Medication literacy in elderly patients with chronic diseases: a community pharmacy perspective

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Abstract

**Background:** Long-term therapy with chronic maintenance medication is essential for reducing risks of disease progression, comorbidity, and mortality. A correct adherence and use of the medication are prerequisite for reducing these risks. Medication literacy (ML) is the specific ability to safely access and understand the information available concerning medication, and act accordingly.

**Methods:** To investigate the ML in a community pharmacy of older users in order to study the factors that are associated with inadequate literacy. A total of 400 patients were analyzed to assess the level of ML (document and numeracy) through the MedLitRxSE tool.

**Results:** Our study showed that 66% had an inadequate-ML. Women were a high frequency of inadequate-ML respect to men (70.1% and 29.9%). Users over 65 years with chronic diseases showed a high frequency of inadequate-ML (76.5%) in both sexes (P<0.001).

**Conclusions:** Older users, those with primary or any studies as well as patients taking many medicines for chronic diseases showed a significantly lower level of ML. Health professionals and managers should adopt new strategies that allow to prevent and reduce the errors in the handling of the medicines and avoiding the undesirable effects of a misuse in older patients.

**Background**

Long-term therapy with chronic maintenance medication is essential for reducing risks of disease progression, comorbidity, and mortality. However, sufficient adherence and a correct use of the medication are prerequisite for reducing these risks [1-3]. Medication non-adherence, or the extent to which patients do not take their medications as agreed with their health care provider, averages 50% among patients suffering from chronic
diseases in developed countries [1] and result in poorer health outcomes and a lower quality of life in patients [4]. Inappropriate prescription use or patient misunderstanding of instructions is often associated with limited information and low knowledge of medication use and a likely cause of medication error and less effective treatment [5, 6]. Besides, many times, the majority of adverse drug reactions are related to excessive dosage and drug interactions associated with polypharmacy [7, 8].

Medication literacy (ML) is the specific ability to safely access and understand the information available concerning medication, and act accordingly [9]. Adherence to chronic medication is of 50% approximately [11], and it could be improved by stimulating the participation of patients in their treatments. Both, knowledge of the medication and health literacy influence on adherence to chronic medication [12]. In order to achieve the maximum effect and a safety use of the medication, patients and caregivers must achieve a proper knowledge of the therapy. Therefore, ML is important to detect in the population since patient safety is threatened when patients cannot understand how to use their treatments and in addition, the safety of children is at risk due to parents' lack of knowledge about medication administration [5, 13, 14].

A proper use of the medication includes how to administrates it, when, for how long, what quantity [15]. This information must be provided first by the health professionals in a simple and effective way adapted to the particular patient but also by medication information sheets readable with pictograms aiding patient comprehension avoid a misuse of the medicines [16, 17].

ML includes skills such as interpretation and the ability to calculate doses, and cannot be measured properly by general evaluations of health literacy. Measurement of ML specially in chronic patients is vital for consolidating numerical and/or documental knowledge about receiving written or oral instructions by health professionals, preparing medication doses,
the duration of treatment or understanding use warnings [18]. Community pharmacists could evaluate ML previous to carrying out a medication review [19], so they can learn what areas are necessary to strengthen intervention to guarantee proper understanding by the patient, influencing their empowerment, their self-efficacy and finally in adhering to treatments. Although there is an absence of tools to measure literacy in medicines, there is a need on the part of community pharmacists to quickly and specifically assess ML of their patients.

In this study was to analyze the ML in patients with and without chronic diseases who acquired medicines in community pharmacies in order to assess the level of literacy and find the factors that are associated with inadequate literacy, with the purpose of designing new strategies that allow to prevent and reduce the errors in the handling of the medicines and avoiding the undesirable effects of a misuse.

**Methods**

**Participants**

A total of 400 patients completed the MedLitRxSE tool [20] administered face to face and answered anonymously in community pharmacies. In this study a total of 249 patients with chronic diseases were comparing with 151 patients without chronic diseases. All the selection of the patients was performed using systematic random probability sampling until the required size was reached.

The community pharmacies were located in urban areas and rural between 2016 and 2018 in Spain. Rural areas were defined as areas with a low population density (<2.500 habitants) and urban areas with high population density (>2500 inhabitants) [21].

Sociodemographic data, the consumption of chronic medication and the frequency of reading the patient information leaflet of the consumer drug were also collected.

The inclusion criteria considered was patients over 18 years of age, public or private
health service users who attended the community pharmacy asking for a medication prescribed by a doctor or an over-the-counter medicine for personal use or for someone else. Written informed consent was obtained from all patients. The study protocol was approved by the institutional ethics committee study in accordance with the Helsinki Declaration of 2000.

**Medication Literacy Assessment**

The MedLitRxSE (Medication Literacy Assessment) is a tool that assesses the skills needed to manage medication properly (Table S1). It consists of 14 items organized in four scenarios, which 10 items pertaining to document literacy and 4 to numeracy, all with a dichotomous response. A possible range of 0-14 points can be obtained, in such a way that higher score is related to greater literacy with medication [20].

