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ORIGINAL ARTICLES AND REVIEWS

Assessment of health literacy skills in family doctors' patients by two brief, self-administered Italian measures

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Abstract

Health Literacy (HL) is an important health determinant: low HL skills result in less healthy choices, riskier behavior, poorer health, less self-management and more hospitalization. An observational study was conducted in a selected population, attending the waiting rooms of family general practitioners, with the aim of assessing HL capabilities through the administration of two HL screeners (IMETER and SILS-IT), and comparing the two measures. An anonymous questionnaire was administered, consisting of the Italian versions of the two tests on a single sheet. Demographic data, as well as concomitant chronic diseases and vaccines received, were also collected. HL skills were measured by the scores observed at both tests, and by the frequency of subjects with low HL levels according to the respective cut-off values. Overall, 305 questionnaires were collected and analyzed. Regarding IMETER, the observed frequency of subjects with low HL skills was 25.2% and the mean score and mean adjusted-score (26.3 ± 8.8 and 23.2 ± 9.4, respectively) were lower than those observed in previous studies. Similarly, at SILS-IT the percentage of subjects with low skills (49.9%) was higher than observed previously. IMETER showed high internal consistency (Cronbach's alpha > 0.9). The two measures were significantly correlated, although with a low Spearman's coefficient, and IMETER did not provide significant information about the probability to predict low HL according to SILS-IT. These results are explainable by the differences in assessment and domains between the two tests, both reliable and suitable to screen patients with low functional HL.

Key words

- health literacy
- screeners
- Italian language
- communication
- patients
- practitioners

INTRODUCTION

Health Literacy (HL) is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate decisions [1]. It is a critical determinant of well-being: weak HL competencies result in less healthy choices, riskier behavior, poorer health, less self-management and more hospitalization [2].

Not all countries have institutionalized routinary measurements of HL levels. So far, no official definition for HL has been introduced in Italy: however, studies have been carried out evaluating the HL skills of different samples of the Italian population, adopting the existing concepts found in literature, such as the three levels described by Nutbeam [3] (HL graded as functional, interactive and critical) and the integrated model from Sørensen [4] (HL defined as knowledge, motivation and competencies to access, understand, appraise and apply health information).

Among the several tools developed to measure HL skills, two self-administered simple measures, the Medical Term Recognition Test (METER) and the Single-item Literacy Screener (SILS) have been adapted from English into Italian and validated.

The Italian Medical Term Recognition Test (hereinafter IMETER) is an objective test which has been recently utilized to evaluate HL skills in a population of undergraduate students [5]. Its English version was based on a reference test (the Rapid Estimate of Adult Literacy in Medicine - REALM) and validated in clinics in 2009: the patients are given a list of items and are asked to check-off those they recognize as medical

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words: it only takes two minutes to complete [6].

SILS is a brief instrument developed in 2006 [7]: it is a self-rated reading ability test, designed to identify adults in need of help with written or printed health related material. Responses are recorded on a 5-point Likert-type scale and categorized as inadequate or adequate. Its Italian version (hereinafter SILS-IT) was validated in comparison to the Newest Vital Sign (NVS-IT), a test which measures both literacy and numeracy skills [8, 9].

It has been shown that people with lower skills have more difficulties communicating with health care providers [10]. Therefore, it is important that practitioners know abilities of their patients in order to better interact with them and improve health outcomes.

Aims of the present study were to measure and describe HL capabilities in a sample of the Italian population attending waiting rooms at family doctors' office, through the administration of both IMETER and SILS-IT, and to compare the two measures.

METHODS

An anonymous questionnaire was drafted to perform the survey (Annex A, available online as Supplementary Material), including IMETER and SILS-IT, on a single page. On the same form, demographic variables (age, sex, education, employment, mother language) were collected, as well as possible concomitant chronic diseases affecting the interviewed subjects, and their vaccination status, namely for Influenza, Pneumococcal and other vaccines received during the previous year. Information about the scope, the characteristics of the survey and the instructions to complete the form were reported on a second sheet handed to the patients at the same time as the questionnaire.

