



# Multiple health literacy dimensions are associated with physicians' efforts to achieve shared decision-making

Youssef M. Ousseine<sup>a</sup>, Marie-Anne Durand<sup>b</sup>, Anne-Déborah Bouhnik<sup>a</sup>,  
Allan 'Ben' Smith<sup>c,d</sup>, Julien Mancini<sup>e,\*</sup>

<sup>a</sup> "Cancer, Biomedicine & Society" group, SESSTIM, INSERM, IRD, Aix-Marseille Univ, Marseille, France

<sup>b</sup> The Dartmouth Institute for Health Policy and Clinical Practice, Dartmouth College, Hanover, NH, USA

<sup>c</sup> Centre for Oncology Education and Research Translation (CONCERT), Ingham Institute for Applied Medical Research & South Western Sydney Clinical School, University of New South Wales, Liverpool, NSW, Australia

<sup>d</sup> Psycho-Oncology Co-operative Research Group (PoCoG), School of Psychology, University of Sydney, Australia

<sup>e</sup> "Cancer, Biomedicine & Society" group, SESSTIM, BIOSITC, APHM, INSERM, IRD, Aix-Marseille Univ, Marseille, France

## ARTICLE INFO

### Article history:

Received 26 December 2018

Received in revised form 23 April 2019

Accepted 14 May 2019

### Keywords:

Health literacy

Numeracy

Shared decision-making

CollaboRATE

Validation studies

Psychometrics

## ABSTRACT

**Objectives:** Shared decision-making (SDM) in health care is widely encouraged. However, for SDM to occur patients need to be able to obtain, understand and apply medical information. Our aim was to assess the relationship between health literacy (HL), numeracy and SDM (using French translations of validated measures).

**Methods:** A cross-sectional survey using a self-administered online questionnaire was proposed to all members of the *Seintinelles* association. Several scales were used to measure HL (FCCHL and 3HLQ/SILS), numeracy (SNS-3), the SDM process (CollaboRATE) and explore their inter-relationships.

**Results:** Data from 2 299 respondents (96.7% women, 46.1% with a history of cancer) were analysed. All measurement scales showed adequate psychometric properties. Functional HL, communicative HL and numeracy were positively associated with SDM while no significant relation was observed between critical HL and SDM. Furthermore, perceived difficulties in asking physicians' questions and deprivation were negatively associated with SDM.

**Conclusion:** Patient support to reach SDM requires high levels of HL, particularly in the functional and communicative domains. Efforts must be made to improve access and understanding of health information.

**Practice implications:** Brief self-reported measures could be used to screen for low levels of health literacy, tailor information accordingly and improve patient involvement in healthcare decision-making.

© 2019 Elsevier B.V. All rights reserved.

## 1. Introduction

In France, as everywhere in the world, shared decision-making (SDM) in health care is encouraged [1,2]. This is due to the recognition of the ethical imperative to adequately involve patients in decisions about their health, and a growing body of evidence demonstrating that patients' participation in medical decision-making presents several advantages including increased patient satisfaction, adherence, and quality of life and decreased patients' anxiety and depression [3]. In order to achieve SDM, the commitment of the patient is very important. Several studies have

shown that the majority of patients want to share decisions with their doctor [4]. In oncology, where complex treatment options with varying short and long-term side effects exist and often have an impact on the patient's quality of life, the doctor alone should not bear the responsibility for the decision. Consequently, SDM is needed and is positively associated with quality of life among cancer patients [5]. However, patients' willingness to participate in decision-making varies according to several factors including the interactions and relationships they have with health professionals but also demographic variables [6]. Globally, younger people, those with higher educational attainment and women prefer to have an active role in decision-making (DM) [6]. Specifically, numerous studies have highlighted that women want to be involved in decisions about their health but are also prepared to play the role of health advocates for other members of their family [7].

Involvement in SDM is dependent on patients obtaining information about their condition, expressing their preferences

\* Corresponding author at: UMR1252 SESSTIM (Aix-Marseille Univ), Institut Paoli-Calmettes, 232, Bd Ste Marguerite, BP 156, 13273 Marseille Cedex 9, France.

E-mail addresses: [julien.mancini@ap-hm.fr](mailto:julien.mancini@ap-hm.fr), [julien.mancini@univ-amu.fr](mailto:julien.mancini@univ-amu.fr) (J. Mancini).

regarding treatment options and clinicians taking into account these preferences [8]. It requires patients' competences to understand medical information and to use it appropriately to participate in DM. These skills are considered key elements of health literacy (HL), which is generally defined as "*the individuals' capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions*" [9]. Contemporary conceptualizations of HL include several skills beyond reading, understanding, and acting on information, including numeracy. Numeracy skills are important to calculate and to understand numbers and tabulated information is frequently used to communicate health information.

Evidence suggests that high levels of HL facilitate disease prevention and access to healthcare in the general population [9]. For patients, higher HL is associated with better self-management of their disease and treatment compliance [10–12]. It is also associated with fewer hospitalizations, lower use of emergency care and ultimately with better health [13,14]. Several studies have focused on the relationship between HL and preferences for participation in medical DM [13–17]. They have shown that higher HL level is positively associated with patients' preferences to participate in DM. However, few studies have evaluated the potential impact of the different dimension of HL and numeracy on actual involvement in SDM [16,20].

With the increasing interest in HL and SDM, several brief self-reported instruments, that are easier to use in clinical practice or large epidemiological studies, have been developed [21–23]. However only longer instruments have been recently translated and validated in French [24].

The main aim of the present study was to assess the relationship between HL, numeracy and SDM processes in a sample of French patients. A preliminary objective was to check the adequate psychometric properties of the French versions of three brief self-reported instruments evaluating health literacy (3HLQ/SILS), numeracy (SNS-3) and SDM processes (CollaboRATE).

## 2. Methods

### 2.1. Study design

A cross-sectional survey approved by the Inserm Ethics Committee (IRB00003888, N°15-266), was performed using a self-administered online questionnaire proposed to all members of *Seintinelles* ([www.seintinelles.com](http://www.seintinelles.com)). *Seintinelles* is a French national non-profit organisation facilitating recruitment for cancer studies including 12 747 members (as of January 15, 2016) who are cancer patients/survivors (primarily breast) and/or other people (e.g. caregivers) "wishing to help cancer research" [25]. All adult members were invited to participate between June 16<sup>th</sup> and 30<sup>th</sup> of 2016. The only exclusion criterion was participants aged less than 18 years old. There were only three patients who did not meet this inclusion criterion.

