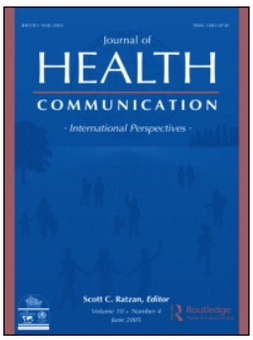

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The Association of Health Literacy with Health Behavior, Socioeconomic Indicators, and Self-Assessed Health From a National Adult Survey in Israel

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There is a growing need to understand how health literacy influences health outcomes in diverse populations. The aim of this study was to examine the relationship between health literacy, health behavior, sociodemographic indicators, and self-assessed health in the adult population in Israel while identifying populations at risk for low health literacy. A cross-sectional national survey was conducted among 600 adults randomly selected from a national database. The Health Literacy Survey-Europe-Q16 (HLS-EU-Q16) research instrument, adapted for use in Israel, was the basis for home interviews in Hebrew, Russian, and Arabic. Three levels of health literacy were distinguished: More than 31% of the sample had inadequate or problematic health literacy, and 69% showed likely sufficient health literacy. Logistic regression analyses showed that after we controlled for other determinants, years of education ($\beta = 1.8$) and income ($\beta = 2.2$) were significantly associated with health literacy. Multinomial logistic regression analysis showed that health literacy, along with age, was the strongest independent variable associated with self-assessed health. Thus, health literacy, strongly influenced by income and years of education, may play a key role in determining self-assessed health, a proxy health outcome, beyond sociodemographic variables. The study results contribute to understanding the role of health literacy in health disparities and identifying action areas for health promotion.

Health literacy is defined in the Healthy People 2020 objectives of the U.S. Department of Health and Human Services as "the capacity to obtain, interpret and understand basic health information and services and the competence to use such information and services to enhance health" (U.S. Department of Health and Human Services, 2000). The concept of health literacy was defined more broadly in the World Health Organization *Health Promotion Glossary* as "the development of the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways that promote and maintain good health" (World Health Organization, 1998, p. 10). More recently, the definition was extended to encompass more comprehensive aspects to the knowledge, motivation, and competencies to access, understand, appraise, and apply health information in order to make judgements and decisions in everyday life concerning health care, disease prevention, and health promotion (Sørensen et al., 2012). Nutbeam characterized health literacy by three main domains (functional, critical, and interactive; Nutbeam, 2000) as well as framed health literacy as an asset instead of only a risk (Nutbeam, 2008). In this study, the more comprehensive definitions were adopted, allowing and supporting the inclusion and analysis of a wide scope of determinants with regard to health literacy and its association with health outcomes.

A substantial body of scientific literature indicates the strong association between health literacy and health outcomes. Low health literacy is significantly associated with increased hospitalization, increased use of emergency services, infrequent use of preventive services, and poorer outcomes for chronic disease indicators (including diabetes) when sociodemographic variables are controlled (Schillinger et al., 2002). It is also significantly associated with poorer health status and greater use of health resources (DeWalt, Berkman, Sheridan, Lohr, & Pignone, 2004). People with low health literacy are at greater risk for misunderstanding diagnoses, instructions for taking medication, and self-care instructions. Navigation of the health system and services, interpretation of written material, medication prescriptions, informed consent forms, and appointment slips are just a few of the junctions where low health literacy leads to challenges in engaging in self-care, maintaining health, and preventing further illness. Although obvious barriers are created and reinforced among people with low health literacy, the additional issue of shame has been recognized, causing delays in seeking care and barriers in receiving appropriate tailored information and instruction (Schwartzberg, VanGeest, & Wang, 2005). Thus, low health literacy seems to compromise an individual's health and the efficient and effective use of health services.