Practitioners who took part in the study received the questionnaire through the CGM Health Monitor Project (a survey program involving several physicians on matters relevant to professional practice and on health policy topics) of CompuGroup Medical Italia (CGM), a company operating in the e-health field [11]. They – or their assistants – printed and distributed the form and the information note to all the persons sitting in the waiting rooms who accepted to give their consent to fill in the questionnaires. Due to the characteristics of the project, no specific random criteria for sampling were proposed, nor non-response information could be gathered: the practitioners were asked to collect at least 15 questionnaires within the two weeks after having joined the study. Subjects were included among who declared to be 18 years or older and able to speak Italian. The interviewed persons had 3 minutes to complete the questionnaire; they were requested not to consult any information source or ask advice to other people. The filled forms were then collected and forwarded back electronically to CGM.

IMETER is based on word/non-word recognition: the form contains a list of 70 terms (40 real medical and 30 non-real medical words, that intuitively sound like real medical terms): the interviewed persons were asked to check-off those they recognized as actual medical words. HL skills were defined as the number of words correctly recognized, with higher scores reflecting higher health literacy: 0-20 = low (cutoff score), 21-34 = marginal, 35-40 = functional HL [6]. The average score was also considered (from 0 to 40), as well as an "adjusted-score", i.e. the number of words correctly checked-off, minus the number of non-actual words checked-off. The medical and non-medical words listed in IMETER were reviewed by a Scientific Committee whose members had backgrounds in Public Health, Pediatrics, Family Medicine and Sociology, and who ensured conceptual suitability of the tool and of the study protocol.

The SILS-IT consisted of the question: "How often do you need to have someone help when you read instructions, pamphlets, or other written material from your doctor or pharmacy?" Possible responses were: Never (1), Rarely (2), Sometimes (3), Often (4) and Always (5). Scores > 2 indicate some difficulty with reading printed health-related material [7].

As no study was previously conducted in Italy using IMETER, the sample size was calculated on the basis of the percentages of individuals with METER low score skills (0-20) reported in previous studies conducted in different, non-homogeneous settings, varying between 1.84% and 25.2%: [12-15]. The highest rate of low health literacy (25.2%) described in those studies was chosen as expected value. Considering a CI of 95% and a margin of error equal to 0.05, the sample size was established as 290 subjects.

The data analysis was conducted by using IBM SPSS Statistics v.25™. Descriptive analysis was performed. Data were presented as percentage or as mean ± standard deviation, as appropriate. For each variable, normality was evaluated using the Kolmogorov-Smirnov test. The means of normally distributed variables were compared using the Student's two-tailed t-test for independent data or using ANOVA. For variables that were not normally distributed, the Mann-Whitney U test and the Kruskal-Wallis test were used. The associations between categorical data were assessed using the $\chi 2$ test.

As regards to IMETER, the number and percentages of responses between 0 and 20, those between 21 and 34, and ≥ 35 were calculated, as well as the average score and adjusted-score. Regarding SILS-IT, the percentage of responses > 2 was calculated, as well as the average score.

IMETER was tested for reliability through the Cronbach's alpha for both the dimensions ("real terms"; "non-real terms") and the Cronbach's alpha if item deleted; values higher than 0.8 indicate good or excellent internal consistency while values between 0.7 and 0.8 acceptable internal consistency.

To assess the concurrent validity (i.e. the degree of agreement between two different tools while measuring the same concept) and the diagnostic accuracy of IMETER with respect to SILS-IT, Spearman's rho and Receiver Operating Characteristic (ROC) analysis were performed. Area under the ROC curve (AUC) was used as a test performance criterion and a measure of accuracy as follow: 0.90-1 "excellent"; 0.80-0.90 "good"; 0.70-0.80 "fair"; 0.60-0.70 "poor"; 0.50-0-60 "fail".

Cohen's kappa was also used to assess the level of agreement between the two tests (score higher than 34

for IMETER and lower than 3 for SILS were considered as concordant).

For each analysis, an alpha level of 0.05 was considered as significant.

The study complies with the principles of the Helsinki Declaration [16]. The study protocol was submitted for approval to the Ethics Committee of the Italian National Institute of Health (ISS), Rome, Italy. Collection of data started beginning of July and finished by the end of September 2017.

RESULTS

Out of 160 practitioners who in a preliminary enquiry had declared their intention to take part in the study, only 21 did it (19 family doctors, 2 pediatricians), from 12 different Italian Regions, spread across North, Center and South: Piedmont (2), Lombardy (2), Tuscany (2), Latium (3), Sardinia (2), Abruzzo (1), Basilicata (1), Molise (1), Campania (1), Apulia (3), Calabria (2), Sicily (1). A total of 339 forms were collected; 34 questionnaires were discarded as incomplete; 305 were analyzed, 54 from Northern, 104 from Central and 147 from Southern Italy. The mean number of forms by the 21 collection centers was 15 ± 3.4 (range 7-21).