### 2.2. Questionnaire

Participants' sociodemographic characteristics, including gender, age and educational attainment were collected. Individual deprivation was collected using the EPICES index [26]. An EPICES score  $\geq 30.17$  was considered to indicate deprivation [27].

Difficulties in asking physicians questions were evaluated using the following question: *Do you usually find asking your doctor questions difficult?* On a 5-point Likert scale, possible responses ranged from 1 ("never") to 5 ("always"). The score has been reversed so that a higher score corresponds to better ease of asking questions. Indeed, patients' ability to ask questions easily can

facilitate deliberation and encourage physicians to provide the information needed to an active engagement in healthcare.

The Functional Communicative and Critical HL scale (FCCHL) is a multidimensional tool validated in French [28] and built around three dimensions including 14 items: (1) Functional literacy assess basic skills in reading and understanding the instructions or leaflets from hospitals and pharmacies; (2) communicative literacy evaluates advanced skills to interact and extract information; (3) critical literacy assess advanced skills to analyse information critically and to use it to make decision. All items are answered on a 5-point Likert scale ranging from 1 ("*strongly disagree*") to 5 ("*strongly agree*"). Items were summed for each participant to obtain a total HL score (possible ranges 14–70), as well as functional, communicative and critical HL sub-scores (possible ranges: 5–25, 5–25 and 4–20 respectively). This scale was used to assess the impact of multiple dimensions of HL on SDM and to evaluate the validity of the other scales translated into French.

#### 2.2.1. French adaptation of brief self-reported instruments

The following scales were translated from English into French by two independent researchers (ADB and JM). The final version of each item was then chosen with the help of a bilingual psychologist. Individual cognitive interviews were then conducted with six cancer patients to evaluate the wording and understanding of the translated items, without any subsequent revisions.

#### 2.2.2. HLQ/SILS

The three questions intended to detect inadequate functional HL are: "How often do you have someone help you read hospital materials?" ("Help read"); "How often do you have problems learning about your medical condition because of difficulty understanding written information?" ("Problem learning"); and "How confident are you filling out medical forms by yourself?" ("Confident with forms"). Possible responses ranged on a 5-point Likert scale of 1 ("never") to 5 ("always"). "Help read" and "Problem learning" were reverse scored. A total score was computed by summing three items and ranged from 3 to 15, with a higher score representing a higher HL level. The first question focusing on the need for a surrogate reader ("Help read") is also known as the single item literacy screener (SILS [29]). For the SILS, response categories are usually merged to form three categories: never (adequate HL), rarely (marginal HL) and at least sometimes (inadequate HL) [30].

#### 2.2.3. SNS-3

This short version of a subjective numeracy scale [31,32] comprises the following 6-point Likert-rated items: "How good are you at working with fractions?" from 1 ("Not good at all") to 6 ("Extremely Good"); "How good are you at figuring out how much a shirt will cost if it is 25% off?" from 1 ("Not good at all") to 6 ("Extremely Good"); and "How often do you find numerical information to be useful?" from 1 ("Never") to 6 ("Very Often"). The SNS-3 was scored by summing three items and ranged from 3 to 18, with a higher score indicating better numeracy.

#### 2.2.4. CollaboRATE

SDM is a collaborative process that allows patients and physicians to make health care decisions based on the best available scientific evidence, patient values and preferences [33]. However, measuring the extent to which SDM is occurring in the clinic visit is not easy without recording medical encounters, and using an observation-based measure. This was not feasible within the context of this study. A short process measure of SDM such as CollaboRATE was appropriate. As patients are often unaware that decisions are required, CollaboRATE has been proposed as a brief process measure of SDM able to estimate the level of SDM achieved

by clinicians. This measure has good psychometric properties and is being used in dozens of studies and in routine clinical practice [34–37]. Moreover, it was conceived at sufficiently generic that it could be applied to all clinical encounters.

CollaboRATE is a three-item measure [23]. Items included are:

- 1 *How much effort was made to help you understand your health issues?*
- 2 *How much effort was made to listen to the things that matter most to you about your health issues?*
- 3 *How much effort was made to include what matters most to you in choosing what to do next?*

Possible responses ranged on a 10-point Likert scale from 0 (“no effort was made”) to 9 (“every effort was made”). Total score ranges from 0 (no effort made) to 27. CollaboRATE, like other patient reported experience measures, has ceiling effect and a top score analysis has been proposed to enhance variation in scores [34]. Moreover, such analysis allows more meaningful interpretation of the score: the proportion of patients perceiving the highest possible quality SDM process (top score: every effort was made to: explain health issue, elicit and integrate patient preferences) compared with those feeling some room for improvement.

### 2.3. Statistics

#### 2.3.1. Psychometric validation (preliminary objective)

Frequency distribution of item responses were described and polychoric correlations were used to study correlations among items [38]. Floor or ceiling effects at the scale level were considered to be present if more than 15% of respondents achieved the lowest or highest possible score, respectively [39]. At the item level, these effects were considered to be present if more than 95% answered the lowest or highest response category [40]. Reliability was assessed by Cronbach's alpha ( $\alpha$ ) with values  $\alpha \geq 0.7$  considered satisfactory [41].

Previous studies have showed a positive relationship between HL and numeracy [21]. In addition, we hypothesized that difficulties asking physicians questions would be negatively correlated with HL. From this perspective, polychoric correlation coefficients between the 3HLQ, SNS-3, FCCHL (sub) scale(s), and difficulties asking physician's questions were measured to evaluate concurrent validity.

HL and numeracy level have also shown associations with sociodemographic variables including education level [42–44]. Therefore, our *a priori* hypotheses were that higher HL and numeracy levels would be associated with: more education, younger age, speaking French as a first language, absence of deprivation. Student's *t* tests and ANOVAs were used to compare mean 3HLQ, SNS-3 and CollaboRATE levels for categorical variables with two or more groups.

