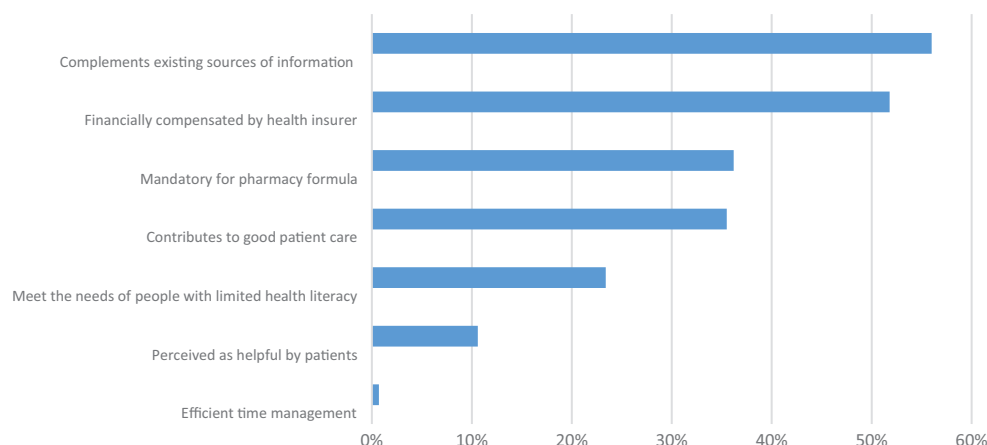
Pharmacy characteristics		N	%
Type of pharmacy	Community	129	92
	Outpatient	3	2
	Dispensing GP	8	6
	1–1.9 fte ¹	7	5
Employee capacity	2–4.9 fte ¹	28	20
	5–9.9 fte ¹	83	59
	≥10 fte ¹	22	16
Distribution of patient population (estimated by the pharmacist)		N	%
Age	Predominantly young (<40 y)	13	9
	Predominantly middle (40–64 y)	32	23
	Predominantly old (>64 y)	34	45
	About equally distributed	32	23
Educational level	Predominantly low	44	31
	Predominantly intermediate	33	24
	Predominantly high	22	16
	About equally distributed	40	29
Health literacy	Many patients with limited health literacy level	49	35
	Many patients with adequate health literacy level	25	18
	About equally distributed	66	47

¹fte = full-time equivalent.

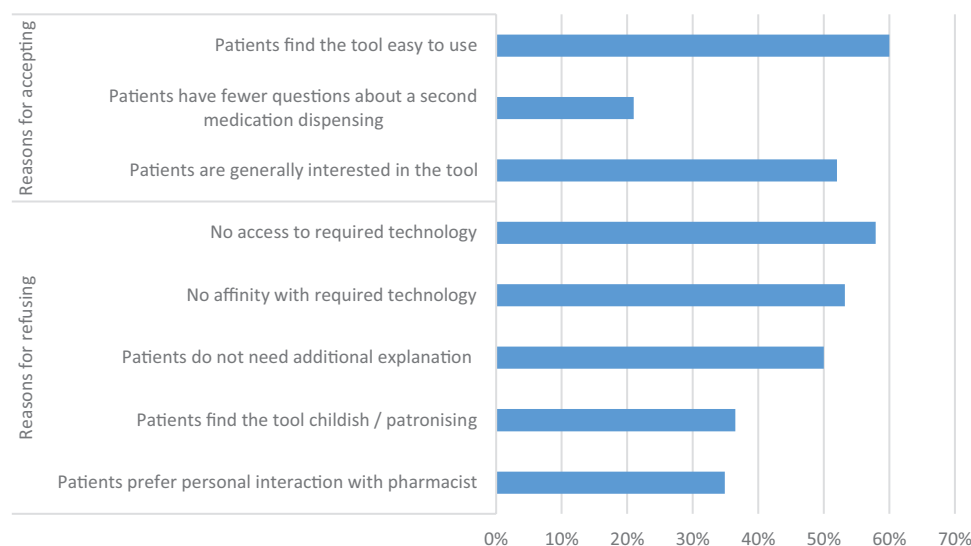
Table 3 Distribution of the animated medication information tool in different patient populations¹