Most (89.5%) of the interviewed persons were native Italian speaking.

The mean age of the entire population was 53.9 (± 15.8) years, ranging from 18 to 89 years (median 54); 72.7% (n = 222) were < 65 years and 27.3% (n = 83) ≥ 65 years old; 38.7% were male and 55.4% female (5.9% of data were missing).

Percentages of levels of school education were: Primary school 9.8%; Secondary school 24.6%; High school 43.0%; University 14.8% (missing data/no education: 7.8%). Only 2.6% of all subjects reported to be employed in the domain of health; most frequent occupations were housewives (16.1%), employees (15.1%) and workers (10.5%); 79 subjects (25.9%) were retired.

Fifty-five % of all interviewees declared to suffer from at least one chronic disease: 44.6% among subjects < 65 years and 84.3% among those ≥ 65 years of age. Overall, frequencies of reported concomitant diseases types were: Cardiovascular, 23%; Respiratory, 19%; Infectious, 1%; Metabolic, 14%; Rheumatic, 13%; Oncologic, 6%; Neurologic, 3%; Others or not known, 10%.

One-hundred seven out of the total sample (35.1%) received the flu vaccine in the previous year: 59 were subjects ≥ 65 years of age (71.1%), and 48 (21.6%) less than 65 years old: 67% of these latter reported to be affected with at least one chronic disease, mostly cardiovascular, respiratory and metabolic.

Very few individuals were vaccinated against *S. pneumoniae* (10 subjects) and other pathogens (5 subjects), therefore these parameters were not considered in the analysis.

The collected data were comparable in demographic respect. In particular, age was similar among all centers, with the exception of only one site, where the mean age was quite low (35.7 ± 6.7, n = 15) *vs* 53.9 ± 15.8 years of the entire population (n = 305): excluding this one, multiple comparison between centers didn't show significant differences. Also, regarding education level, as well as gender, no significant differences were observed among all centers (Kruskal-Wallis).

Both SILS-IT and IMETER scores, as well as the percentages of checked-off real terms, didn't show a normal distribution.

IMETER

IMETER showed a high degree of reliability, with Cronbach's alpha equal to 0.902 (0.932 in the real terms group; 0.869 in the non-real terms group). Moreover, when deleted each single term, the alpha's value remained always higher than 0.9, both for real and non-real words, indicating that none of the terms influence the test consistency more than others.

The percentages of detected HL levels were:

- Low HL (score between 0 and 20): 25.2% (n = 77)
- Marginal HL (score between 21 and 34): 56.7% (n = 173)
- Functional HL (score between 35 and 40): 18% (n = 55)

The mean IMETER score was 26.3 (± 8.8); the adjusted-score was 23.2 (± 9.4). *Table 1* reports frequencies and percentages of correct answers for each real and non-real term.

Table 1
Frequencies and percentages of real and non-real terms checked-off at IMETER

Words #	Words	English translation	Correct answers (N)	%
2	Polmonite	Pneumonia	285	93.4
3	Zoster	Zoster	129	42.3
4	Posologia	Posology	195	63.9
6	Sifilide	Syphilis	250	82.0
7	Controindicazioni	Controindication	192	63.0
8	Calendario	Schedule	41	13.4
9	Antibiogramma	Antibiogram	152	49.8
14	Meningococco	Meningococcus	237	77.7
15	Pustola	Pustule	182	59.7
17	Batterio	Bacterium	266	87.2
18	Anafilassi	Anaphylaxis	176	57.7
20	Gravidanza	Pregnancy	245	80.3
21	Diagnosi	Diagnosis	260	85.2
23	Ittero	Jaundice	225	73.8
24	Linfonodi	Lymph nodes	254	83.3
25	Asplenia	Asplenia	34	11.1
26	Epatite	Hepatitis	271	88.9
29	Asma	Asthma	276	90.5
30	Infiammatorio	Inflammatory	256	83.9
31	Anemia	Anemia	263	86.2
34	Stress	Stress	213	69.8
36	Disinfezione	Disinfection	171	56.1
39	Papillomavirus	Papillomavirus	209	68.5
40	Antibiotici	Antibiotics	274	89.8