#### 2.3.2. Factors associated with SDM (main objective)

Because a top score analysis can enhance variation in scores of a patient reported experience measure such as CollaboRATE [34] and can facilitate interpretation of our results, we considered our principal outcome (CollaboRATE) as a binary variable, with top score representing the proportion of patients perceiving the highest possible quality SDM process. To assess the relationship between HL and perception of maximum physicians' efforts to reach SDM, three binary logistic regression models were used. In each model, we included CollaboRATE top score (27 vs other scores) as the dependent variable and one of the HL measures (SILS and FCCHL), numeracy and sociodemographic characteristics as independent variables. In the last model (model 3), the difficulties in asking physicians questions variable was removed to limit a

potential mitigation of the communicative HL dimension. We expected an increased odds of the healthcare team making maximum efforts to involve the patient in their care among participants who were older [35], had higher HL level, and were less prone to report usual difficulties in asking their physicians questions. All the variables found in the univariate analyses to be associated with a *p*-value  $<0.20$  were tested in this model.

All statistical analyses were two-tailed, and results were taken to be statistically significant when *p*-values  $<0.05$  were obtained. Analyses were performed using SPSS PAWS Statistics 18.0 (IBM Inc., New York, USA) and StataCorp. 2011 (Stata Statistical Software: Release 12. College Station, TX: StataCorp LP).

## 3. Results

### 3.1. Sample characteristics

Between the 16<sup>th</sup> and 30<sup>th</sup> of June 2016, 2 568 participants answered the online questionnaire, including 124 participants (4.8%) who only completed their sociodemographic characteristics and were excluded from further analyses. Those participants who responded only to sociodemographic questions had lower education level (20.2% primary/secondary vs 11.8%,  $p=0.003$ ) and were more often men (7.3% vs 3.5%,  $p=0.029$ ) compared to other respondents.

Among the remaining 2 444 participants, missing values by item ranged from 1.8% to 2.4% for the 3HLQ, from 1.5% to 1.8% for the SNS-3 and from 1.5% to 2.4% for CollaboRATE. The majority of participants (94.1%) answered all items of the 3HLQ, SNS-3, CollaboRATE and FCCHL scales. Regarding complete ( $n=2\ 299$ ) versus incomplete respondents ( $n=145$ ), 25.5% of the latter were 61 or more years old versus 19.4% of complete respondents ( $p=0.04$ ). No other differences in respondents' characteristics were observed. The following results were obtained from complete respondents ( $n=2\ 299$ ).

The mean age was 47.7 years ( $SD=13.6$ ), 96.7% of participants were women, 19.9% were deprived and 46.1% had a history of cancer (Table 1). Among those who had a history of cancer, 83.2% had a breast cancer.

### 3.2. Reliability and validity of the translated brief measures

The distribution of the responses to the 3HLQ items, SNS-3 items and the CollaboRATE are presented in Appendix A in Supplementary material. The percentages of respondents for each of the response categories range from 0.2% to 57.3% over the nine items, indicating no floor or ceiling effects at the item level. However, responses to the three scales were negatively skewed (Appendix B in Supplementary material). The highest score for 3HLQ, SNS-3 and CollaboRATE was obtained by 23.4%, 17.9% and 26.3% of participants respectively indicating ceiling effect for all measures. No floor effect was observed. Globally, correlations between the different items within each scale were  $>0.4$  (ranging from 0.40 to 0.88) (Appendix C in Supplementary material). For SNS-3 (mean = 14.25,  $SD=3.46$ ), Cronbach's  $\alpha$  was 0.76. For the 3HLQ (mean = 12.79,  $SD=1.87$ ),  $\alpha$  was 0.67. For CollaboRATE (mean = 20.77,  $SD=6.22$ ),  $\alpha$  was 0.91.

The correlation coefficients between 3HLQ, SNS-3, CollaboRATE, FCCHL total and subscale scores, and difficulties in asking physicians questions demonstrated concurrent validity between these different measures (Table 2). 3HLQ total score was moderately correlated with functional HL, less with communicative HL and not at all with critical HL. The first 3HLQ question (SILS) was the most strongly correlated to the functional dimension and the total FCCHL scores (Table 2) and there was a significant increase of FCCHL scores considering three categories for SILS: inadequate

**Table 1**

Main participants' characteristics (n = 2299).

Sociodemographic and medical history		n	%
Age	18–40	765	33.3
	41–60	1088	47.3
	61–83	446	19.4
Female Gender		2223	96.7
French maternal language		2231	97.9
Education level	Primary/secondary	275	12.0
	≤Three-year higher education	926	40.3
	>Three-year higher education	1098	47.7
Deprivation (EPICES Index)		457	19.9
Cancer history		1057	46.0
Difficulties in asking physicians questions <sup>a</sup>	Always (1)	36	1.6
	Often (2)	226	9.8
	Sometimes (3)	737	32.1
	Rarely (4)	665	28.9
	Never (5)	624	27.1
	Missing values	11	0.5
	Possible range	Mean	SD
Health literacy and numeracy			
FCCHL	14–70	55.58	6.98
Functional dimension	5–25	18.97	4.15
Communicative dimension	5–25	20.68	2.99
Critical dimension	4–20	15.95	3.08
Functional health literacy (3HLQ)	3–15	12.79	1.87
Numeracy (SNS-3)	3–18	14.25	3.46
Shared Decision Making (CollaboRATE)	0–27	20.77	6.22

FCCHL = Functional, Communicative and Critical Health Literacy.

3HLQ = Three Health Literacy Questions.

SNS-3 = 3-item Subjective Numeracy Scale.

<sup>a</sup> The score has been reversed so that a higher score corresponds to better communication.

HL ( $51.97 \pm 6.62$ ), marginal HL ( $54.75 \pm 6.34$ ), and adequate HL ( $57.90 \pm 6.92$ ,  $p < 0.001$ ). Numeracy (SNS-3) was significantly correlated with all HL measures (except critical HL) but weakly. CollaboRATE was significantly correlated with most HL measures (except communicative and critical HL) and with difficulties asking physicians questions.

Bivariate relationships between SNS-3, 3HLQ, CollaboRATE and sociodemographic parameters are shown in Table 3. A higher education level was associated with higher levels of HL and numeracy but not SDM. A lack of deprivation was significantly associated with higher levels of HL, numeracy and SDM. Age showed significant positive associations with numeracy and SDM, but not with 3HLQ. In contrast having French as mother tongue (97.8%) was only significantly associated with 3HLQ.