To understand the factors associated with medication literacy, two study groups were established, adequate and inadequate literacy, based on the third quartile values as a cut-off point [22]. Adequate literacy punctuation was established, with scores of total ML≥13 points, document ML with ≥9 points, and numeracy-ML equal to 4 points.

**Statistical analysis**

Sociodemographic data and results of surveys were collected in a database (Microsoft Access 11.0; Microsoft corporation, Seattle, WA), and statistical analysis was performed using the SPSS 15.0 software (SPSS Inc., Chicago IL, USA). Categorical data were compared using chi-square test or Fisher’s Exact test, and non-parametric count data were compared using the Kruskal Wallis test or Mann Whitney U test. Inadequate and adequate ML were compared using bivariate analyses to determine whether there was a difference in descriptive characteristics (e.g., age, sex, education). Logistic regression analysis was used to examine factors associated with adequate medication literacy. A level of P < 0.05 was accepted as statistically significant. Odds ratios (OR) and their 95% confidence
intervals (CI) were calculated to estimate relative risk. Forest plots were performed to assess the significance of the results and generated using 95% confidence intervals (CIs). The I-square (I²) statistic with cut-off values of 73.1% and a p-value of <0.001 was considered statistically significant.

Results

**Demographic characteristics**

A total of 400 community pharmacy users, including 264 females (66%) and 136 males (34%) were analyzed in this study (Table 1a, Fig. 1). The median age of total cohort was 49.65 ± 16.62 (years ± SD). All age groups analyzed were equally represented and no significant differences were found (P=0.090). Individuals under 50 years represented 53.5% while individuals over or equal to 51 years were 46.5%. The analysis of school level showed significant differences between the analyzed groups ($X^2=0.003$) because a 42.5% had only primary school level or any study, while a 57.5% had a middle and high school levels (32.3% and 25.2%, respectively).

A 41% of the surveys were conducted by users of rural community pharmacies, while 59% were conducted in urban areas. It should be noted that there were no significant differences in terms of gender, age or school level. The analysis of medicine consumption in community pharmacy showed that 44.8% were performed by patients with chronic disease while 37.7% did not have any type of chronic disease. The chronic diseases present in these patients were metabolic syndrome (32.9%), hypertension (30.1%), hyperlipemia (16.1%), depression (12.5%) and diabetes (8.4%). Finally, with respect to the reading of medicine leaflets, it was observed that 47% stated to read them, while 24.8% never and sometimes 28.2% of respondents ($X^2=0.0001$).

**Analysis of total literacy medication**
It should be noted that only 19% and 15% respond adequately to 13 and 14 questions respectively in the MedLiTRxSE tool. On the other hands, adequate- and inadequate-ML and the sociodemographic characteristics were analyzed (Table 1a). The results showed that only a 34% (n=136) had an adequate-ML respect to inadequate-ML (66%; n=264).

Respect to gender, women were a high frequency of inadequate literacy respect to men (70.1% and 29.9%, respectively; P=0.019, OR=0.592, 95% CI: 0.385-0.910). Similarly, the analysis of the different age groups showed statistically significant differences regarding medication and literacy (P<0.001; OR=0.312; 95% CI: 0.195-0.499). The groups between 51-65 and >65 years showed a high frequency of inadequate-ML (76.5% and 92.9%, respectively) compared with the rest of age groups. The school level was also analyzed, and a statistically significant increase in ML was observed with the academic level was increased (P <0.001; OR=15.403; 95% CI: 8.109-29.257).

Besides, any different in inadequate-ML were observed in different community pharmacy, rural or urban areas (61.0% and 69.5% respectively, P=0.086). However, with regard to the consumption of medications, an inadequate literacy was observed in chronic patients group (75.1%) compared to non-chronic patients (51%; P<0.001; OR=0.345; 95% CI: 0.225-0.530). No significant statistical difference was found respect to reading information leaflet (P=0.180).

Finally, the total correct answers obtained in total-ML depending on the different sociodemographic characteristics were analyzed (Table 1b). The mean number of correct answers for total-ML was 10.30±3.41 (mean points ± SD; range: 0-14 points). No difference between both sexes was observed, obtaining both a similar and high percentage of correct answers (P=0.075). On the contrary, a gradual decrease in the number of correct answers was observed when age was increased (P<0.001). On the other hand, high school level showed the highest number of correct answers (12.67±1.46, mean
The location of the pharmacy (rural or urban) did not show significant differences (P=0.083). However, a decrease in correct responses was observed in users with chronic diseases (P<0.001) compared to users without chronic diseases and those who never read leaflet information (P<0.001).