Continues

Table 1
Continued

Words #	Words	English translation	Correct answers (N)	%
43	Parenterale	Parenteral	83	27.2
44	Chemioterapia	Chemotherapy	258	84.6
47	Impetigine	Impetigo	85	27.9
48	Prescrizione	Prescription	205	67.2
50	Convulsioni	Seizures	247	81.0
51	Avvertenze	Warnings	150	49.2
54	Dose	Dose	204	66.9
55	Orale	Oral	191	62.6
56	Varicella	Chickenpox	271	88.9
57	Somministrazione	Administration	219	71.8
61	Resistenza	Resistance	73	23.9
64	Eruzione	Rash	185	60.7
65	Germi	Germs	232	76.1
66	Gonorrea	Gonorrhoea	188	61.6
68	Immunizzazione	Immunization	162	53.1
69	Fungo	Fungus	216	70.8
	Non-words			
1	Antitetranico		266	87.2
5	Polmomielite		218	71.5
10	Allegoria		277	90.8
11	Parentale		245	80.3
12	Pandomico		287	94.1
13	Testino		288	94.4
16	Cerpes		290	95.1
19	Poziente		285	93.4
22	Limpociti		260	85.2
27	Respingente		286	93.8
28	Dittero		274	89.8
32	Allegrene		277	90.8
33	Gravidismo		270	88.5
35	Ellargico		285	93.4
37	Equipollente		259	84.9
38	Maloria		293	96.1
40	Alcolioso		287	94.1
42	Antiregressivo		245	80.3
45	Occitanica		291	95.4
46	Nausia		262	85.9
49	Aborigeno		294	96.4
52	Amoxacellina		222	72.8
53	Rottovirus		271	88.9
58	Locazione		275	90.2
59	Insonniaco		287	94.1
60	Autista		272	89.2
62	Pelvice		254	83.3
63	Vaccillaneo		287	94.1
67	Tumico		294	96.4
70	Contrapazione		294	96.4

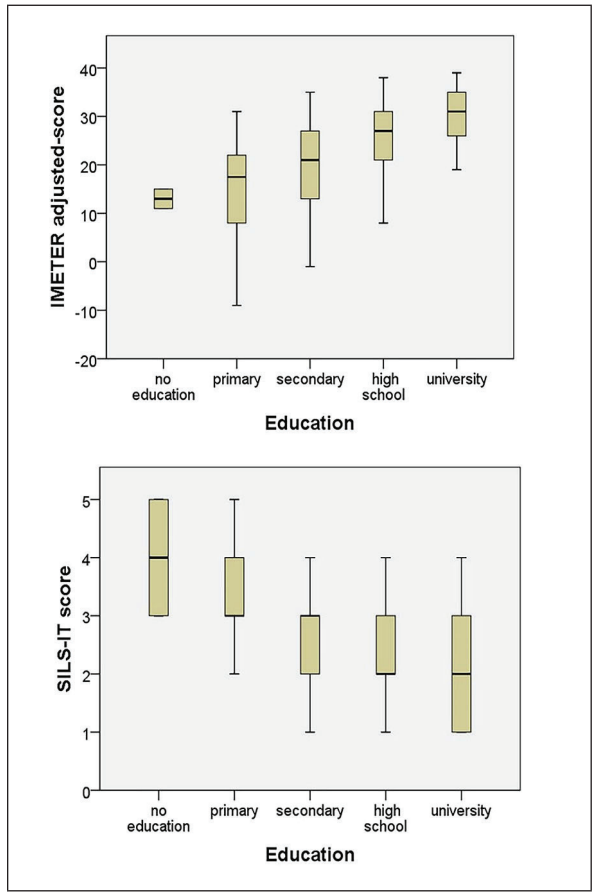

Figure 1
Association of IMETER and SILS-IT scores with education levels.

No significant differences were observed between genders.

HL levels and score were significantly associated with the educational level and with flu vaccination received within the previous year: in particular, functional and marginal HL increased with the increasing of the level of education *(Figure 1)*. On the opposite, the frequency of individuals showing low HL was higher among vaccinated subjects. No statistically significant correlation was observed between IMETER scores and the age of interviewed subjects.

Native Italian speaking subjects had a higher IMETER score than people of other nationalities (Mann-Whitney U test, independent samples: $p < 0.05$), with a mean score of 26.7 ± 8.5 *vs* 18.4 ± 5.7. Similar significant associations were observed for the adjusted-score.