### 3.3. Relationships between HL and SDM

The multivariate relationships between each HL measure and SDM are presented in Table 4. Respondents who had no difficulties in asking physicians questions, women and respondents without deprivation reported higher SDM whichever the other factors. Participants with marginal ( $OR = 1.65$ ,  $p = 0.003$ ) or adequate ( $OR = 2.12$ ,  $p < 0.001$ ) level of HL according to the SILS reported more frequently maximum physicians' efforts to reach SDM compared with inadequate level of HL (**Model 1**; in a similar model [Appendix D in Supplementary material], the 3HLQ was also positively associated with CollaboRATE top score). Only the functional dimension of FCCHL was positively associated with CollaboRATE top score (**Model 2**). However, when difficulties in

**Table 2**

Polychoric correlations between the various instrument used (n = 2299).

	a	b	c	d	e	f	g	h	i	j	k
a. Functional HL dimension	1										
b. Communicative HL dimension	<b>0.15</b>	1									
c. Critical HL dimension	0.03	<b>0.45</b>	1								
d. FCCHL	<b>0.67</b>	<b>0.72</b>	<b>0.65</b>	1							
e. Lack of difficulties in asking physicians questions <sup>a</sup>	<b>0.20</b>	<b>0.12</b>	–	<b>0.15</b>	1						
			0.05								
f. Numeracy (SNS-3)	<b>0.16</b>	<b>0.13</b>	0.06	<b>0.18</b>	<b>0.12</b>	1					
g. CollaboRATE	<b>0.17</b>	0.09	0	<b>0.14</b>	<b>0.42</b>	<b>0.11</b>	1				
h. Functional HL (3HLQ)	<b>0.46</b>	<b>0.16</b>	0.02	<b>0.33</b>	<b>0.32</b>	<b>0.15</b>	<b>0.30</b>	1			
i. How often do you have someone help you read hospital materials? <sup>a,b</sup>	0.48	<b>0.15</b>	0.02	<b>0.35</b>	<b>0.31</b>	<b>0.11</b>	<b>0.20</b>	<b>0.87</b>	1		
j. How often do you have problems learning about your medical condition because of difficulty understanding written information? <sup>a</sup>	<b>0.45</b>	<b>0.14</b>	0.03	<b>0.32</b>	<b>0.32</b>	<b>0.12</b>	<b>0.30</b>	<b>0.86</b>	<b>0.76</b>	1	
k. How confident are you filling out forms by yourself?	<b>0.25</b>	<b>0.14</b>	0.003	<b>0.21</b>	<b>0.24</b>	<b>0.14</b>	<b>0.20</b>	<b>0.73</b>	<b>0.42</b>	<b>0.38</b>	1

HL=Health Literacy; FCCHL = Functional, Communicative and Critical Health Literacy; SNS-3 = 3-item Subjective Numeracy Scale.

3HLQ = Three Health Literacy Questions.

Bold characters denote  $p < 0.01$ .<sup>a</sup> The scores have been reversed so that a higher score corresponds to better communication and higher level of HL.<sup>b</sup> Single-item literacy screener (SILS).

**Table 3**

Bivariate relationships between numeracy, health literacy, shared decision-making and sociodemographic characteristics (n = 2299).

	Numeracy (SNS-3)		Health Literacy (3HLQ)		Shared decision-making (CollaboRATE)	
	Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Age						
18–40	13.93 ± 3.61	<0.001	12.85 ± 1.91	0.152	20.41 ± 6.22	0.035
41–60	14.23 ± 3.41		12.81 ± 1.84		20.77 ± 6.14	
61–83	14.83 ± 3.25		12.62 ± 1.87		21.37 ± 6.38	
French maternal Language						
No	14.85 ± 2.80	0.219	12.14 ± 2.13	0.015	19.79 ± 7.17	0.270
Yes	14.24 ± 3.47		12.80 ± 1.87		20.78 ± 6.20	
Education						
Primary/secondary	12.51 ± 3.65	<0.001	12.33 ± 1.94	<0.001	20.99 ± 6.21	0.423
≤Three-year higher education	13.72 ± 3.51		12.86 ± 1.76		20.91 ± 6.18	
>Three-year higher education	15.13 ± 3.09		12.84 ± 1.93		20.59 ± 6.26	
Deprivation (EPICES Index)						
No	14.55 ± 3.34	<0.001	12.87 ± 1.85	<0.001	21.10 ± 6.04	<0.001
Yes	13.01 ± 3.64		12.45 ± 1.94		19.44 ± 6.70	

3HLQ = Three Health Literacy Questions; SNS-3 = 3-item Subjective Numeracy Scale.

**Table 4**

Binary logistic regression models to assess factors associated with shared decision-making (CollaboRATE topscore) (N = 2288).

		Model 1: HL = SILS			Model 2: HL = FCCHL			Model 3: HL = FCCHL, without difficulties in asking physicians questions		
		Odds Ratio	95% CI		p value	Odds Ratio	95% CI		p value	
			Lower	Upper			Lower	Upper		
Gender	Male	1				1				
	Female	2.66	1.42	4.99	0.002	2.75	1.47	5.17	0.002	1.68
Deprivation (EPICES Index)	Yes	1				1				0.93
	No	1.52	1.15	2.06	0.003	1.46	1.10	1.94	0.008	3.04
Subjective numeracy (SNS-3) <sup>a</sup>		1.02	0.99	1.05	0.114	1.02	0.99	1.06	0.098	1.13
	Difficulties in asking physicians questions	1				1				1.93
Functional Health literacy (SILS)	At least sometimes	1				1				1.06
	Rarely	2.22	1.71	2.89	<0.001	2.17	1.65	2.84	<0.001	
	Never	6.28	4.84	8.13	<0.001	6.53	5.02	8.49	<0.001	
	Inadequate	1								
Health literacy (FCCHL) <sup>a</sup>	Marginal	1.65	1.18	2.31	0.003					
	Adequate	2.12	1.52	2.95	<0.001					
Health literacy (FCCHL) <sup>a</sup>	Functional					1.05	1.02	1.08	<0.001	1.08
	Communicative					1.03	0.99	1.07	0.079	1.07
	Critical					0.99	0.96	1.03	0.894	1.03

HL = Health Literacy; SILS = Single-item literacy screener FCCHL = Functional, Communicative and Critical Health Literacy; SNS-3 = 3-item Subjective Numeracy Scale. All models were systematically adjusted with education level and age even if they were not significant in any model (all p-values &gt; 0.05).