	Flyer	Medication-specific web link	General web link	Referral to patient portal	Viewed in pharmacy
All pharmacies offering the tool (<i>n</i> = 125)	81 (65%)	41 (33%)	32 (26%)	26 (21%)	3 (2%)
Health literacy					
Many patients with adequate health literacy level (<i>n</i> = 22)	12 (55%)	8 (36%)	8 (36%)	3 (14%)	2 (9%)
Equally distributed (<i>n</i> = 60)	40 (67%)	11 (18%)	14 (23%)	17 (28%)	0 (0%)
Many patients with limited health literacy level (<i>n</i> = 43)	29 (67%)	22 (51%)	10 (23%)	6 (14%)	1 (2%)

¹The pharmacists estimated the health literacy level of their patient population. Multiple answers were possible.

**Figure 1** Motivations of pharmacists to offer the animated medication information tool to patients (*n* = 125).

Percentage of the pharmacists surveyed who choose these motivations for offering the animated medication information tool. Multiple answers were possible.

**Figure 2** Reasons according to pharmacists why patients accepted or refused to use the animated medication information tool (*n* = 125)*.

*Percentage of the pharmacists who reported each reason why patients accepted or refused to use the animated medication information tool. Multiple answers were possible.

using the tool to other pharmacies. The pharmacists generally considered the tool to be of added value (81%) and held the opinion that it should be used by all patients (67%) and that it fitted well in the digitization of healthcare (93%). However, in most pharmacists' experience, the tool did not save their time for other activity (91%), and it did not reduce the number of questions at the first refill (80%).

Perceived reasons for patient acceptance or refusal of the tool

More than half of the pharmacists (*n* = 125) reported that patients use it because they find it easy to use (60%) and are interested in the tool (52%) (Figure 2). Reasons for accepting or refusing the tool were that patients did not have access to the required technology (58%)

or they had no affinity for the required technology (53%). The pharmacists estimated that half of patients refused to use the tool because they did not need any additional information and approximately one-third (37%) of patients refused to use the tool because they thought it childish or preferred personal interaction with the pharmacist (35%).

Discussion

Key findings

The majority of the pharmacists surveyed offered the tool to all of their patients, including patients with limited health literacy. The tool was mainly offered because of the financial incentive provided by the health insurer and because the tool complements other existing medication information. Most patients were interested in using the tool and found it easy to use; according to the pharmacists surveyed, the main reasons patients refused to use the tool were a lack of affinity for or lack of access to the required technology.

Strengths and limitations

This study has several strengths and limitations. One strength is that the survey was widely distributed among approximately three-quarters of all Dutch community pharmacies. Furthermore, this study assessed the implementation of an intervention at the pharmacy level. Although more and more interventions are available for pharmacies, there is still little research assessing the implementation of these interventions.^[37, 38] The questions used to assess the implementation were based on the RE-AIM framework. However, due to the distribution of the survey to pharmacies and not patients, the effectiveness was not assessed. Future research should also assess the effectiveness of the intervention in patients to complete all the dimensions of the RE-AIM framework. Another limitation of this study is that pharmacists estimated the health literacy level of their patients instead of measuring it with a validated measure, while research has shown that pharmacists find it difficult to estimate the level of health literacy.^[39, 40] On the other hand, this study showed that pharmacists' estimations of the health literacy level of their population did not lead to a selection of the patient population to which the tool was offered, which is in line with the universal precautions approach. Another limitation of this study is that it is unclear to what extent the respondents who volunteered to participate in this study are representative of pharmacists in the Netherlands, limiting the extent to which the results can be generalized to all Dutch pharmacies. Furthermore, the pharmacists reported the reasons they believed patients chose whether or not to use the animated medication information tool. Patient experiences with the tool are currently being investigated, which could be used to improve the fit of the tool and the method used to offer the tool. This could contribute to the sustainable use of a tool that is beneficial for understanding, remembering and interpreting medication information for people with adequate and limited health literacy.