**Analysis of total literacy medication in patients with chronic disease**

Adequate- and inadequate-ML in patients with chronic disease and their relationships with sociodemographic characteristics were analyzed (Table 2, Fig. 2). The results showed a low adequate-ML in both men and women, there being no significant differences between both groups of patients (X²=0.874). Our results showed that the only variables that influenced ML were the patient's age and school level (P<0.001). It should be noted that patients with an age ≥ 51 years showed a high frequency of inadequate-ML compared with the rest of age groups analyzed. Patients with high school level also showed high adequate-ML (68.3%) and only 31.7% showed inadequate-ML. Finally, the influence of reading information leaflet was also analyzed and no statistically significant influence was observed (X² = 0.973)

**Analysis of documental medication literacy**

It should be noted that 21% and 16% respond correctly to a total of 9 and 10 questions respectively in the documental MedLiTRxSE tool. The analysis of the 10 questions that reflect the documentary literacy showed an average of correct answers of 7.06 ± 2.51 (mean ± SD) in the total population analyzed (Table 1b). The analysis of the influence of the different sociodemographic characteristics when the number of correct answers between men and women was compared showed significant differences according to gender (P=0.008). A decrease in the number of correct answers was observed in individuals over 65 years compared with the rest of ages analyzed (P <0.001). On the
other hand, a greater number of correct answers was observed in individuals with high school level (8.79±1.28, mean ± SD) respect to others groups. No influence was observed between rural or urban area of the community pharmacy (P = 0.069). Also a smaller number of correct answers were observed in users with chronic diseases respect to users without chronic diseases (P = 0.002).

Finally, the different scenarios in the MedLiTRxSE tool for documental-ML were also analyzed. The identification of Doctor prescription medicine (scenario # 5) showed the high frequency of correct answers (96%) junto con la identification of name of medicine (93%; scenario # 5). On the contrary, the identification of the parts of the body to inject the medicine (45%, scenario # 3) and the correct identification of doses per day for syrup (54%; scenario # 8) were the scenarios with the greatest difficulty to answer adequately.

**Analysis of numeracy medication literacy**

The percentage of each MedLiTRxSE question correctly answered for numeracy-ML questions were analyzed. It is observed as a 43% answered adequately ≤3 questions and 57% answered adequately four questions.

The analysis of the four questions of numerical literacy in medicines showed an average of corrected answers of 3.23±1.09 (mean ±DS) in the total study cohort (Table 1b). The analysis of numeracy-ML on different sociodemographic characteristics did not show differences according to gender (P=0.268) or according to the location of the community pharmacy (P=0.154), however, statistically significant differences were found in function of age (P <0.001), observing a decrease in numeracy-ML as the patient's age increased. This association was confirmed and improved when multivariable analysis was applied (P<0.0001; Table 3). Similarly, statistically significant differences were found in school level (P <0.001). The individuals with primary studies or without studies showed a low numerical literacy (1.86±1.17; mean±DS) compared with individuals with a high school
education (3.88±0.35; mean ± SD), this association was confirmed and improved when multivariable analysis was applied (P<0.0001; Table 3).

On the other hand, chronic patients obtained lower values of numeracy-ML (2.86 ± 1.34; mean ± DS) than patients without chronic disease (3.36±1.01; mean±DS), being statistically significant (P=0.002). This association was confirmed and improved when multivariable analysis was applied (P=0.001). Finally, differences were also observed between individuals who never read the leaflet information and those who always read it (P=0.002).

Frequency of correct answers in the MedLiTRxSE tool for numeracy-ML were also analyzed (Fig. 2). It should be noted that the numerical calculation of units of injectable medicine for diabetes (scenario #1) was the one that presented the lowest frequency of correct answers (62%), with respect to the rest of the questions whose frequency of success was 87% in all of them.

Discussion

In this study was analyzed the ML in patients with and without chronic disease who acquired medicines in community pharmacies in order to assess the level of literacy and find the factors that are associated with inadequate literacy with the purpose of designing new strategies that allow to prevent and reduce the errors in the handling of the medicines and avoiding the undesirable effects of a misuse.

The incorrect use of medication is a major health problem, not only because it diminishes the effectiveness, but also because of the high frequency of associated problems [23]. In this study, the MedLitRxSE tool proved to be an effective and quick-to-use tool, focused on recognizing the literacy of patients, playing an important role that guarantees patient safety and adherence to medicines in the community pharmacy.

Knowledge and improvement of ML could help reduce non-adherence to chronic
treatments, giving power to patients and enabling them to participate in their medication therapy, helping to reduce non-adherence to chronic treatments [24].

In our study, only 19.75% of the participants can be considered to have an inadequate level of medication literacy. Our results were similar to that obtained by Sauceda et al. [21] in a population of 181 participants of English and Spanish speakers in health centers and general population. Our results showed an high frequency of inadequate literacy in patient groups with >51 years compared with the rest of age groups, these results being similar to those found by Lee YM et al. [25].

Patients with limited health literacy have a significantly low understanding of the instructions on the label of medicine containers, and therefore a higher risk of having problems related to the medication [26].

