Final Report for the Determining Patient Health Literacy during a Medicine Consultation Study

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Contents

Main messages

What we already know

- Up to half of the UK population may not have adequate health literacy.
- Limited health literacy is associated with lower uptake of illness prevention activities; increased morbidity; mortality and a widening in health inequalities.
- Existing health literacy instruments have constraints that limit their use in clinical practice.
- The Newest Vital Sign (NVS) instrument was identified in a systematic review as the most practical health literacy instrument to test in community pharmacies.
- Health care professionals overestimate the health literacy ability of their patients.

What this study adds

- School leaving age is correlated with health literacy so those remaining in education longer had higher NVS health literacy level.
- Adequate health literacy levels in the sample pharmacies were less than fifty percent which compares to previous work in a non-pharmacy environment.
- Without the support of heuristic indicators, the pharmacists overestimated health literacy ability.
- The recall of verbal information, recall of written information and patient's knowledge of their medication are moderately correlated with the NVS health literacy level.
- Pharmacists varied in their ability to accurately predict health literacy.
- There was a trend towards pharmacists more accurately predicting patients with adequate health literacy compared to those with limited health literacy.
- The best predictor of health literacy is the patient's ability to recall written information about their medication.
- The results indicate a heuristic assessment of health literacy incorporating the features of assessing recall of written and verbal health related information, and medicine related knowledge may be feasible and accurate.

Background

Health literacy is 'the degree to which individuals can obtain, process, and understand the basic health information and services needed to make appropriate health decisions' (1). Health literacy ability is described as one of three categories: limited, marginal or adequate. Parts of the UK have more than half of the population lacking adequate health literacy (2).

Limited health literacy prevents patients fully understanding their chronic diseases and impacts on their ability to take their medicines as prescribed. Patients with limited health literacy are ten to eighteen times more likely to be unable to recognise all of their medicines compared to someone with adequate health literacy (3). Health literacy is not assessed in routine healthcare practice. The approach adopted in the USA is a 'universal precaution' which assumes that everyone has limited health literacy. However, this approach contradicts the principle of patient-centred care and of tailoring communication to the individual's requirements. A simple, quick way to identify patients with limited health literacy, that is acceptable to patients, would allow pharmacists to tailor their communication to best support patients take their medicines correctly and manage their chronic diseases.

A systematic review of existing health literacy instruments (4) identified that the Newest Vital Sign (NVS) may be a practical instrument to use in the research setting but there was little evidence of its suitability for use in practice. The research team recently investigated the acceptability and feasibility of using the NVS in a routine community pharmacy consultation. This project established that whilst it was largely acceptable to patients, it would not be feasible to incorporate into all routine consultations. There is therefore a need to investigate alternative approaches which may be more readily incorporated into routine consultations. Research indicates seven possible 'short cuts' termed heuristic health literacy indicators to assessing a patient's level of health literacy which are provided in figure 1.

Figure 1 Seven heuristic indicators identified from previous research

- Poor recall of medication name, purpose, dosage and frequency
- Poor recall of verbal instructions
- Poor recall of written medicine information
- Limited use of medical terminology
- Not seeking new information
- Not asking questions
- Time required to sign own name

Commented [DB(1]: Do we have an abstract from this project?

Commented [PD2]: We have the abstract created for the poster for the RPS conference

Commented [DB(3]: Then please add the reference here.

The present study investigates the use of these heuristics as a potential replacement for a validated health literacy instrument such as the NVS. These heuristics were tested during a pharmacist led medicine consultation to identify if they could be used to accurately assess a patient's health literacy level. The aims of the study were to:

- estimate the health literacy levels of individuals using pharmacies
- assess the accuracy of pharmacists' ability to classify health literacy compared to the NVS
- characterise use of the heuristic indicators by pharmacists during a consultation
- investigate factors correlated to and predictors of health literacy
- assess the acceptability/appropriateness of approaches to health literacy assessment in the community pharmacy

Methods

Design

Mixed qualitative and quantitative methods were used to estimate the ability of the heuristic indicators relative to the NVS, to accurately distinguish between patients with differing levels of health literacy. Pharmacist interviews were used to assess the provisional acceptability to community pharmacists of using the heuristic indicators in routine medicine consultations.