The complex causal model describing the association of health literacy and its determinants with health outcomes was

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first suggested conceptually by Paasche-Orlow and Wolf (2007). More recently, a comprehensive logic model postulating the way in which health literacy is associated with health outcomes was suggested in a systematic review (Berkman et al., 2011). The model, structured with path analysis, begins with an evaluation of the health literacy level, continues with determinants and indicators of health behavior, and finally leads to health outcomes and the use of health care services. Yet still little is known empirically about the relationship between a comprehensive concept of health literacy, its association with selected health behaviors, and one of the most important aspects of health outcomes, namely, self-assessed health. Conceptualizing health literacy in quantifiable terms provides the basis on which the relationship between health literacy, social and behavioral determinants, and health measures can be estimated.

Risk factors for low health literacy have been a basis for research that seeks to understand how to improve and promote health literacy. Thus, previous research has focused on specific sociodemographic and personal characteristics that have been noted to influence health literacy. Older age is acknowledged as a significant risk factor for low functional health literacy (Howard, Sentell, & Gazmararian, 2006). Cultures in transition, as in the case of immigrants, migrants, and refugees (Wångdahl, Lytsy, Mårtensson, & Westerling, 2015), may be at higher risk for health complications, mainly because of services that are not culturally appropriate (Levin-Zamir & Wills, 2012; Pelikan & Krajic, 2007). Nearly all of the aforementioned studies (Curtis et al., 2015) focused more on functional aspects of health literacy, specifically on individual skills necessary for performing in the clinical setting. Rootman and Gordon El-Bihbety (2008) were among the first to explore the need to examine health literacy on a national population level. Acknowledging the need for a more comprehensive measure, the Health Literacy Survey of Europe (HLS-EU) was conducted at the population level in eight countries using a 47-item questionnaire (Sørensen et al., 2015). Based on the questions included in this survey instrument, a Health Literacy Survey-Europe-16 (HLS-EU-16) was tested and applied among various populations (Röthlin, Pelikan, & Ganahl, 2013; Wångdahl et al., 2015) but not in a national study. To date, health literacy in Israel has been evaluated in two separate studies. The Hebrew Health Literacy Test was developed based on the readability comprehension test Short Test of Functional Health Literacy in Adults (S-TOFHLA; Baker, Williams, Parker, Gazmararian, & Nurss, 1999) and tested among Hebrew-speaking and -reading adults regarding a specific health issue in a specific area of the country (Baron-Epel, Balin, Daniely, & Eidelman, 2007). The concept and measure of media health literacy (Levin-Zamir, Lemish, & Gofin, 2011) was developed, validated, and analyzed with relation to health behavior, empowerment, and sources of health information among adolescents in Israel. Although these studies established new concepts and measures, health literacy has yet to be measured and analyzed on a national scale in a way that takes into account Israel's social and religious mosaic. Thus, our study used a nationally representative sample in Israel to address the following objectives: (a) to identify populations at risk for low health literacy by ethnicity, gender, age, education, religiosity, and socioeconomic status; and (b) to assess and analyze the association between health literacy, health behavior, and self-assessed health.

Study Design And Methodology

The study was a cross-sectional national survey. The study was approved by the Helsinki Ethics Committee of Clalit Health Services in accordance with public policy and law in Israel.

Study Population

The study population consisted of a random sample of adult members (18 years old or older) of Clalit Health Services, Israel's largest nonprofit health service organization, which provides comprehensive health care for nearly 53% of the Israeli population in accordance with the National Health Insurance Law. Under this law, universal coverage is provided for all citizens of Israel. Clalit maintains a computer-based data system for maintaining health records and monitoring all of its members.

The Research Instrument

The research instrument used was based on components of the questionnaire from the HLS-EU. A qualitative methodology was used to validate and culturally adapt the tool to Israel; three focus groups and several in-depth interviews were performed. Within the focus groups, interdisciplinary consultation took place with the participation of a variety of stakeholders: family physicians, community and management nurses, national and district health promotors, clinical dieticians, a director of physical therapy, representatives from patient organizations, including those that advocate for people of diverse ethnic backgrounds, and spokespeople for health service organizations. The participants offered feedback regarding the study questions as well as prioritized health knowledge areas in which they felt that the public should be competent. Questions making up the tool were adapted to reflect the feedback offered in the groups as well as the specific characteristics of the Israeli health care system.