In relation to document literacy, participants did not correctly answer properly the question about identifying the parts of the body in which medication for diabetes could be injected. We think it might be interesting to add illustrations to help patients with low levels of literacy to improve their understanding of how medicines should be used and their degree of satisfaction with the care received in the community pharmacy [27], and to reduce medication dosage errors [28].

However, it must be borne in mind that a study conducted in patients with low literacy showed that the use of illustrations did not reinforce the information of the medication compared to those who received only written information [29]. At the same time, the design of the illustrations should be suitable, because it has been shown that they may be a source of errors that result adverse effects because the improper administration of the medication [30]. One alternative to the use of written information and illustrations could be providing the information about medication in audio format. This has been used for treating patients with a low health literacy with statins, and was seen to increase
knowledge about the medication and a patient satisfaction, compared to those who received the usual materials [31].

In terms of numeracy-ML, 57% answered the 4 questions correctly, compared with the study carried out by Osborn et al. [32], in which only 38.24% of participants had an adequate level of numeracy-ML. Participants in our study made mistakes most frequently in the question related to the medication dose required and this can lead to underdosing or safety risks. It should be noted that users with medium or higher education have a greater and more significant total literacy in medicines than users without education or only with primary education. Romero-Sanchez et al. [29] in a study conducted in 7278 community pharmacy patients throughout Spain, observed that uneducated patients had a higher risk of not understanding the information of the medication compared to patients with primary, secondary or university level studies.

The more patients read patient information leaflets, the higher their score for total, numeracy and document-ML. In this sense, some authors have suggested that the habit of frequent reading is a powerful tool for improving health literacy [33].

A predictive factor for having adequate total, document and numeracy-ML was having a higher educational level. Moreover, in the case of numeracy, a younger age was also seen to be a predictive factor. The same factors associated with ML are also mentioned in the literature as predictors of health literacy [32, 34].

In a study conducted by Osborn et al. [32] with 205 outpatients aged from 18 to 80 years, health literacy was measured using the Rapid Estimate of Adult Literacy in Medicine (REALM) and numeracy with the Wide Range Achievement Test, 3rd Edition (WRAT-3), the authors finding that as the level of studies and income increased, both numeracy and health literacy improved. For their part, Okamoto et al. [35] measured numeracy-ML in 300 people aged between 20 and 69 years using Lipkus and Schwartz scales. The first
scale identified 46.33% of participants as having a low level of literacy, while the Schwartz scale identified 39.67% of participants as having a low literacy level. Men who had had a university education scored better score, while as age increased, the score decreased. Income did not have any effect on the results obtained for numeracy.

Using the short test on functional health literacy (S-TOFHLA) in a cross-sectional study of 79 patients from 3 pharmacies in the United States, Backes and Kuo [36] observed that 27 of the patients did not have an adequate functional level of health literacy. Such patients often did not remember the name of their treatment compared with patients considered to have a correct functional level of health literacy (60% vs. 84%, p<0.001). The same occurred with remembering the correct dose (71% vs. 83%, p = 0.03) and the frequency with which the medicine should be taken (62% vs. 85%, p<0.001).

Bauer et al. [37] studied the relationship between health literacy and adherence to following treatment correctly in 1366 patients treated with antidepressants during a 4 year follow-up. Seventy-two percent of patients were classified as having limited health literacy, these patients showing poor adherence compared to patients with no such limitations.

Notably, the MedlitRxSE questionnaire has not been used in a wide variety of situations. To our knowledge, there are few instruments exclusively dedicated to measuring medication literacy. Therefore, one of the problems with discussing the data is that it is difficult to compare our results with other studies specifically referring to ML whether using the MedLitRxSE or other tools. In addition, the survey used in our research to measure ML does not measure the communication skills of patients, which forms part of health literacy and is essential for interaction with health professionals, with the health care system and for understanding the advertising related to medication and health [38].

Conclusions
In conclusion, the MedlitRxSE questionnaire is a useful tool to measure ML in an effective and fast way in the community pharmacy, a structured, easy-to-complete tool for participants and useful for evaluating the knowledge, abilities and skills necessary for managing personal medication. By means of the use of this questionnaire it has been detected that old users and those with lower levels of education and as well as patients taking many medicines for chronic diseases show a significantly lower level of medication literacy.

This reality should encourage health professionals and health managers to adopt strategies and initiatives that will improve the skills and abilities necessary for managing medication, especially in the population groups mentioned, besides encouraging the reading of patient information leaflet or similar initiatives. Knowledge about the ML of patients would improve communication with health professionals, and contribute to increasing user knowledge and understanding of their illnesses and the pharmacotherapy involved. Finally, such knowledge should increase adherence to, the clinical outcomes and safety of treatments.

Declarations

**Ethics approval and consent to participate**

Written informed consent was obtained from all patients. The study protocol was approved by Clinical Research Ethics Committee (CEIC) of the University of Murcia in accordance with the Helsinki Declaration of 2000.

**Consent for Publication**

Not applicable.