Pharmacy eligibility

The study was open to all pharmacies in North East Essex CCG except online pharmacies. Pharmacies were invited to complete an expression of interest form and asked to provide information to aid selection of the pharmacies for participation in terms of socio-demographic characteristics of the patient population, pharmacist characteristics and likely capacity to recruit. The information used to guide selection is provided in figure 2.

Figure 2 Pharmacy details collected when expressing interest in participation

1. How long has the pharmacist been qualified?
2. How long has the pharmacist worked at that pharmacy?
3. Pharmacy geographical ward
4. Does the pharmacy have a second pharmacist?
5. Does the pharmacy have at least one full time member of counter staff or two part-time members each working at least three days a week?
6. Does the pharmacist carry out Medicine Use Reviews (MUR) and the New Medicine Service (NMS)?

Study recruitment and activity

Figure 3 shows the process followed by the pharmacy teams to recruit and assess patients. All adults prescribed at least one medication for treating high blood pressure were eligible for study participation. The rationale for focussing on people with high blood pressure was that it is a very common long term condition that requires prescription medication to regulate.

Patients providing written, informed consent were invited into the pharmacy consultation room by a trained member of the pharmacy staff who further explained study procedures. The NVS assessment was then undertaken as per figure 4 relating to the information provided in figure 5. NVS scores of four or above indicate adequate health literacy, two to three marginal and one or less indicate limited health literacy. On completing the NVS assessment, the completed score sheet was sealed in a stamped addressed envelope for return to the principal researcher. The patient was then directed to the pharmacist who was given the patient's unique reference number to add to subsequent documentation.

The pharmacist used their professional judgement to choose the topic of the medicine consultation for the heuristic assessment. They were advised to structure the consultation to trigger participants to demonstrate the heuristic indicators in figure 1. They then entered their assessment for each indicator on a data collection form. After the participant left the consultation room, the pharmacist entered a brief explanation of their decision making process for determining the patient's health literacy level. They also recorded on a scale of 0 to 10 how easy it was to incorporate each indicator into the consultation and indicated the perceived value of each indicator in reaching their overall assessment of health literacy.

Sample size

With seven heuristic indicators, a sample size of 91 patients would provide sufficient power to detect whether any of the heuristics are significantly associated with NVS assessed level of health literacy.