SILS-IT

Results of SILS-IT are summarized in *Table 2*: 152 subjects (49.9%) declared to need sometimes, often or always someone's help when reading written health material (score > 2, corresponding to low HL skills). The mean score was 2.45 (± 2.00). No significant differences were observed between genders.

HL skill was significantly associated with education *(Figure 1)*: the number of subjects with lower HL (score > 2) decreases as the education level increases ($\chi 2 = 20.169$; $p < 0.001$), and the more the mean score de-

Table 2
Replies to the SILS-IT question: "How often do you need to have someone's help when you read instructions, pamphlets, or other written material from your doctor or pharmacy?"

	Frequency	Percentage
1. Never	73	23.9
2. Rarely	80	26.2
3. Sometimes	104	34.1
4. Often	38	12.5
5. Always	10	3.3
Total	**305**	**100.0**

creases, the more the education level increases (Kruskal-Wallis test $p < 0.05$).

Higher SILS-IT score was associated with at least one concomitant chronic disease (Mann-Whitney $p < 0.05$). No significant correlation was observed with age.

IMETER vs SILS-IT

IMETER score and adjusted-score are significantly different according to the HL levels measured by SILS-IT, with higher median and mean values in subjects with score ≤ 2 *(Table 3)*.

The correlation between SILS-IT score and IMETER scores are significant, although the Spearman's coefficient is low both regarding the IMETER score ($r = -0.181$; $p = 0.001$) and the adjusted-score (-0.222 $p < 0.001$).

Figure 2 reports the analysis of ROC curves of the IMETER score and adjusted-score, considering the SILS-IT as gold standard (classification variable SILS-IT score > 2). The area under the curve (AUC) was less than 0.5, therefore, IMETER doesn't appear to provide significant information about the probability to predict low HL according to SILS-IT. Similar results were obtained analyzing the level of agreement of the two tests when considering two levels of HL *(Table 4)*, with Cohen's kappa value equal to 0.140

DISCUSSION

Practitioners should be aware of the HL levels of their patients: those showing low skills might experience difficulties in communicating with health care providers and feel less empowered in treating their health condition. Yet, healthcare settings and professionals seem not to consider people's real abilities in understanding health information, taking for granted the fact that each single person would have a good capacity in reading, writing and understanding medical advices and prescriptions [17].

Lining up the offer of healthcare and preventive services to people's knowledge is critical, keeping into account that the portion of subjects with low HL skills is still high. A survey conducted on a sample of the Italian population using a tool derived from the model suggested by the HLS-EU consortium [18] measuring self-perceived levels of HL, found limited HL skills in more than 50% of the Italian population: according to the data recorded in the HLS-EU survey, Italy reported the highest number of people living with limited HL in Europe, after Bulgaria (62.1%), Spain (58.3%), and Austria (56.4%) [17].

This study describes the HL skills of a selected adult population, attending the waiting rooms of family doctors, by means of two measures, SILS-IT and IMETER.

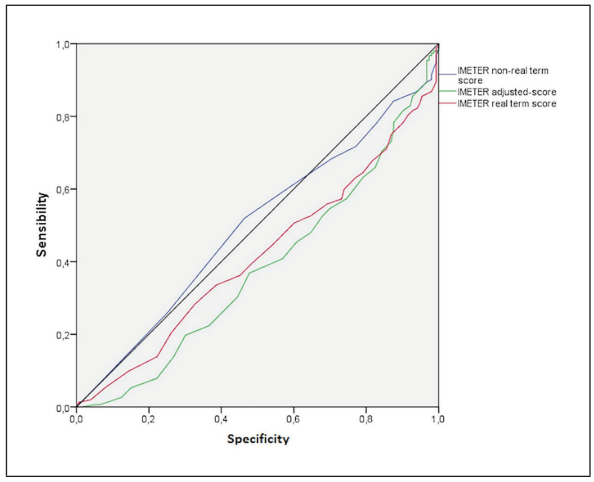

Figure 2
ROC curve analysis of IMETER real, non-real terms and adjusted-scores. Gold standard: SILS-IT score (classification variable: SILS-IT > 2). AUC = 0.414 (score) and 0.498 (adjusted score).