**Availability of data and material**

The datasets used during the current study are available from the corresponding author on reasonable request.
Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JPZ and IL contributed equally to this article. JPZ, IL and MDPC contributed to the study design, interpretation of data and discussion of manuscript; EO contributed to the study design and discussion of manuscript; IL performed statistical analysis and drafted and finalized the manuscript. All authors reviewed and approved the final version.

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Abbreviations

CI: Confidence intervals; I2: I-square; LCL: Lower confidence level; MedLitRxSE: Medication Literacy Assessment; ML: Medication literacy; OR: Odds ratios; REALM: Rapid Estimate of Adult Literacy in Medicine; SD: Standard deviation; S-TOFHLA: Short test on functional health literacy; UCL: Upper confidence level; WRAT-3: Wide Range Achievement Test, 3rd Edition

References
1. Zwikker HE, van den Bemt BJ, Vriezekolk JE, van den Ende CH, van Dulmen S. Psychosocial predictors of non-adherence to chronic medication: systematic review of longitudinal studies. Patient Prefer Adherence. 2014;8:519-63. doi:10.2147/PPA.S47290.

2. Baena MI, Faus MJ, Fajardo PC, Luque FM, Sierra F, Martinez-Olmos J, et al. Medicine-related problems resulting in emergency department visits. Eur J Clin Pharmacol. 2006;62:387-93. doi:10.1007/s00228-006-0116-0.

3. McLachlan CYL, Yi M, Ling A, Jardine DL. Adverse drug events are a major cause of acute medical admission. Intern Med J. 2014;44:633-8. doi:10.1111/imj.12455.

4. Gazmararian JA, Kripalani S, Miller MJ, Echt K V, Ren J, Rask K. Factors associated with medication refill adherence in cardiovascular-related diseases: a focus on health literacy. J Gen Intern Med. 2006;21:1215-21. doi:10.1111/j.1525-1497.2006.00591.x.

5. Davis TC, Federman AD, Bass PF, Jackson RH, Middlebrooks M, Parker RM, et al. Improving Patient Understanding of Prescription Drug Label Instructions. J Gen Intern Med. 2009;24:57-62. doi:10.1007/s11606-008-0833-4.

6. Hughes GF, McElnay JC, Hughes CM, McKenna P. Abuse/misuse of non-prescription drugs. Pharm World Sci. 1999;21:251-5. http://www.ncbi.nlm.nih.gov/pubmed/10658232. Accessed 1 Feb 2019.

7. Hoemme A, Barth H, Haschke M, Krähenbühl S, Strasser F, Lehner C, et al. Prognostic impact of polypharmacy and drug interactions in patients with advanced cancer. Cancer Chemother Pharmacol. 2019. doi:10.1007/s00280-019-03783-9.

8. Pazan F, Kather J, Wehling M. A systematic review and novel classification of listing tools to improve medication in older people. Eur J Clin Pharmacol. 2019. doi:10.1007/s00228-019-02634-z.

9. Sauceda JA, Loya AM, Sias JJ, Taylor T, Wiebe JS, Rivera JO. Medication literacy in
Spanish and English: Psychometric evaluation of a new assessment tool. J Am Pharm Assoc. 2012;52:e231–40. doi:10.1331/JPhA.2012.11264.

10. Dowse R, Ehlers M. Medicine labels incorporating pictograms: do they influence understanding and adherence? Patient Educ Couns. 2005;58:63–70. doi:10.1016/j.pec.2004.06.012.

11. WHO 2015. Adherence to long-term therapies: evidence for action. WHO 2015. https://www.who.int/chp/knowledge/publications/adherence_report/en/. Accessed 2 Feb 2019.

12. Locke MR, Shianbola OO, Gripentrog E. Improving prescription auxiliary labels to increase patient understanding. J Am Pharm Assoc (2003). 2014;54:267–74. doi:10.1331/JPhA.2014.13163.

13. Wolf MS, Davis TC, Shrank W, Rapp DN, Bass PF, Connor UM, et al. To err is human: patient misinterpretations of prescription drug label instructions. Patient Educ Couns. 2007;67:293–300. doi:10.1016/j.pec.2007.03.024.

14. Zandieh SO, Goldmann DA, Keohane CA, Yoon C, Bates DW, Kaushal R. Risk Factors in Preventable Adverse Drug Events in Pediatric Outpatients. J Pediatr. 2008;152:225–31. doi:10.1016/j.jpeds.2007.09.054.

15. Serper M, Patzer RE, Reese PP, Przytula K, Koval R, Ladner DP, et al. Medication misuse, nonadherence, and clinical outcomes among liver transplant recipients. Liver Transpl. 2015;21:22–8. doi:10.1002/lt.24023.

16. Braich PS, Almeida DR, Hollands S, Coleman MT. Effects of pictograms in educating 3 distinct low-literacy populations on the use of postoperative cataract medication. Can J Ophthalmol. 2011;46:276–81. doi:10.1016/j.jcjo.2011.05.004.