Figure 3 Patient recruitment and activity

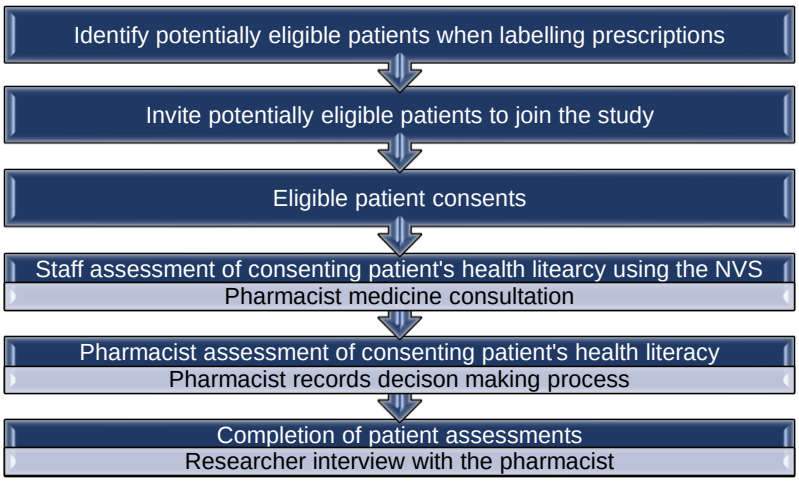


Figure 4 NVS Label

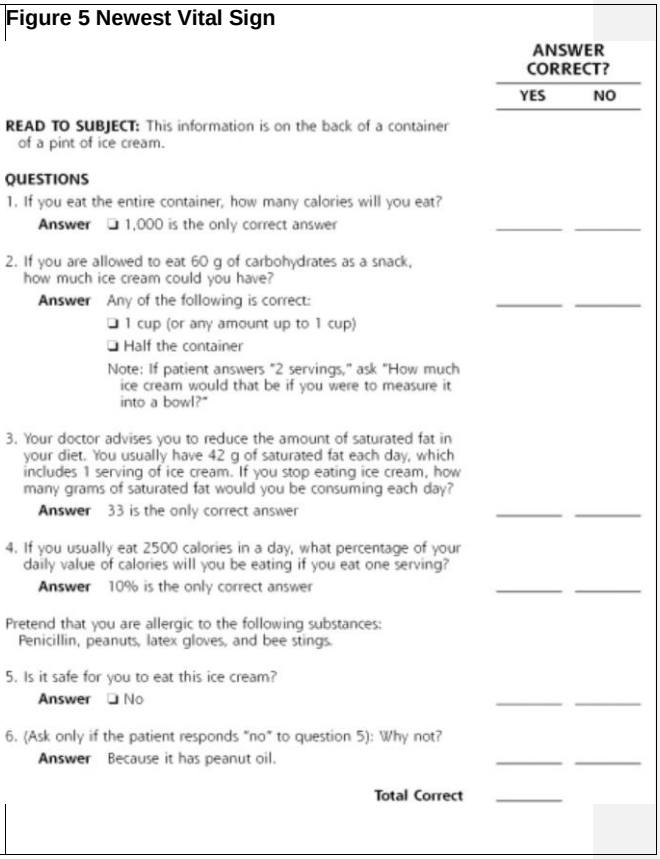
Nutrition Facts

Serving Size	½ cup
Servings per container	4
Amount per serving	
Calories 250	Fat Cal 120
	%DV
Total Fat 13g	20%
Sat Fat 9g	40%
Cholesterol 28mg	12%
Sodium 55mg	2%
Total Carbohydrate 30g	12%
Dietary Fiber 2g	
Sugars 23g	
Protein 4g	8%

*Percentage Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Ingredients: Cream, Skim Milk, Liquid Sugar, Water, Egg Yolks, Brown Sugar, Milkfat, Peanut Oil, Sugar, Butter, Salt, Carrageenan, Vanilla Extract.

Figure 5 Newest Vital Sign



	ANSWER CORRECT? YES	NO
READ TO SUBJECT: This information is on the back of a container of a pint of ice cream.		
QUESTIONS		
1. If you eat the entire container, how many calories will you eat? **Answer** ❑ 1,000 is the only correct answer	_____	_____
2. If you are allowed to eat 60 g of carbohydrates as a snack, how much ice cream could you have? **Answer** Any of the following is correct: ❑ 1 cup (or any amount up to 1 cup) ❑ Half the container Note: If patient answers "2 servings," ask "How much ice cream would that be if you were to measure it into a bowl?"	_____	_____
3. Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 g of saturated fat each day, which includes 1 serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day? **Answer** 33 is the only correct answer	_____	_____
4. If you usually eat 2500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving? **Answer** 10% is the only correct answer	_____	_____
Pretend that you are allergic to the following substances: Penicillin, peanuts, latex gloves, and bee stings.		
5. Is it safe for you to eat this ice cream? **Answer** ❑ No	_____	_____
6. (Ask only if the patient responds "no" to question 5): Why not? **Answer** Because it has peanut oil.	_____	_____
Total Correct	_____	

Quantitative data collection

NVS scores ranging from 0 to 6 were obtained from the completed score sheets provided by the pharmacy team. Additionally, the following data were entered for each patient participant by a pharmacy team member onto a bespoke data collection form: sex, age, education level, pharmacist's initial assessment of health literacy as either inadequate, marginal, adequate or unsure, and pharmacist's interpretation of participant performance for each of the six indicators as either poor, fair or good.