<sup>a</sup> Per 1-point increase.

asking physicians questions was removed from the model, both functional (OR = 1.08,  $p < 0.001$ ) and communicative (OR = 1.03,  $p < 0.001$ ) dimensions of the FCCHL were positively associated with the highest possible quality SDM process (**Model 3**). In this 3rd model, numeracy also reached statistical significance (OR = 1.03,  $p = 0.027$ ) while gender was no longer significant (OR = 1.68,  $p = 0.081$ ).

## 4. Discussion and conclusion

### 4.1. Discussion

To our knowledge, this is the first time that the psychometric properties of brief HL, numeracy and SDM self-administered measurement tools have been assessed in France. The French versions of these validated brief measures presented satisfactory psychometric properties. Their relationships also confirm the link between HL and SDM and show that involvement in DM is much more related to functional and communicative HL skills, less to numeracy and not with critical HL competencies. In addition, women and people of higher socioeconomic status reported also

more often they were completely supported by their physicians to get involved in DM.

Our study highlighted the reliability and validity of the French versions of the 3HLQ/SILS, the SNS-3 and CollaboRATE among a heterogeneous sample including cancer patients and people without cancer from the general population. As expected, 3HLQ was positively correlated with the functional dimension of FCCHL. Indeed, 3HLQ measures functional skills and was validated against the S-TOFHLA [22]. The first question ("Help read") was the most strongly correlated to the functional dimension and the total FCCHL score (Table 2), confirming it seems a good choice to use it as a Single Item Literacy Screener (SILS) [45].

Perceived difficulties in asking physicians questions were correlated with HL and numeracy scales. Their stronger association with functional HL might indicate difficulties formulating medical questions, consistent with results showing that patients with limited functional HL ask fewer and more basic questions to their doctors [46]. As hypothesized and consistent with previous studies [47–49], people with lower education had lower health literacy and numeracy skills. Only the 3HLQ was able to discriminate the few participants whose mother tongue was not French,



highlighting that numeracy skills may not be related to potential difficulties understanding French.

Contrary to our hypothesis, we observed no association between age and HL and a positive association between age and numeracy [49–51]. The lack of a significant association between age and 3HLQ might show that the 3HLQ is more invariant across age groups compared to the FCCHL [28]. As in a previous study [35], age was positively associated with CollaboRATE. Our results also confirm that CollaboRATE was well accepted, even in a context where the last visit with a doctor may have been a long time ago. This new French version might help to evaluate SDM from a patient's perspective, in order to assess healthcare quality and provider performance.

Also, in line with our main hypothesis, perceived efforts to involve patients in their care were influenced by their level of HL and numeracy. Functional HL and numeracy were associated with SDM. Our results on the link between functional HL, numeracy and SDM process complement previous work [15–20] that investigated the link between functional HL, numeracy and SDM and highlights the impact of difficulties in understanding medical information on patient engagement in a SDM process. These results may also reflect physicians' behaviours towards people with low functional health literacy. Indeed, physicians might not make efforts to inform patients they think will have difficulty understanding. This is the case, for example, with elderly patients [52]. Such discriminatory physician behaviours create inequalities in patient participation in decision-making. Low-literacy patients might also perceive they need more help from physicians. More research is needed to understand factors underlying this statistical association. Future research should also address the notion of 'healthgraphicacy', defined as the "the ability to understand and present information in the form of sketches, photographs, diagrams, maps, plans, charts, graphs, and other non-textual, two-dimensional formats" [53]. This may be a skill that could be mobilized to communicate efficient information to patients or persons with low HL and or numeracy [54].

Furthermore, patients with high level of communicative HL for the FCCHL scale or who had no difficulties in asking questions to physicians were more likely to participate in DM. Previous studies have shown less medical question asking by low literacy patients [55] and among those with lower communicative HL in particular [56]. In this latter study, physician's explanation of information was beneficial for patients with lower communicative HL on the information exchange in general [56] while in other studies patients' abilities to ask questions was considered as an indicator of their active participation in the care process [56,57]. Indeed the 2<sup>nd</sup> question of CollaboRATE focusing on the effort of physicians to listen patients is conceptually linked to the possibility to ask questions. Moreover to make the SDM process effective, Elwyn et al. [8] proposed a second step called "talk options" corresponding to the exchange of information between doctor and patient to reach the process of deliberation. To achieve SDM, considering both the functional and communicative skills of patients seems a prerequisite. This will help ensure adequate comprehension of the discussion of the choice to be made and the different possible options.

Conversely, no relationship between critical HL and SDM was observed. This third dimension of HL corresponds to more advanced cognitive skills which can be applied to critically analyze information and use this to exert greater control over life [42]. One explanation for this result may be that those skills are not related to the efforts of the physicians to facilitate the SDM process. In addition, critical health literacy skills are rarely used in everyday life and they are often mobilized in contexts that are much more societal than individuals [48].

Finally, deprivation was a barrier to SDM after adjustment for multiple characteristics. Deprived patients might be more

concerned about their socioeconomic situation and might have lower self-efficacy, therefore making it more difficult to engage in SDM, even when their HL or numeracy are not barriers to this involvement. This negative association has been shown in an English study and was not explained by the place of treatment suggesting that it was not due to the type of physicians consulted [58].

Our study has some limitations. Regarding the psychometric validation, we used only subjective measures and were unable to compare the translated measures against objective tests evaluating functional HL or numeracy. Regarding the factors associated with the SDM process, the significant associations highlighted in this cross-sectional study might have benefited of our large sample size. They are not demonstrated causes and might explain a limited amount of physicians' behaviours. Further, the generalizability of our results is limited because our sample has been recruited online and exclusively from the members of a volunteer patient advocacy group. It included mainly women (96%), who were highly educated and had French as their mother tongue, consistent with the overall population of *Seintinelles*, which first started recruiting breast cancer patients. However, the sample was more heterogeneous regarding age and cancer history and the 3HLQ and SNS-3 showed variability despite them being negatively skewed (Appendix B in Supplementary material). Further, we do not have any information on the medical encounter rated using CollaboRATE. However, it is worth noting that this instrument has been conceptualized as general enough to be used in all types of encounters. This could explain the fact that having a chronic disease or cancer history was not associated here with the self-reported patients' skills.

## 4.2. Conclusion

Our study highlighted the reliability and validity of the French versions of the 3HLQ/SILS, the SNS-3 and CollaboRATE. Low functional and communicative HL was a barrier to patient involvement in decision-making. Furthermore, perceived difficulties in asking physicians' questions and social deprivation were negatively associated with SDM. Physicians involved patients without difficulties more frequently in DM or if they made specific efforts it was not reported by those with higher needs.