17. Raynor DK, Dickinson D. Key principles to guide development of consumer medicine information-content analysis of information design texts. Ann Pharmacother.
18. al Tehewy M, Fahim H, Gad NI, El Gafary M, Rahman SA. Medication Administration Errors in a University Hospital. J Patient Saf. 2016;12:34–9. doi:10.1097/PTS.0000000000000196.

19. Manfrin A, Tinelli M, Thomas T, Krskka J. A cluster randomised control trial to evaluate the effectiveness and cost-effectiveness of the Italian medicines use review (I-MUR) for asthma patients. BMC Health Serv Res. 2017;17:300. doi:10.1186/s12913-017-2245-9.

20. Sauceda JA, Loya AM, Sias JJ, Taylor T, Wiebe JS, Rivera JO. Medication literacy in Spanish and English: psychometric evaluation of a new assessment tool. J Am Pharm Assoc (2003). 2012;52:e231-40. doi:10.1331/JAPhA.2012.11264.

21. Goerlich Gisbert F, Cantarino Martí I. Estimaciones de la población rural y urbana a nivel municipal. Estadística Española. 2015;57:5–28.

22. Mazumdar M, Glassman JR. Categorizing a prognostic variable: review of methods, code for easy implementation and applications to decision-making about cancer treatments. Stat Med. 2000;19:113–32. http://www.ncbi.nlm.nih.gov/pubmed/10623917. Accessed 18 Feb 2019.

23. Soendergaard B, Kirkeby B, Dinsen C, Herborg H, Kjellberg J, Staehr P. Drug-related problems in general practice: results from a development project in Denmark. Pharm World Sci. 2006;28:61-4. doi:10.1007/s11096-006-9008-8.

24. Chang F-C, Chi H-Y, Huang L-J, Lee C-H, Yang J-L, Yeh M-K. Developing school-pharmacist partnerships to enhance correct medication use and pain medication literacy in Taiwan. J Am Pharm Assoc (2003). 2015;55:595–602. doi:10.1331/JAPhA.2015.15053.

25. Lee Y-M, Yu HY, You M-A, Son Y-J. Impact of health literacy on medication adherence
in older people with chronic diseases. Collegian. 24:11-8.
http://www.ncbi.nlm.nih.gov/pubmed/29218957. Accessed 20 Mar 2019.

26. Custodis F, Rohlehr F, Wachter A, Böhm M, Schulz M, Laufs U. Medication knowledge of patients hospitalized for heart failure at admission and after discharge. Patient Prefer Adherence. 2016;Volume 10:2333-9. doi:10.2147/PPA.S113912.

27. Mohan A, Riley MB, Boyington D, Kripalani S. PictureRx: Illustrated medication instructions for patients with limited health literacy. J Am Pharm Assoc (2003). 2012;52:e122-9. doi:10.1331/JAPhA.2012.11132.

28. Condren ME, Desselle SP. The fate of pediatric prescriptions in community pharmacies. J Patient Saf. 2015;11:79-88. doi:10.1097/PTS.0b013e3182948a7d.

29. King SR, McCaffrey DJ, Bentley JP, Bouldin A, Hallam J, Wilkin NE. The influence of symbols on the short-term recall of pharmacy-generated prescription medication information in a low health literate sample. J Health Commun. 2012;17 Suppl 3:280-93. doi:10.1080/10810730.2012.712620.

30. Lokker N, Sanders L, Perrin EM, Kumar D, Finkle J, Franco V, et al. Parental misinterpretations of over-the-counter pediatric cough and cold medication labels. Pediatrics. 2009;123:1464-71. doi:10.1542/peds.2008-0854.

31. Gossey JT, Whitney SN, Crouch MA, Jibaja-Weiss ML, Zhang H, Volk RJ. Promoting knowledge of statins in patients with low health literacy using an audio booklet. Patient Prefer Adherence. 2011;5:397-403. doi:10.2147/PPA.S19995.

32. Osborn CY, Wallston KA, Shpigel A, Cavanaugh K, Kripalani S, Rothman RL. Development and validation of the General Health Numeracy Test (GHNT). Patient Educ Couns. 2013;91:350-6. doi:10.1016/j.pec.2013.01.001.

33. Wister A V, Malloy-Weir LJ, Rootman I, Desjardins R. Lifelong educational practices and resources in enabling health literacy among older adults. J Aging Health.
34. Paasche-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Bohlman LT, Rudd RR. The prevalence of limited health literacy. J Gen Intern Med. 2005;20:175–84. doi:10.1111/j.1525-1497.2005.40245.x.

35. Okamoto M, Kyutoku Y, Sawada M, Clowney L, Watanabe E, Dan I, et al. Health numeracy in Japan: measures of basic numeracy account for framing bias in a highly numerate population. BMC Med Inform Decis Mak. 2012;12:104. doi:10.1186/1472-6947-12-104.