Quantitative data analysis

Descriptive statistics were used for reporting NVS assessed and pharmacist initial assessment of health literacy level. Kappa was used to measure agreement between these assessments. Accuracy was reported by obtaining the sensitivity and specificity; negative and positive predictive values; positive and negative likelihood ratios and assessing the area under the receiver operator curves. Comparison of accuracy of heuristic health literacy assessment by each pharmacist was carried out to identify the variation in predictive ability. The relationship between participant performance in each of the six indicators and the NVS level was tested using Spearman's correlation coefficient.

Qualitative data collection and analysis

A semi-structured schedule was developed in conjunction with the study management team. Each pharmacist was interviewed after completing their final patient assessment. Written consent for the interviews to be recorded was obtained and each interview was transcribed verbatim. The transcript was analysed using a thematic approach. Each transcript was manually coded by using a word or phrase to summarise each statement. Common codes were grouped into categories which were grouped into themes.

Study Management

Ethical approval was granted by NRES Committee East of England- Essex. Management permission for local sites was provided by Norfolk & Suffolk Primary & Community Care Research Office. The NIHR Clinical Research Network provided additional support for patient recruitment to the participating pharmacies. The University of East Anglia acted as the trial sponsor and the project financial report is provided.

The study management committee consisted of all authors, including two patient members. Meetings were held at all significant project time points, with a total of five meetings during the study.

Results

Pharmacy characteristics

Of the sixty-one community pharmacies in North East Essex CCG, seven (11.5%) expressed an interest in participation and five were purposively selected. Table 1 provides information on the selected pharmacies. Four of the five pharmacies were owned by large pharmacy chains, the fifth was a GP owned pharmacy. All participating pharmacies reported providing the MUR and NMS services and had adequate staff for study participation. Most pharmacies were in urban areas and all had population demographics that encompassed mixed levels of deprivation in their catchment areas. None of the pharmacies were in wards that were rated as the most or least deprived wards nationally. The number of years practicing as a pharmacist was bimodal in distribution with three participants practicing for 30 years or longer whilst the remaining two had substantially fewer years in practice. The length of time practising at the included pharmacy demonstrated less variation.

Pharmacy no.	% population over 65 years	Location	Pharmacist sex	No. years at current pharmacy	No. of years practising	Second pharmacist
1	38.7	Urban	Female	3.5	30	No
2	12.7	Urban	Male	1	34	Yes
3	15.1	Urban	Male	5	16	Yes
4	12.7	Urban	Male	1 month	0.5	Yes
5	26.8	Rural	Female	11	36	Yes

Table 1 Pharmacy selection and pharmacist characteristics

Patient characteristics

One hundred and twenty patients were invited of which 95 (79.2%) consented. The variation in consent rate between pharmacies was 63.3% to 95.0%. Only one patient dropped out during the NVS assessment (1% dropout rate) providing a final sample of 119 patient participants.

Commented [DB(5]: ?? 79% of 120 patients is 95 consenting so how did we end up with a final sample of 119?

Commented [PD6]: This is an error. 96 attempted the NVS and 95 completed it as the pharmacy continued until it had 19 completed assessments.

Commented [DB(7]: Please re-phrase so that it is correct.

Table 2 shows the variation in patient characteristics at each of the pharmacy study locations. Participants were mainly older people and the widest variation between locations was the percentage of females. Few participants completed higher education.

Pharmacy no.	Median age	Age range	Median education leaving age	% Female
1	71	46-87	16	26.3
2	72	45-90	16	52.6
3	67	37-81	16	31.6
4	69	44-81	16	47.4
5	67	21-80	16	68.4
Combined	**69**	**21-90**	**16**	**45.0**

Table 2 Patient characteristics

Commented [PD8]: The Standard Deviation for pharmacies 1&5 was large (over five years) hence the 95% CI would be very large.
I remember David's comment was why I had used both mean and median in the same table so I have reverted to both as median values.