## 4.3. Practice implications

The brief instruments validated will help the assessment of HL and SDM, in clinical or research settings, which will aid the tailoring of efforts to engage those with varying HL levels in SDM. Indeed, physicians should be aware that underserved patients with lower HL do not feel sufficiently supported to reach SDM. SDM interventions that target lower health literacy populations may be appropriate [59–61]. Clinician education in identifying people with lower health literacy and adapting information and services to their needs may also be warranted [62]. The association between CollaboRATE and functional HL, communicative HL, numeracy and difficulties in asking physicians questions can also suggest the implementation of interventions to improve involvement of patients in health care DM by improving those skills or better tailoring communication to patients with different skills.

## Conflict of interest statement

M-A D has developed the Option Grid patient decision aids, which are licensed to EBSCO Health. She receives consulting income from EBSCO Health and may receive royalties in the future. M-A D is also a consultant for ACCESS Community Health Network. The other authors have no conflicts to declare.

## Funding

The project leading to this publication has received funding from Excellence Initiative of Aix-Marseille University - A\*MIDEX, a French “Investissements d’Avenir” program. This work was supported by the French National Cancer Institute (grant number INCA\_8102). M-A D’s collaboration with SESSTIM was supported through Institut Paoli-Calmettes/IMéRA (Aix-Marseille Univ) Chair.

The sponsors had no role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

## Acknowledgements

We particularly thank all members of *Seintinelles*. We are also grateful to Cyril Berenger for his help to implement the e-survey.