Comparison to existing knowledge

Regarding the reach and adoption dimensions of the RE-AIM framework, pharmacists reported offering the tool to all patients, not exclusively to those with limited health literacy. Previous research has indicated that pharmacists find it difficult to estimate the level of health literacy and assessing health literacy levels takes time, partly because patients are not likely to expose their limited health literacy skills because they feel ashamed.^[41] The universal precautionary approach advocates structuring the delivery of care as if every patient may have limited health literacy, thus with

information that is easy to process and understand.^[31, 42–44] This is beneficial for understanding, remembering and interpreting medication information for both people with adequate and people with limited health literacy.^[44–46]

While the majority of the pharmacists offered the animated medication information tool to all patients, it is possible that patients with limited health literacy more often refused the tool. Previous research showed that patients with limited health literacy have more difficulty using internet and websites and use digital tools less often than patients with adequate health literacy.^[22, 47–49] Patients with limited health literacy might thus not be reached through the current methods pharmacists use to offer the tool, while they may benefit most from the tool.

To reach patients with limited health literacy, an active method of recommending the tool to all patients with tailored information may be more effective. Although patients with limited health literacy use digital tools less than patients with adequate health literacy, they can effectively use digital tools if they are properly guided.^[50–52] Pharmacists often play a pivotal role in this active provision of tailored information. For example, a pharmacist can actively offer the tool by showing it to patients or providing a medication-specific web link. These types of access were less reported in the pharmacies, possibly because not all pharmacies had all distribution methods available at the time of the study. For example, they may not have had a tablet or PC available yet or the tool may not yet have been integrated into the patient portal. Further research is needed to explore how the intervention can be best offered to patients with limited health literacy.

The motivations pharmacists reported for offering the tool can be divided into two categories. First, the pharmacists considered the animated medication information tool to be of value to their patients because it complements the existing information provided when medication is dispensed. Second, the financial incentive from the health insurer. This finding aligns with the results of previous research which indicates that financial incentives promote more frequent offering of cognitive pharmaceutical services.^[53] It is not clear from this study which reason contributed most to implementation of the tool; future research could further investigate the primary motivating factor to maintain sustainable use of the tool.

Conclusion

This study demonstrates that the animated medication information tool is used in pharmacies and that it is offered to all patients, regardless of their presumed health literacy level. The current method of distribution is mainly passive. A more active method of offering the tool may be warranted to better reach patients with limited health literacy.

Supplementary Material

Supplementary data are available at *International journal of Pharmacy Practice* online.

Author Contributions

Boudewijn B. Visscher: conceptualization, methodology, formal analysis, investigation, data curation, writing—original draft, visualization. Marcia Vervloet: conceptualization, methodology, writing—review & editing, supervision, funding acquisition. Roland te Paske: conceptualization, methodology, writing—review & editing,

investigation, project administration. Liset van Dijk: conceptualization, methodology, writing-review & editing, supervision, funding acquisition. Eibert R. Heerdink: conceptualization, methodology, writing-review & editing, supervision. Jany Rademakers: conceptualization, methodology, writing-review & editing, supervision.

Funding

This work was supported by a grant of Stichting Kijksluiters.

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Data Availability Statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