Table 3
IMETER score ("score", "adjusted-score") by HL skills according to SILS-IT

Health literacy levels SILS-IT	IMETER score* "Real terms"			IMETER^ Adjusted-score "Real terms minus non-real terms"		
	Median	Mean	SD	Median	Mean	SD
≤ 2 (High HL)	29.0	27.9	7.6	26.0	25.1	8.7
> 2 (Low HL)	28.0	24.8	9.6	23.0	21.2	9.7
Total	28.0	26.3	8.8	25.0	23.2	9.4

*Mann-Whitney U test for independent samples by HL level: $p < 0.05$
^ Mann-Whitney U test for independent samples by HL level: $p < 0.05$

Table 4
Agreement between SILS-IT (≤ 2; > 2) and IMETER (≤ 20; > 20) categories

IMETER		SILS-IT High HL (≤ 2)	SILS-IT Low HL (> 2)	Total
Marginal + functional HL (score > 20)	N	125	103	228
	%	41.0%	33.8%	74.8%
Low HL (score 0-20)	N	28	49	77
	%	9.2%	16.1%	25.2%
TOTAL	N	153	152	305
	%	50.2%	49.8%	100.0%

Cohen's kappa = 0.140

While several tests for the assessment of HL skills have been developed in English and are widely used in clinics and in the general population, few tools have been adapted from English to Italian [17, 19-22].

The Italian version of SILS has been recently validated (SILS-IT) [8]: its cutoff value (= 2) was proven to be able to predict low HL when evaluated in comparison to another test, the Newest Vital Sign (NVS-IT). METER has been adapted into Italian (IMETER) as well, and validated through a sort of construct validity, according to a similar approach adopted by Paiva et al [23], i.e. by the association of the results with the educational attainment of the interviewed subjects: students attending medical courses were compared with those attending humanistic and non-biological academic courses, assuming that medical students would score significantly higher [5].

In the present study, considering the results of SILS-IT, the percentage of subjects with low HL levels (score > 2) was higher (49.9%) than that observed in a previous study (33.4%) conducted in a sample of people recruited in the waiting rooms of first aid and family doctors [8] and that of a sample of oncology patients (42.1%) recruited in seven hospitals [22].

IMETER results indicated high internal consistency, comparable to that observed in previous studies [5, 6, 23]. Overall, 25.2% of subjects showed low HL (score between 0 and 20), with a mean score of 26.3 and a mean adjusted-score of 23.2: these values are lower than those observed in a previous study where IMETER was administered to a non-medical, younger population of undergraduate students (28.79% and 25.8%, respectively). Moreover, the HL scores observed in this study were generally lower than those reported in the literature when METER was administered to comparable age groups [6, 12, 13] *(Table 5)*.

IMETER score and adjusted-score were significantly higher in categories of subjects with high HL levels according to SILS-IT, and a significant correlation between IMETER and SILS-IT scores has been observed, although with a low Spearman's rho value, lower also to what observed in other studies [12]. Moreover, IMETER doesn't appear to provide significant information about the probability to predict low HL according to SILS-IT. These observations, as well as the scant agreement between the two tests, can be explained by the fact that both the two tests are very simple and mainly used as screeners instead of tools to deeply measure the various constructs beneath HL. Moreover, they are characterized by different kinds of assessment and domains: IMETER is objective (performance-based), aiming to measure reading and recognition abilities of single words, while SILS-IT is subjective (self-reported), measuring comprehension and decision-making abilities.

The relationship between objective and subjective HL measures has received limited attention: few studies using multiple instruments have been conducted by now [24], although measuring HL using different tools at the same time is encouraged [25, 26], so as to have a more complete picture compared to the use of only one of them.