36. Backes AC, Kuo GM. The association between functional health literacy and patient-reported recall of medications at outpatient pharmacies. Res Social Adm Pharm. 2012;8:349–54. doi:10.1016/j.sapharm.2011.08.001.

37. Bauer AM, Schillinger D, Parker MM, Katon W, Adler N, Adams AS, et al. Health literacy and antidepressant medication adherence among adults with diabetes: the diabetes study of Northern California (Distance). J Gen Intern Med. 2013;28:1181–7. doi:10.1007/s11606-013-2402-8.

38. Pleasant A, McKinney J. Coming to consensus on health literacy measurement: an online discussion and consensus-gauging process. Nurs Outlook. 2011;59:95-106.e1. doi:10.1016/j.outlook.2010.12.006.

Tables
Table 1. (A) Analysis of medication literacy and the sociodemographic characteristics of the population. (B) Analysis of the mean of correct answers in MedLiTRx tool according to the sociodemographic characteristics of the population.

(A) Medication literacy, N=400

|                          | Total N=400, n (%) | Adequate N=136, n (%) | Inadequate N=264, n (%) | P1       | Total mean (mean ± SD)* |
|--------------------------|--------------------|-----------------------|-------------------------|----------|-------------------------|
| Gender                   |                    |                       |                         |          |                         |
| Male                     | 136 (34.0)         | 57 (41.9)             | 79 (58.1)               | 0.019a   | 10.72 : 10.08 :         |
| Female                   | 264 (66.0)         | 79 (29.9)             | 185 (70.1)              |          |                         |
| Age (years)              |                    |                       |                         |          |                         |
| <35                      | 99 (24.8)          | 54 (54.5)             | 45 (45.5)               | <0.001b  | 12.28 : 11.50 : 6.68 :  |
| 35-50                    | 115 (28.7)         | 52 (45.2)             | 63 (54.8)               |          |                         |
| 51-65                    | 102 (25.5)         | 24 (23.5)             | 78 (76.5)               |          |                         |
| >65                      | 84 (21.0)          | 6 (7.1)               | 78 (92.9)               |          |                         |
| School level             |                    |                       |                         |          |                         |
| Primary or any study     | 170 (42.5)         | 12 (7.1)              | 158 (92.9)              |          | 4.77 : 11.80 : 12.67 :  |
| Middle                   | 129 (32.3)         | 57 (44.2)             | 72 (55.8)               | <0.001c  |                         |
| High                     | 101 (25.2)         | 67 (66.3)             | 34 (33.7)               |          |                         |
| Pharmacies areas         |                    |                       |                         |          |                         |
| Rural                    | 164 (41.0)         | 64 (39.0)             | 100 (61.0)              | 0.086    | 10.65 : 10.05 :         |
| Urban                    | 236 (59.0)         | 72 (30.5)             | 164 (69.5)              |          |                         |
| Consumption of medication|                    |                       |                         |          |                         |
| Chronic disease          | 249 (44.8)         | 62 (24.9)             | 187 (75.1)              | <0.001d  | 6.08 : 10.91 :         |
| Non chronic disease      | 151 (37.7)         | 74 (49.0)             | 77 (51.0)               |          |                         |
| Reading information leaflet|                  |                       |                         |          |                         |
| Never                    | 99 (24.8)          | 28 (28.3)             | 71 (71.7)               |          | 8.94 : 10.47 : 10.91 :  |
| Sometimes                | 113 (28.2)         | 40 (35.4)             | 73 (64.6)               | 0.180    |                         |
| Always                   | 188 (47.0)         | 68 (36.2)             | 120 (63.8)              |          |                         |

N, total number of individuals; n, number of individuals in each study. SD, standard deviation. P1, Comparisons were made by the Mann-Whitney U test or the Kruskal-Wallis test. *Mean of total point in each case. P-values marked in bold a versus adequate medication literacy. OR, odds ratio with a confidence interval (CI) of 95%. a, OR=0.592; 95% CI:0.385-0.910, P<0.001 (P-value obtained comparing 18-35 years’ group versus the rest of the groups; b, OR=15.403; 95% CI: 8.109-29.7, CI: 0.225-0.530, P<0.001 (P-value obtained comparing consumption medication in patient with chronic disease versus no
Table 2. Analysis of medication literacy in patients with chronic disease.