References

- Vervloet M, van Dijk L, Rademakers JJDJM *et al.* Recognizing and Addressing Limited PHarmaceutical literacy: development of the RALPH interview guide. *Res Social Adm Pharm* 2018; 14: 805–11. <https://doi.org/10.1016/j.sapharm.2018.04.031>
- Heringa M, Floor-Schreuderling A, Wouters H *et al.* Preferences of patients and pharmacists with regard to the management of drug-drug interactions: a choice-based conjoint analysis. *Drug Saf* 2018; 41: 179–89. <https://doi.org/10.1007/s40264-017-0601-7>
- Bailey SC, Hasnain-Wynia R, Chen AH *et al.* Developing multilingual prescription instructions for patients with limited english proficiency. *J Health Care Poor Underserved* 2012; 23: 81–7. <https://doi.org/10.1353/hpu.2012.0000>
- Vaillancourt S, Seaton MB, Schull MJ *et al.* Patients' perspectives on outcomes of care after discharge from the emergency department: a qualitative study. *Ann Emerg Med* 2017; 70: 648–658.e2. <https://doi.org/10.1016/j.annemergmed.2017.05.034>
- Cabilan CJ, Boyle M, Currey E. The effectiveness of pharmacist-led discharge medication counselling in the emergency department (ExPLAIN): a pilot quasi-experimental study. *Patient Educ Couns* 2019; 102: 1157–63. <http://doi.org/10.1016/j.pec.2019.01.020>
- Horne R, Chapman SC, Parham R *et al.* Understanding patients' adherence-related beliefs about medicines prescribed for long-term conditions: a meta-analytic review of the Necessity-Concerns Framework. *PLoS One* 2013; 8:e80633.
- Zaugg V, Korb-Savoldelli V, Durieux P *et al.* Providing physicians with feedback on medication adherence for people with chronic diseases taking long-term medication. *Cochrane Database Syst Rev* 2018; 1: CD012042. <https://doi.org/10.1002/14651858.cd012042.pub2>
- Patton DE, Hughes CM, Cadogan CA *et al.* Theory-based interventions to improve medication adherence in older adults prescribed polypharmacy: a systematic review. *Drugs Aging* 2017; 34: 97–113. <https://doi.org/10.1007/s40266-016-0426-6>
- Roseleur J, Harvey G, Stocks N *et al.* Behavioral economic insights to improve medication adherence in adults with chronic conditions: a scoping review. *Patient* 2019; 12: 571–92. <https://doi.org/10.1007/s40271-019-00377-8>
- Lee JK, Alshehri S, Kutbi HI, Martin JR. Optimizing pharmacotherapy in elderly patients: the role of pharmacists. *Integr Pharm Res Pract* 2015; 4: 101–11. <https://doi.org/10.2147/irp.s70404>
- Van Dijk L, Vervloet M, Monteiro SP *et al.* Feasibility and value of a possible "key information section" in patient information leaflets and summaries of product characteristics of medicinal products for human use. *The PILS-BOX Study*. Brussels, European Union 2014.
- Van Hulten R, Blom L, Mattheusens J *et al.* Communication with patients who are dispensed a first prescription of chronic medication in the community pharmacy. *Patient Educ Couns* 2011; 83: 417–22. <https://doi.org/10.1016/j.pec.2011.05.020>
- Bragazzi NL, Mansour M, Bonsignore A *et al.* The role of hospital and community pharmacists in the management of COVID-19: towards an expanded definition of the roles, responsibilities, and duties of the pharmacist. *Pharmacy (Basel)* 2020; 8: E140. <http://doi.org/10.3390/pharmacy8030140>
- Koster ES, van Meeteren MM, van Dijk M *et al.* Patient-provider interaction during medication encounters: a study in outpatient pharmacies in the Netherlands. *Patient Educ Couns* 2015; 98: 843–8. <https://doi.org/10.1016/j.pec.2015.03.007>