Commented [DB(9]: We still need to show the spread even if it is large.

Health literacy levels of individuals using pharmacies

Table 3 provides the distribution of patient participant NVS scores and corresponding health literacy level. Less than 20% of participants answered all six questions correctly. Just under half of the sample had adequate health literacy and approximately a third had marginal health literacy.

NVS score	Health literacy level	Number (%) patients
6	Adequate	18 (18.9)
5	Adequate	13 (13.7)
4	Adequate	13 (13.7)
Total	**Adequate**	**44 (46.3)**
3	Marginal	15 (15.8)
2	Marginal	16 (16.8)
Total	**Marginal**	**31 (32.6)**
1	Limited	7 (7.4)
0	Limited	13(13.7)
0-1	**Limited**	**20 (21.1)**

Table 3 Percentage of patients obtaining each NVS score

Accuracy of pharmacists' ability to classify health literacy compared to the NVS

A comparison of the pharmacists' overall estimate of each participant's health literacy level with the participant's NVS assessed health literacy level is shown in table 4. There was poor

agreement between pharmacist and NVS assessment indicated by a Kappa score of 0.10 which was non-significant (p=0.173). The cells shaded in green indicate the number (%) cases where the pharmacist's judgement matched the NVS level. In general, pharmacists underestimated the percentage of patients having limited and marginal health literacy and over-estimated the percentage with adequate health literacy.

Commented [DB(10]: Hi Allan,
why is this non-significant - not enough data points?

Pharmacist health literacy assessment	NVS health literacy level			Total
	Limited	Marginal	Adequate	
Limited	4 (20%)	5	1	10 (10.5%)
Marginal	11	4 (18%)	7	22 (23.2%)
Adequate	5	22	36 (82%)	63 (66.3%)
Total	**20 (21.1%)**	**31 (32.6%)**	**44 (46.3%)**	**95**

Table 4 Comparison of pharmacist estimate with NVS assessment levels

Use of the indicators by pharmacists during a medicine related consultation

There was variation in practice between pharmacists in terms of how the indicators were incorporated into the medicine consultations. Most pharmacists took a structured medicine use review format and introduced the indicators in a systematic way. The other pharmacists allowed the patient to dictate the flow of the discussion. The pharmacists ranked how difficult they perceived it to incorporate the indicators into the consultation. Table five reports their perceptions.

Ranking of ease of incorporating indicators into assessment	Ranking of perceived importance of indicators in decision making	Ranking
Recall of verbal information	Drug knowledge	Easiest
Time to Sign their name	Recall of verbal information	
Drug Knowledge	Use of medical terminology	
Use of medical terminology	Time to sign their name	
Asking questions	Asking questions	
Seeking new information	Recall of written information	
Recall of written information	Seeking new information	Hardest

Table 5 Ranking the use of indicators for assessment

Assessing recall of verbal information was reported to be relatively easy, recall of written information was more challenging as demonstrated by the following interview quotes:

> *'How do you ask them recall of written information really? There isn't really anything, whereas recall of verbal information, possibly because the doctors told them something or other. So, the written information I found a bit difficult' (P1).*

> *'Like I say, the verbal ones were very easy to use, the written ones the harder ones' (P2).*

> *'The seeking medical information or new information I would say was very difficult to assess. Well I suppose you didn't know where they'd got the information from, so you wouldn't always necessarily know whether it was written or verbal… Written information, obviously rather more difficult unless it came up in conversation that they had read things' P5.*

The ranking of the perceived importance for each of the indicators in terms of helping the decision making is provided in table 5. The pharmacists in the interviews were openly sceptical of the indicator of the patient signing their name. This is incongruent to the score ranking for this indicator. The pharmacists placed greater importance on indicators that directly reported medicine knowledge.