## Appendices A–D. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.pec.2019.05.015>.

## References

- [1] N. Moumjid, A. Brémond, H. Mignotte, et al., Shared decision-making in the physician-patient encounter in France: a general overview, *Z. Für Ärztl. Fortbild. Qual. Im Gesundheitswesen – Ger. J. Qual. Health Care* 101 (2007) 223–228, doi:<http://dx.doi.org/10.1016/j.zgesun.2007.02.042>.
- [2] H.M. Van De Bovenkamp, M.J. Trappenburg, K.J. Grit, Patient participation in collective healthcare decision making: the Dutch model, *Health Expect Int. J. Public Particip. Health Care Health Policy* 13 (2010) 73–85, doi:<http://dx.doi.org/10.1111/j.1369-7625.2009.00567.x>.
- [3] D. Stacey, F. Légaré, N.F. Col, et al., Decision aids for people facing health treatment or screening decisions, *Cochrane Database Syst. Rev.* (2014) CD001431, doi:<http://dx.doi.org/10.1002/14651858.CD001431.pub4>.
- [4] B. Chewning, C. Bylund, B. Shah, et al., Patient preferences for shared decisions: a systematic review, *Patient Educ. Couns.* 86 (2012) 9–18, doi:<http://dx.doi.org/10.1016/j.pec.2011.02.004>.
- [5] M.S. Kashaf, E. McGill, Does shared decision making in Cancer treatment improve quality of life? A systematic literature review, *Med. Decis. Mak. Int. J. Soc. Med. Decis. Mak.* 35 (2015) 1037–1048, doi:<http://dx.doi.org/10.1177/0272989X15598529>.
- [6] R. Say, M. Murtagh, R. Thomson, Patients’ preference for involvement in medical decision making: a narrative review, *Patient Educ. Couns.* 60 (2006) 102–114, doi:<http://dx.doi.org/10.1016/j.pec.2005.02.003>.
- [7] W. Levinson, A. Kao, A. Kuby, et al., Not all patients want to participate in decision making, *J. Gen. Intern. Med.* 20 (2005) 531–535, doi:<http://dx.doi.org/10.1111/j.1525-1497.2005.04101.x>.
- [8] G. Elwyn, M.A. Durand, J. Song, et al., A three-talk model for shared decision making: multistage consultation process, *Br. Med. J. Clin. Res. Ed (Clin Res Ed)* 359 (2017) j4891, doi:<http://dx.doi.org/10.1136/bmj.j4891>.
- [9] K. Sørensen, S. Van den Broucke, J. Fullam, et al., Health literacy and public health: a systematic review and integration of definitions and models, *BMC Public Health* 12 (2012) 80, doi:<http://dx.doi.org/10.1186/1471-2458-12-80>.
- [10] D.A. DeWalt, N.D. Berkman, S. Sheridan, et al., Literacy and health outcomes, *J. Gen. Intern. Med.* 19 (2004) 1228–1239, doi:<http://dx.doi.org/10.1111/j.1525-1497.2004.04153.x>.
- [11] M. Heijmans, G. Waverijn, J. Rademakers, et al., Functional, communicative and critical health literacy of chronic disease patients and their importance for self-management, *Patient Educ. Couns.* 98 (2015) 41–48, doi:<http://dx.doi.org/10.1016/j.pec.2014.10.006>.
- [12] P. Easton, V.A. Entwistle, B. Williams, Health in the ‘hidden population’ of people with low literacy. A systematic review of the literature, *BMC Public Health* 10 (2010) 459, doi:<http://dx.doi.org/10.1186/1471-2458-10-459>.
- [13] N.D. Berkman, S.L. Sheridan, K.E. Donahue, et al., Low health literacy and health outcomes: an updated systematic review, *Ann. Intern. Med.* 155 (2011) 97–107, doi:<http://dx.doi.org/10.7326/0003-4819-155-2-201107190-00005>.
- [14] K. Eichler, S. Wieser, U. Brügger, The costs of limited health literacy: a systematic review, *Int. J. Public Health* 54 (2009) 313–324, doi:<http://dx.doi.org/10.1007/s00038-009-0058-2>.
- [15] A.D. Naik, R.L. Street, D. Castillo, et al., Health literacy and decision making styles for complex antithrombotic therapy among older multimorbid adults, *Patient Educ. Couns.* 85 (2011) 499–504, doi:<http://dx.doi.org/10.1016/j.pec.2010.12.015>.
- [16] H.S. Yin, B.P. Dreyer, K.L. Vivar, et al., Perceived barriers to care and attitudes towards shared decision-making among low socioeconomic status parents: role of health literacy, *Acad. Pediatr.* 12 (2012) 117–124, doi:<http://dx.doi.org/10.1016/j.acap.2012.01.001>.
- [17] J.L. Barton, L. Trupin, C. Tonner, et al., English language proficiency, health literacy, and trust in physician are associated with shared decision-making in rheumatoid arthritis, *J. Rheumatol.* 41 (2014) 1290–1297, doi:<http://dx.doi.org/10.3899/jrheum.131350>.
- [18] K. Goggins, K. Wallston, S. Nwosu, et al., Health literacy, numeracy, and other characteristics associated with hospitalized patients’ preferences for involvement in decision-making, *J. Health Commun.* 19 (2014) 29–43, doi:<http://dx.doi.org/10.1080/10810730.2014.938841>.
- [19] J. Seo, M.S. Goodman, M. Politi, et al., Effect of health literacy on decision-making preferences among medically underserved patients, *Med. Decis. Mak. Int. J. Soc. Med. Decis. Mak.* 36 (2016) 550–556, doi:<http://dx.doi.org/10.1177/0272989X16632197>.
- [20] A.E.M. Brabers, J.J.D.J.M. Rademakers, P.P. Groenewegen, et al., What role does health literacy play in patients’ involvement in medical decision-making? *PLoS One* 12 (2017), doi:<http://dx.doi.org/10.1371/journal.pone.0173316>.
- [21] C.D. McNaughton, K.L. Cavanaugh, S. Kripalani, et al., Validation of a short, 3-item version of the subjective numeracy scale, *Med. Decis. Mak.* 35 (2015) 932–936, doi:<http://dx.doi.org/10.1177/0272989X15581800>.
- [22] L.D. Chew, K.A. Bradley, E.J. Boyko, Brief questions to identify patients with inadequate health literacy, *Fam. Med.* 36 (2004) 588–594.
- [23] G. Elwyn, P.J. Barr, S.W. Grande, et al., Developing CollaboRATE: a fast and frugal patient-reported measure of shared decision making in clinical encounters, *Patient Educ. Couns.* 93 (2013) 102–107, doi:<http://dx.doi.org/10.1016/j.pec.2013.05.009>.
- [24] X. Debussche, V. Lenclume, M. Balcou-Debussche, et al., Characterisation of health literacy strengths and weaknesses among people at metabolic and cardiovascular risk: validity testing of the Health Literacy Questionnaire, *SAGE Open Med.* 6 (2018) 2050312118801250, doi:<http://dx.doi.org/10.1177/2050312118801250>.
- [25] L. Fasse, C. Flahault, C. Vioulac, et al., The decision-making process for breast reconstruction after cancer surgery: representations of heterosexual couples in long-standing relationships, *Br. J. Health Psychol.* 22 (2017) 254–269, doi:<http://dx.doi.org/10.1111/bjhp.12228>.
- [26] E. Labbe, M. Blanquet, L. Gerbaud, et al., A new reliable index to measure individual deprivation: the EPICES score, *Eur. J. Public Health* 25 (2015) 604–609, doi:<http://dx.doi.org/10.1093/eurpub/cku231>.
- [27] A. Fouchard, P.-H. Bréchat, D. Castiel, et al., Caractéristiques métrologiques et comparaison de trois outils de repérage de la précarité sociale dans une permanence d’accès aux soins de santé hospitalière à Paris. [Qualitative and quantitative comparisons of three individual deprivation scores for outpatients attending a free hospital care clinic in Paris], *Rev. Épidémiologie Santé Publique* 62 (2014) 237–247, doi:<http://dx.doi.org/10.1016/j.respe.2014.04.004>.
- [28] Y.M. Ousseine, A. Rouquette, A.-D. Bouhnik, et al., Validation of the french version of the functional, communicative and critical health literacy scale (FCCHL), *J. Patient-Rep. Outcomes* 2 (2018), doi:<http://dx.doi.org/10.1186/s41687-018-0027-8>.
- [29] N.S. Morris, C.D. MacLean, L.D. Chew, et al., The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability, *BMC Fam. Pract.* 7 (2006) 21, doi:<http://dx.doi.org/10.1186/1471-2296-7-21>.
- [30] B.J. Powers, J.V. Trinh, H.B. Bosworth, Can this patient read and understand written health information? *J. Am. Med. Assoc.* 304 (2010) 76–84, doi:<http://dx.doi.org/10.1001/jama.2010.896>.
- [31] A. Fagerlin, B.J. Zikmund-Fisher, P.A. Ubel, et al., Measuring numeracy without a math test: development of the subjective numeracy scale, *Med. Decis. Mak.* 27 (2007) 672–680, doi:<http://dx.doi.org/10.1177/0272989X07304449>.
- [32] B.J. Zikmund-Fisher, D.M. Smith, P.A. Ubel, et al., Validation of the subjective numeracy scale: effects of low numeracy on comprehension of risk communications and utility elicitation, *Med. Decis. Mak.* 27 (2007) 663–671, doi:<http://dx.doi.org/10.1177/0272989X07303824>.
- [33] C. Charles, A. Gafni, T. Whelan, Decision-making in the physician-patient encounter: revisiting the shared treatment decision-making model, *Soc. Sci. Med.* 49 (1999) 651–661, doi:[http://dx.doi.org/10.1016/S0277-9536\(99\)00145-8](http://dx.doi.org/10.1016/S0277-9536(99)00145-8).
- [34] P.J. Barr, R. Thompson, T. Walsh, et al., The psychometric properties of CollaboRATE: a fast and frugal patient-reported measure of the shared decision-making process, *J. Med. Internet Res.* 16 (2014), doi:<http://dx.doi.org/10.2196/jmir.3085>.
- [35] Rachel C. Forcino, Paul J. Barr, A. James O’Malley, et al., Using CollaboRATE, a brief patient-reported measure of shared decision making: results from three clinical settings in the United States, *Health Expect.* 21 (2018) 82–89, doi:<http://dx.doi.org/10.1111/hex.12588>.
- [36] P.J. Barr, R.C. Forcino, R. Thompson, et al., Evaluating CollaboRATE in a clinical setting: analysis of mode effects on scores, response rates and costs of data collection, *BMJ Open* 7 (2017) e014681, doi:<http://dx.doi.org/10.1136/bmjopen-2016-014681>.
- [37] P. Scalia, G. Elwyn, P. Barr, et al., Exploring the use of Option Grid™ patient decision aids in a sample of clinics in Poland, *Z. Evidenz. Fortbild. Qual. Im Gesundheitswesen* 134 (2018) 1–8, doi:<http://dx.doi.org/10.1016/j.zefq.2018.04.002>.
- [38] R.B. Kline, *Principles and Practice of Structural Equation Modeling* Guilford, New York, (2005).
- [39] C.B. Terwee, S.D.M. Bot, M.R. de Boer, et al., Quality criteria were proposed for measurement properties of health status questionnaires, *J. Clin. Epidemiol.* 60 (2007) 34–42, doi:<http://dx.doi.org/10.1016/j.jclinepi.2006.03.012>.
- [40] Vet H.C.W. de, C.B. Terwee, L.B. Mokkink, et al., *Measurement in Medicine: A Practical Guide*, Cambridge University Press, 2011.