- Van De Pol, JM., Van Dijk L, Koster ES, *et al.* How does the general public balance convenience and cognitive pharmaceutical services in community pharmacy practice. *Res Social Adm Pharm* 2020; 17: 606–12. <https://doi.org/10.1016/j.sapharm.2020.05.014>
- Tille F, Weishaar H, Gibis B *et al.* Patients' understanding of health information in Germany. *Patient Prefer Adherence* 2019; 13: 805–17. <https://doi.org/10.2147/ppa.s202748>
- Smith SK, Trevena L, Barratt A *et al.* Development and preliminary evaluation of a bowel cancer screening decision aid for adults with lower literacy. *Patient Educ Couns* 2009; 75: 358–67. <https://doi.org/10.1016/j.pec.2009.01.012>
- Helitzer D, Hollis C, Cotner J *et al.* Health literacy demands of written health information materials: an assessment of cervical cancer prevention materials. *Cancer Control* 2009; 16: 70–8. <https://doi.org/10.1177/107327480901600111>
- Heijmans M, Brabers AEM, Rademakers J. Health literacy in Nederland [health literacy in the Netherlands]. *Nivel* 2018.
- Sørensen K, Van den Broucke S, Fullam J *et al.* Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health* 2012; 12: 80. <https://doi.org/10.1186/1471-2458-12-80>
- Zhang NJ, Terry A, McHorney CA. Impact of health literacy on medication adherence: a systematic review and meta-analysis. *Ann Pharmacother* 2014; 48: 741–51. <http://doi.org/10.1177/1060028014526562>
- Davis TC, Wolf MS, Bass PF, 3rd *et al.* Literacy and misunderstanding prescription drug labels. *Ann Intern Med* 2006; 145: 887–94. <https://doi.org/10.7326/0003-4819-145-12-200612190-00144>
- Berkman ND, Sheridan SL, Donahue KE *et al.* Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med* 2011; 155: 97–107. <https://doi.org/10.7326/0003-4819-155-2-201107190-00005>
- Patwardhan PD, Amin ME, Chewning BA. Intervention research to enhance community pharmacists' cognitive services: a systematic review. *Res Social Adm Pharm* 2014; 10: 475–93. <http://doi.org/10.1016/j.sapharm.2013.07.005>
- Fransen MP, Dekker E, Timmermans DRM *et al.* Accessibility of standardized information of a national colorectal cancer screening program for low health literate screening invitees: a mixed method study. *Patient Educ Couns* 2017; 100: 327–36. <https://doi.org/10.1016/j.pec.2016.09.004>
- Smith SK, Trevena L, Nutbeam D *et al.* Information needs and preferences of low and high literacy consumers for decisions about colorectal cancer screening: utilizing a linguistic model. *Health Expect* 2008; 11: 123–36. <https://doi.org/10.1111/j.1369-7625.2008.00489.x>
- Meppelink CS, Smit EG, Buurman BM *et al.* Should we be afraid of simple messages? The effects of text difficulty and illustrations in people with low or high health literacy. *Health Commun* 2015; 30: 1181–9. <https://doi.org/10.1080/10410236.2015.1037425>
- Wilson EA, Wolf MS. Working memory and the design of health materials: a cognitive factors perspective. *Patient Educ Couns* 2009; 74: 318–22. <http://doi.org/10.1016/j.pec.2008.11.005>
- Visscher BB, Steunenberg B, Heerdink ER *et al.* Medication self-management support for people with diabetes and low health literacy: a needs assessment. *PLoS One* 2020; 15: e0232022. <https://doi.org/10.1371/journal.pone.0232022>
- Meppelink CS, van Weert JC, Haven CJ *et al.* The effectiveness of health animations in audiences with different health literacy levels: an experimental study. *J Med Internet Res* 2015; 17: e11. <https://doi.org/10.2196/jmir.3979>
- Meppelink CS, Smit EG, Diviani N *et al.* Health literacy and online health information processing: unraveling the underlying mechanisms. *J Health*