Factors correlated to and predictors of health literacy

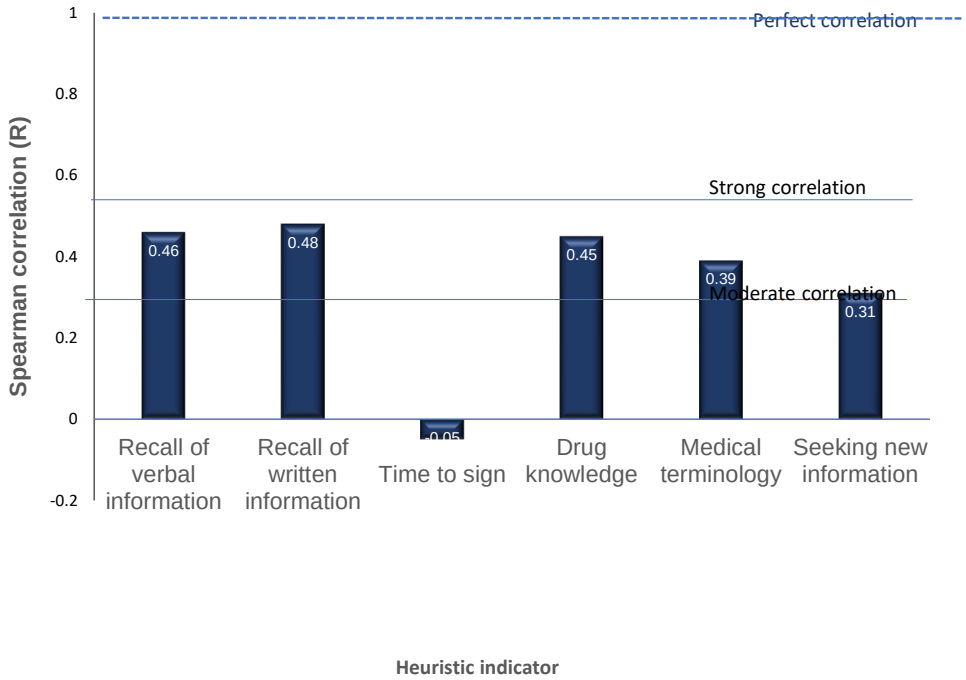
Patient demographic characteristics

No significant relationships were observed between the level of health literacy and sex (Spearman's R=-0.14, p=0.18) or age (Spearman's R=-0.16, p=0.13) however, older school leaving age was significantly correlated with better health literacy (Spearman's R=0.34, p<0.0001).

Heuristic indicators

Six of the seven heuristic indicators had a positive correlation with NVS level, all at a significance level of p<0.001. Figure 6 illustrates these relationships between heuristic indicators and NVS level. The strongest relationship with NVS level was between recall of written information. The only indicator not significantly associated with NVS level was time to sign (R= -0.05 p=0.63).

Figure 6 Correlations between NVS level and indicators



Pharmacist accuracy of predicting health literacy with the indicators.

Combining limited and marginal health literacy levels improved the predictive ability of the pharmacists to identify limited health literacy. Table 6 shows the positive predictive values for each pharmacist and the 95% confidence intervals. The confidence intervals and the predictive capability of the pharmacists varied considerably.

Limited and marginal combined		
Pharmacist number	**Positive Predictive Value (PPV)**	**PPV 95%CI**
5	84.9	76.3-90.7
4	78.3	69.6-85.1
1	75.6	68.4-81.2
2	66.7	50.7-79.5
3	47.2	40.4-54.2

Table 6. Pharmacists' predictive ability to identify limited health literacy

Combining marginal and adequate health literacy increased the predictive ability of all the pharmacists to identify adequate health literacy. Table 7 shows the predictive capability of pharmacists to identify patients with adequate health literacy. The positive predictive value indicates the likelihood that an obtained limited health literacy result is correct. The three most experienced pharmacists' accuracy for all of the indicators for true negative cases (adequate health literacy) was greater than 89%. The most experienced pharmacist only missed one true negative case for the indicator use of medical terminology.