- [41] J.M. Bland, D.G. Altman, Statistics notes: Cronbach's alpha, *Br. Med. J.* 314 (1997) 572, doi:http://dx.doi.org/10.1136/bmj.314.7080.572.
- [42] D. Nutbeam, Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century, *Health Promot. Int.* 15 (2000) 259–267, doi:http://dx.doi.org/10.1093/heapro/15.3.259.
- [43] M.K. Paasche-Orlow, M.S. Wolf, The causal pathways linking health literacy to health outcomes, *Am. J. Health Behav.* 31 (2007) S19–26.
- [44] P.J. Ciampa, L.M.E. Vaz, M. Blevins, et al., The association among literacy, numeracy, HIV knowledge and health-seeking behavior: a population-based survey of women in rural Mozambique, *PLoS One* 7 (2012), doi:http://dx.doi.org/10.1371/journal.pone.0039391.
- [45] J.H. Brice, M.B. Foster, S. Principe, et al., Single-item or two-item literacy screener to predict the S-TOFHLA among adult hemodialysis patients, *Patient Educ. Couns.* 94 (2014) 71–75, doi:http://dx.doi.org/10.1016/j.pec.2013.09.020.
- [46] M.G. Katz, T.A. Jacobson, E. Veledar, et al., Patient literacy and question-asking behavior during the medical encounter: a mixed-methods analysis, *J. Gen. Intern. Med.* 22 (2007) 782–786, doi:http://dx.doi.org/10.1007/s11606-007-0184-6.
- [47] H. Ishikawa, T. Takeuchi, E. Yano, Measuring Functional, Communicative, and critical health literacy among diabetic patients, *Diabetes Care* 31 (2008) 874–879, doi:http://dx.doi.org/10.2337/dc07-1932.
- [48] D. Nutbeam, The evolving concept of health literacy, *Soc. Sci. Med.* 67 (2008) 2072–2078, doi:http://dx.doi.org/10.1016/j.socscimed.2008.09.050.
- [49] M.K. Paasche-Orlow, R.M. Parker, J.A. Gazmararian, et al., The prevalence of limited health literacy, *J. Gen. Intern. Med.* 20 (2005) 175–184, doi:http://dx.doi.org/10.1111/j.1525-1497.2005.40245.x.
- [50] Y. Chen, J. Wang, R.M. Kirk, et al., Age differences in adaptive decision making: the role of numeracy, *Educ. Gerontol.* 40 (2014) 825–833, doi:http://dx.doi.org/10.1080/03601277.2014.900263.
- [51] N.M. Clark, B.W. Nelson, M.A. Valerio, et al., Consideration of shared decision making in nursing: a review of clinicians' perceptions and interventions, *Open Nurs. J.* 3 (2009) 65–75, doi:http://dx.doi.org/10.2174/1874434600903010065.
- [52] J.P. Bynum, L. Barre, C. Reed, et al., Participation of very old adults in healthcare decisions, *Med. Decis. Mak. Int. J. Soc. Med. Decis. Mak.* 34 (2014) 216–230, doi:http://dx.doi.org/10.1177/0272989X13508008.
- [53] F. Aldrich, L. Sheppard, Graphicacy – the fourth 'R'? *Prim. Sci. Rev.* 64 (2000) 8–11.
- [54] I.M. Lipkus, J.G. Hollands, The visual communication of risk, *J. Natl. Cancer Inst. Monogr.* (1999) 149–163.
- [55] H.J. Aboumatar, K.A. Carson, M.C. Beach, et al., The impact of health literacy on desire for participation in healthcare, medical visit communication, and patient reported outcomes among patients with hypertension, *J. Gen. Intern. Med.* 28 (2013) 1469–1476, doi:http://dx.doi.org/10.1007/s11606-013-2466-5.
- [56] H. Ishikawa, E. Yano, S. Fujimori, et al., Patient health literacy and patient-physician information exchange during a visit, *Fam. Pract.* 26 (2009) 517–523, doi:http://dx.doi.org/10.1093/fampra/cmp060.
- [57] S. Greenfield, S.H. Kaplan, J.E. Ware, et al., Patients' participation in medical care, *J. Gen. Intern. Med.* 3 (1988) 448–457, doi:http://dx.doi.org/10.1007/BF02595921.
- [58] A. El Turabi, G.A. Abel, M. Roland, et al., Variation in reported experience of involvement in cancer treatment decision making: evidence from the National Cancer patient Experience Survey, *Br. J. Cancer* 109 (2013) 780–787, doi:http://dx.doi.org/10.1038/bjc.2013.316.
- [59] K.J. McCaffery, M. Holmes-Rovner, S.K. Smith, et al., Addressing health literacy in patient decision aids, *BMC Med. Inform. Decis. Mak.* 13 (2013) S10, doi:http://dx.doi.org/10.1186/1472-6947-13-S2-S10.
- [60] D.M. Muscat, S. Morony, S.K. Smith, et al., Qualitative insights into the experience of teaching shared decision making within adult education health literacy programmes for lower-literacy learners, *Health Expect Int. J. Public Particip. Health Care Health Policy* 20 (2017) 1393–1400, doi:http://dx.doi.org/10.1111/hex.12580.
- [61] D. Stacey, S. Hill, K. McCaffery, et al., Shared decision making interventions: theoretical and empirical evidence with implications for health literacy, *Stud. Health Technol. Inform.* 240 (2017) 263–283.
- [62] C. Coleman, Teaching health care professionals about health literacy: a review of the literature, *Nurs. Outlook* 59 (2011) 70–78, doi:http://dx.doi.org/10.1016/j.outlook.2010.12.004.