- Commun 2016; 21: 109–20. <https://doi.org/10.1080/10810730.2016.1193920>
32. Bol N, Smets EM, Eddes EH *et al.* Illustrations enhance older colorectal cancer patients' website satisfaction and recall of online cancer information. *Eur J Cancer Care (Engl)* 2015; 24: 213–23. <https://doi.org/10.1111/ecc.12283>
 33. Visscher BB, Steunenberg B, Heijmans M *et al.* Evidence on the effectiveness of health literacy interventions in the EU: a systematic review. *BMC Public Health* 2018; 18: 1414–7. <https://doi.org/10.1186/s12889-018-6331-7>
 34. Stichting K. *Watchyourmeds*. 2019; Available at: <https://www.stichtingkijksluit.nl/health-care-provider/> (28 September 2020, date last accessed).
 35. Central Committee on Research Involving Human Subjects. *Questionnaire Research*. Available at: <https://english.ccmo.nl/investigators/additional-requirements-for-certain-types-of-research/other-types-of-research/questionnaire-research>. (27 May 2021, date last accessed).
 36. Glasgow RE, Klesges LM, Dziewaltowski DA *et al.* Evaluating the impact of health promotion programs: using the RE-AIM framework to form summary measures for decision making involving complex issues. *Health Educ Res* 2006; 21: 688–94. <https://doi.org/10.1093/her/cyl081>
 37. Baumgartner AD, Clark CM, LaValley SA *et al.* Interventions to deprescribe potentially inappropriate medications in the elderly: lost in translation? *J Clin Pharm Ther* 2020; 45: 453–61. <https://doi.org/10.1111/jcpt.13103>
 38. Shoemaker SJ, Curran GM, Swan H *et al.* Application of the consolidated framework for implementation research to community pharmacy: a framework for implementation research on pharmacy services. *Res Social Adm Pharm* 2017; 13: 905–13. <https://doi.org/10.1016/j.sapharm.2017.06.001>
 39. Ohl M, Harris A, Nurudtinova D *et al.* Do brief screening questions or provider perception accurately identify persons with low health literacy in the HIV primary care setting? *AIDS Patient Care STDS* 2010; 24: 623–9. <https://doi.org/10.1089/apc.2009.0319>
 40. Koster ES, Philbert D, Blom L *et al.* "These patients look lost" - community pharmacy staff's identification and support of patients with limited health literacy. *Int J Pharm Pract* 2016; 24: 403–10. <https://doi.org/10.1111/ijpp.12272>
 41. Rajah R, Ahmad Hassali MA, Jou LC *et al.* The perspective of healthcare providers and patients on health literacy: a systematic review of the quantitative and qualitative studies. *Perspect Public Health* 2018; 138: 122–32. <https://doi.org/10.1177/1757913917733775>
 42. DeWalt DA, Brouckson KA, Hawk V *et al.* Developing and testing the health literacy universal precautions toolkit. *Nurs Outlook* 2011; 59: 85–94. <https://doi.org/10.1016/j.outlook.2010.12.002>
 43. Berkman ND, Sheridan SL, Donahue KE *et al.* Health literacy interventions and outcomes: an updated systematic review. *Evid Rep Technol Assess (Full Rep)* 2011; (199): 1–941. <https://doi.org/10.7326/0003-4819-155-2-201107190-00005>
 44. Ayre J, Cvejic E, Bonner C *et al.* Accounting for health literacy and intervention preferences when reducing unhealthy snacking: protocol for an online randomised controlled trial. *BMJ Open* 2019; 9: e028544–028544. <https://doi.org/10.1136/bmjopen-2018-028544>
 45. Stableford S, Mettger W. Plain language: a strategic response to the health literacy challenge. *J Public Health Policy* 2007; 28: 71–93. <http://doi.org/10.1057/palgrave.jphhp.3200102>
 46. Meppelink CS, Smit EG, Buurman BM *et al.* Should we be afraid of simple messages? The effects of text difficulty and illustrations in people with low or high health literacy. *Health Commun* 2015; 30: 1181–9. <https://doi.org/10.1080/10410236.2015.1037425>
 47. Zarcadoolas C, Blanco M, Boyer JF *et al.* Unweaving the Web: an exploratory study of low-literate adults' navigation skills on the World Wide Web. *J Health Commun* 2002; 7: 309–24. <https://doi.org/10.1080/10810730290088157>
 48. Birru MS, Monaco VM, Charles L *et al.* Internet usage by low-literacy adults seeking health information: an observational analysis. *J Med Internet Res* 2004; 6: e25. <https://doi.org/10.2196/jmir.6.3.e25>
 49. Haas K, Brillante C, Sharp L *et al.* Lung cancer screening: assessment of health literacy and readability of online educational resources. *BMC Public Health* 2018; 18: 1356–8. <https://doi.org/10.1186/s12889-018-6278-8>
 50. Tieu L, Sarkar U, Schillinger D *et al.* Barriers and facilitators to online portal use among patients and caregivers in a safety net health care system: a qualitative study. *J Med Internet Res* 2015; 17: e275. <https://doi.org/10.2196/jmir.4847>
 51. Kim EH, Stolyar A, Lober WB *et al.* Challenges to using an electronic personal health record by a low-income elderly population. *J Med Internet Res* 2009; 11: e44. <https://doi.org/10.2196/jmir.1256>
 52. Irizarry T, Shoemaker J, Nilsen ML *et al.* Patient portals as a tool for health care engagement: a mixed-method study of older adults with varying levels of health literacy and prior patient portal use. *J Med Internet Res* 2017; 19: e99. <https://doi.org/10.2196/jmir.7099>
 53. Christensen DB, Neil N, Fassett WE *et al.* Frequency and characteristics of cognitive services provided in response to a financial incentive. *J Am Pharm Assoc (Wash)* 2000; 40: 609–617. [https://doi.org/10.1016/s1086-5802\(16\)31100-7](https://doi.org/10.1016/s1086-5802(16)31100-7)