Pharmacy number	Negative Predictive Value (NPV)	NPV 95%CI
5	98.6	91.4-99.8
2	97.4	97.4-97.4
1	91.7	85.0-95.5
3	89.2	86.7-91.3
4	74.4	69.5-78.9

Table 7 Pharmacists predictive ability to identify adequate health literacy

The NPV indicates the likelihood that an adequate health literacy assessment obtained is correct. The ranking of Negative Predictive Values (NPV) scores obtained by the pharmacists matched their length of experience as practising pharmacists. That is, the pharmacist with the longest experience had the highest NPV and second longest second highest down to the least experienced who scored lowest. The 95% confidence interval

ranges indicate that there was a significant difference between the least experienced pharmacist (practising for less than one year) and the other pharmacists. The Pearson correlation between the length of time practising and the NPV was r= 0.97 p=0.01.

Estimates of model parameters and precision

One statistical method to assess the effectiveness of the indicators is to generate a ROC curve. Table 8 shows the Receiver Operating Characteristic (ROC) curve analysis results of the indicators or combination of indicators to predict health literacy. The recall of written information was the best heuristic indicator. Combining recall of written information with recall of verbal information or combining all the indicators did not greatly improve the results.

Indicators	ROC (95%CI)
Recall of written	0.81 (0.70-0.91)
Recall of verbal	0.79 (0.68-0.90)
Drug Knowledge	0.73 (0.60-0.85)
Medical terminology	0.73 (0.60-0.85)
Seeking new information	0.74 (0.58-0.83)
Asking questions	0.72 (0.60-0.85)
Recall of verbal + Recall of written	0.83 (0.72-0.93)
Combination of all associated indicators	0.80 (0.68-0.92)

Table 8 ROC curve assessment when marginal and adequate health literacy levels are combined.

Alternative statistical measures of the effectiveness of the indicators are reported in table 9. A large proportion of the sample had adequate health literacy and the results indicate that the indicators were relatively good at predicting adequate health literacy. Due to the low proportion with limited health literacy there was less certainty regarding the accuracy of predicting limited health literacy.

Indicators	Specificity (95%CI)	Sensitivity (95%CI)	PPV (95%cl)	NPV (95%cl)
Recall of written	87.2 (78.3-93.4)	66.7 (29.9-92.5)	35.3 (21.0-52.8)	96.2 (90.8-98.4)
Recall of verbal	85.9 (76.6-92.5)	50.0 (18.7-81.3)	35.3 (21.0-52.8)	96.2 (90.8-98.4)
Recall of verbal + Recall of written	87.2 (78.3-93.4)	66.7 (29.9-92.5)	35.3 (21.0-52.8)	96.2 (90.8-98.4)
Recall of written+ recall of verbal+ medical terminology + drug knowledge + asking questions +seeking information	88.2 (79.4-94.2)	70.0 (34.8-93.3)	41.2 (25.6-58.7)	96.2 (90.6-98.5)

Table 9 Combination of indicators and precision measures when marginal and adequate health literacy levels are combined.

Review of the pharmacist's written commentary regarding decision making indicates that the patient's knowledge and level of engagement were the main criteria used. For example, pharmacist 4, often asked the question "tell me about an occasion where you looked up information on your medicines, what did you find out?"

In general patients with adequate health literacy were more likely to have good knowledge and had researched their treatment. Whereas those with limited health literacy were more likely to have a poor knowledge and have less interest in finding out more about their medicines.

Discussion

Pharmacist accuracy

The ability of pharmacists to predict health literacy was consistent with other studies that found healthcare professionals over estimate adequate health literacy (6-9). The pharmacists showed a wide variation in their individual ability to use the heuristic indicators to make accurate judgements of health literacy ability. In general, the greater the length of time the pharmacist had been practising, the greater their predictive ability. Similar observations were reported in a study of nurse practitioners' decision making abilities which indicated that more experienced nurses were better at making accurate intuitive decisions (10).