|                     | TOTAL N=249, n (%) | Medication literacy N=249 | Adequate N=62, n (%) | Inadequate N=187, n (%) | P*     |
|---------------------|--------------------|---------------------------|----------------------|-------------------------|--------|
| **Gender**          |                    |                           |                      |                         |        |
| Male                | 77 (30.9)          |                           | 20 (31.5)            | 57 (30.5)               | 0.874  |
| Female              | 172 (69.1)         |                           | 42 (24.4)            | 130 (75.6)              |        |
| **Age (years)**     |                    |                           |                      |                         |        |
| <35                 | 46 (18.5)          |                           | 24 (52.2)            | 22 (47.8)               | <0.001 |
| 35-50               | 43 (17.3)          |                           | 18 (41.9)            | 25 (58.1)               |        |
| 51-65               | 82 (32.9)          |                           | 15 (19.2)            | 63 (80.8)               |        |
| >65                 |                    |                           | 5 (6.1)              | 77 (93.9)               |        |
| **School level**    |                    |                           |                      |                         |        |
| Primary or any study| 145 (58.2)         |                           | 8 (9.5)              | 137 (94.5)              |        |
| Middle              | 63 (25.3)          |                           | 26 (41.3)            | 37 (58.7)               | <0.001 |
| High                | 41 (16.5)          |                           | 28 (68.3)            | 13 (31.7)               |        |
| **Pharmacies areas**|                   |                           |                      |                         |        |
| Rural               | 105 (42.2)         |                           | 32 (30.5)            | 73 (69.5)               | 0.102  |
| Urban               | 144 (57.8)         |                           | 30 (20.8)            | 114 (79.2)              |        |
| **Reading information leaflet** | |                     |                      |                         |        |
| Never               | 76 (30.5)          |                           | 19 (25.0)            | 57 (75.0)               |        |
| Sometimes           | 71 (28.6)          |                           | 17 (23.9)            | 54 (76.1)               | 0.973  |
| Always              | 102 (40.9)         |                           | 26 (25.5)            | 76 (74.5)               |        |

N, total number of individuals; n, number of individuals in each study. Comparisons were made by the two-sided Fisher exact test or Pearson’s Chi-Square test respectively. P-values marked in bold are statistically significant (P < 0.05). P-value obtained comparing inadequate medication literacy group versus adequate medication literacy. OR, odds ratio with confidence interval (CI) of 95%.
Table 3. Logistic regression multivariable analysis for MedLitRxSE, document and numeracy literacy.

| Total MedLitRxSE | Wald | P     | OR   | Lower  | Upper  | 95% CI       |
|------------------|------|-------|------|--------|--------|--------------|
| Gender           | 3.79 | 0.050 | 1.68 | 1      | 2.85   |              |
| Age              | 4.93 | 0.030 | 2.69 | 1.12   | 6.44   |              |
| School level     | 47.96| <0.0001| 14.81| 6.91   | 31.77  |              |
| Pharmacie areas  | n.s. |       |      |        |        |              |
| Consumption      | 37.53| <0.0001| 13.69| 8.72   | 33.82  |              |
| medcityration    | n.s. |       |      |        |        |              |
| Reading          | 5.37 | 0.068 | 3.79 | 1.29   | 11.12  |              |
| information     | 5.90 | 0.020 | 10.42| 5.27   | 17.62  |              |
| leaflet          | 49.83| <0.0001| 14.88| 7.03   | 31.49  |              |
| Document literacy| n.s. |       |      |        |        |              |
| Gender           | 26.37| <0.0001| 6.59 | 3.21   | 13.53  |              |
| Age              | 21.20| 0.015 | 5.67 | 2.71   | 11.87  |              |
| School level     | 21.20| 0.015 | 5.67 | 2.71   | 11.87  |              |
| Pharmacie areas  | n.s. |       |      |        |        |              |
| Consumption      | 5.37 | 0.068 | 3.79 | 1.29   | 11.12  |              |
| medcityration    | 5.90 | 0.020 | 10.42| 5.27   | 17.62  |              |
| Reading          | 43.13| <0.0001| 14.92| 6.66   | 33.42  |              |
| information     | 43.13| <0.0001| 14.92| 6.66   | 33.42  |              |
| leaflet          | n.s. |       |      |        |        |              |
| Numeracy         | 23.33| 0.001 | 16.59| 7.99   | 34.45  |              |
| Reading          | 23.33| 0.001 | 16.59| 7.99   | 34.45  |              |
| information     | n.s. |       |      |        |        |              |
| leaflet          | 7.96 | 0.043 | 8.52 | 5.04   | 14.39  |              |

OR, odds ratio with a confidence interval (CI) of 95%. P-values marked in bold are statistically significant (P < 0.05). n.s.; not significant.

Figures
Figure 1
Forest plot of medication literacy comparing adequate or inadequate literacy in chronic patients with different sociodemographic characteristics. The squares and horizontal lines correspond to the study-specific OR and 95% CI. The area of the squares reflects the weight (inverse of the variance). The diamond represents the summary OR and 95% CI. Odds Ratio values higher than 1 indicate the existence of a causal relationship between the sociodemographic variable analyzed and the inadequate medication literacy. The results are presented as Odds Ratio with a confidence interval (CI) of 95%. OR; Odds ratio; LCL; Lower confidence level, UCL; Upper confidence level.
Figure 2

Frequency of correct answers in the MedLiTRxSE tool. (A) Frequency of correct
answers related to document literacy (B) Frequency of correct answers related to numeracy-ML.

Supplementary Files

This is a list of supplementary files associated with the primary manuscript. Click to download.
Table S1.docx