IMETER's concurrent validity should be evaluated in

Table 5
Synthesis of published studies using METER to measure HL skills

Author, year	Setting	N	Age (y.s) ± SD, gender	Other tests administered	Cronbach's alpha	METER			
						% low HL (0-20)	% marginal HL (21-34)	% functional HL (35-40)	mean score (± SD)
Rawson, 2009 [6]	Hospital (USA)	155	62.7 ±11.9 79% females	REALM	0.93				36.1 (±5)
Biasio, 2017 [5]	University (Italy)	224 Undergraduate medical and non-medical students	23.3 65.5% females	-	0.93 medical; 0.86 non-medical students		72.3	27.7	33.86 ± 6.61 medical 28.79 ± 5.60 non medical
Gong, 2015 [12]	Reumathologists' Office (Canada)	311 Patients with reumathoid arthritis	62.8 ±12.7	STOFHLA. REALM. SILS	-	3.2	10.9	85.9	38 (median)
Hawkins, 2016 [13]	Cardiologists' office (USA)	330 Patients with heart failure	68.45 ± 9.48 39.4% females	REALM	-	25.2			35.38 (± 5.99)
Marrie, 2014 [14]	Residence (North America)	8934 Patients with multiple sclerosis	57.0 ± 10.4 78.2% females	NVS. eHEALS	-	1.84	17.12	81.04	-
Schprechman, 2013 [15]	Residence (USA)	119 Patients with heart failure	69.85 ± 9.20 29.4% females	-	-	4.2	14.3	81.5	-
Paiva, 2014 [23]	Hospital. primary health care. Research Institutes (Portugal)	249 Physicians. health and non-health researcher general population	Between 32.3 ± 7 (physicians) and 43.8 ± 13.0 (Researchers)	-	0.92	-	-	-	-

comparison with the reference test, the Rapid Estimate of Adult Literacy in Medicine (REALM), similarly to its original English version [6]: this is not feasible at present, as REALM has not been adapted into Italian yet. This is a limitation of the study, together with a no random sampling strategy and the low number of participating providers, although the sample size criteria were met: moreover, they were representatives of many Italian geographical areas and the demographic variables of the population of the 21 collecting centers were comparable.

HL skills evaluated at both tests were significantly associated with the educational levels, but not with age, as already reported in other specific settings [27]: this can be explained by the trait of the selected study population, i.e. patients attending the doctor's office. If in the younger people HL may be related to higher education, in the elderly HL skills assessed on simple tests (in particular objective measures evaluating word recognition and reading) are likely linked to higher morbidity rates and more frequent use of medicines, as well as medical visits, with a consequent better recollection of medical terms, as a sort of crystallized cognitive ability [28, 29]. These observations were not affected by any demographic variables, such as employment, as only 2.6% of interviewed subjects reported to work in the domain of health.

Low HL levels according to SILS-IT were associated with at least one concomitant disease. This appears critical, since patients with chronic pathologies should learn from providers about treating their health condition, thus increasing their own HL skills. If this doesn't happen, it could be in part due to an inadequate information from the health care system and its professionals, who do not pay sufficient attention to manage people with different levels of education. Future studies will deeply investigate predictors of IMETER scores, using multivariate analysis in order to control for confounding factors.

Interestingly, in this study higher HL skills correspond to lower flu vaccination rates, in contradiction with previous observations regarding the same vaccination [30]. Additionally, very few subjects were immunized against other diseases. Results concerning association between HL and vaccination are uneven and can be specific to the different vaccines and settings [31]. In any case, also people with appropriate levels of functional and interactive literacy, can risk incurring in errors of evaluation about the opportunity to be vaccinated, possibly due to an overload or conflicting information. Again, this confirms the providers' need to possess adequate communication skills which is still underestimated by part of them – although its improvement is strongly recommended, and its relevance is proven [32] – and should go in parallel with a better understanding of people's HL skills.

CONCLUSION

Although additional studies are required to compare IMETER results with other HL measures, the results of this survey show that it is a practical tool to assess people's functional HL.

IMETER doesn't appear to provide significant information about the probability to predict low HL according to SILS-IT. While different HL tests assess different aspects of HL, so being poorly comparable, both SILS-IT and IMETER perform well at identifying limited skills in adults: they are open-use, very brief, and self-administered. Both can be easily administered, providing a quick, complementary and quite extensive assessment, and allowing providers to adapt their communication and possibly target additional evaluations to patients most in need. This seems to be the case, according to the results of this survey, which has revealed low HL skills in a high percentage of the studied population at both tests, thus confirming previous studies [8, 17].

The improvement of HL skills is important in contributing to patient empowerment and patient centeredness. However, a high level of HL may not necessarily guarantee higher health system performance or better outcomes, given the complexity of influencing individual behavior [33]. More research is needed to understand the mechanisms through which improved HL levels can contribute to better health system performance and better health outcomes.

Authors' contributions

L.R. Biasio drafted the study protocol and coordinated the study. M. Della Seta and P. De Castro reviewed the protocol. C. Lorini designed and performed the statistical analysis. G. Abbattista managed the acquisition of data and E. Bozzola verified their reliability. G.Bonaccorsi and A.Villani critically revised the manuscript. All Authors read and approved it.

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Conflict of interest statement

No potential conflicts of interest declared.

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