The pharmacists were more accurate at assessing adequate health literacy than limited health literacy. This may be due to the predictive properties of the NVS rather than the

heuristic indicators. Validation of the NVS (11) demonstrated that it had a high specificity for detecting adequate health literacy.

Effectiveness of the indicators

The indicator 'recall of written information' was most effective of the six tested. It had similar success in predicting health literacy as other validated tools. (12) (13) In contrast to previously reported tools, we have demonstrated that this indicator is suitable for use within a standard medicine related consultation. Combining all six indicators that had a significant correlation with NVS score did not greatly improve the overall effectiveness as a health literacy assessment. Based on the data obtained, the small increase is effectiveness is insufficient to warrant further exploration of combining all six indicators.

The percentage of the sample that had adequate health literacy is comparable to a larger UK NVS study carried out in Stoke (2). Consequently, the health literacy levels observed in this study may be generaliseable to the wider community pharmacy environment.

The current thinking on health literacy assessment recommends the use of the 'universal precaution' approach (14) The universal precaution approach is to treat all individuals as potentially having limited health literacy. However, patient-centred care is based on treating people as individuals and not treating them all the same regardless of their needs.

The level of limited health literacy observed, in this study, would suggest that 80% of the sample would be inappropriately treated as having limited health literacy if a universal approach was applied. The assessment of an individual's recall of written information could be used to identify those patients that have adequate health literacy thereby allowing all patients to have information tailored to their personal needs.

Further work is required with a larger study sample size to reduce the uncertainty of the predictive accuracy for identifying limited health literacy.

Why professionals over-estimate health literacy

This study is the first to collect information on why clinicians over estimate health literacy. The pharmacists provided explanations of how they estimated individual's health literacy ability. When the comments were compared for individuals having the same health literacy level themes were identified. The themes of patient knowledge and patient engagement were clearly visible within each health literacy level. The variation in patient knowledge and engagement between each health literacy level suggests a pattern of increasing knowledge

and engagement with higher health literacy levels. This pattern is concordant with previous research indicating that those with limited health literacy are less likely to access information and lack health knowledge (15)'. However, for each health literacy level, there were exceptions to the expected pattern. Therefore, if the pattern was being used by pharmacists to inform their health literacy assessment it is unsurprising that they occasionally reached the wrong conclusion.

Pharmacist 5 who was the most accurate at using the indicators referred frequently to the importance of the individual's ability to correctly pronounce medical terms and conditions. The pharmacist was therefore using a heuristic version of the REALM instrument (16) as part of her decision making. It is unclear to what extent this heuristic version of REALM influenced her final decisions. It does raise the possibility that future research could explore the use of a heuristic use of REALM as an alternative mechanism to assess health literacy.

In contrast to the quantitative findings the pharmacists perceived using the recall of written information the hardest indicator to incorporate into a consultation. However, any further research which would have to include guidance on how to use the indicator in a consistent way. This guidance could therefore address these initial concerns and lead to a fully validated heuristic assessment observation or direct question.

Limitations

The variation in proportion of patients with limited health literacy at each pharmacy may impact on the comparison between the samples. NPV values are susceptible to changes in the underlying prevalence however other measures of accuracy used in this study are less prone to be affected.

Future directions

The recall of written information potentially could be used to guide the tailoring of information to patients in community pharmacies. However, due to a relatively small proportion of study participants having limited health literacy, there is a high degree of uncertainty regarding the accuracy of this indicator. A further study with a larger sample size is required to see if the same level of accuracy in predicting health literacy for patients with adequate health literacy can be replicated for those with limited health literacy.

Further work is also required to formulate more structured guidance on how to use the heuristic in consistent way so that the predictive ability demonstrated by the experienced pharmacists can be replicated by all.

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