National Survey Data Collection

The final tool consisted of 69 items divided into the following categories: health literacy based on the short European Health Literacy questionnaire (HLS-EU-Q16) research instrument adapted for Israel, sources of health information, health behavior, self-assessed health, use of health services, and sociodemographic indicators.

Measuring Health Literacy

The HLS-EU-Q16 was used to assess the more comprehensive health literacy. The instrument consists of 16 items focusing on four HL dimensions reflecting perceived ease or difficulty in an individual's ability to access/obtain health information, understand health information (not only in written form), process/appraise health information, and apply/use health information. More specifically, the 16 items include perceived skills for understanding health information, where to seek consultation

Table 1. Items included in the health literacy measure

"How easy or difficult is it for you to …?"
• Find information regarding treatment of your health conditions
• Find information regarding coping with mental health situations such as depression and stress
• Find information regarding quality of life: meditation, physical activity, Pilates, yoga, etc.
• Decide how reliable the risk information (smoking, alcohol, lack of physical activity) is that is conveyed through mass media (television, Internet)
• Understand the information given to you by a physician or pharmacist regarding medication taking
• Understand information given by your family physician
• Adhere to recommendations of physician or pharmacist
• Use information given by a physician for making decisions regarding a health condition
• Understand how to maintain your health from sources of information such as pamphlets and newspaper articles
• Know who to turn to when in need of professional help
• Know when a second opinion is needed
• Understand health warnings—smoking alcohol, etc.
• Understand why early detection is necessary (mammography, Pap, etc.)
• Understand how to prevent health problems based on information appearing in the mass media
• Understand health advice conveyed by family and friends
• Understand which daily habits are associated with your health status

and health information on prevention, early detection, and health care, health warnings, advice given by family and friends, how to seek a second opinion, and how to apply advice given by care providers. Response options include "very easy," "easy," "difficult," and "very difficult." The specific items included in the instrument (see Table 1) were chosen based on a Rasch psychometric model (Rasch, 1980) applied in previous studies (Röthlin et al., 2013; Wångdahl et al., 2015). Cronbach's alpha coefficient of reliability for the 16 items in this study was .928. The responses were dichotomized, with "very easy" and "easy" given a score of 1 and "difficult" and "very difficult" given a score of 0. Health literacy was defined according to three levels: likely sufficient health literacy (13–16), problematic health literacy (9–12), and inadequate health literacy (1–8). For logistic regression analyses, the HLS-EU-Q16 index was dichotomized into inadequate (inadequate and problematic) and adequate (sufficient) health literacy.

Additional Measures

Personal factors were gender (male, female), age (year of birth), country of birth, degree of religiosity (secular, observant, religious, very religious; for the purpose of analysis the latter three categories were redefined together as "religious"), marital status (single, married, widowed, divorced), mother tongue, and employment status (employed, unemployed, unemployed for medical reasons). Education was measured by number of years of formal education. Socioeconomic status was based on three questions: reported ability to pay monthly bills; earnings of below-average, average, or above-average salary; and specific monthly income, categorized according to five categories. Ethnicity was based on the three major ethnic groups in Israel, namely, long-term Israeli Jews (LTIJ), those who immigrated after 1990 from the former Soviet Union (fSU), and Arabs (Baron-Epel, Heyman, Friedman, & Caplan, 2015).

Health behavior measures were chosen based on the priorities for public health used in the European study that are very relevant for Israel as well. In addition, sun protection behavior was included, as it is a priority in Israel, mentioned by the experts in the focus groups previously described. More specifically, self-reported behavior measures included physical activity (frequency of engaging in physical activity 30 minutes/day in the past 3 months: daily, several times a week/month, not at all), sun protection index (consisting of the average on a scale of 1 to 4 of frequency of use of sunscreen, sunglasses, hat, and clothing when exposed to the sun and degree of avoidance of sunlight exposure during peak hours), current cigarette smoking status (smoke at least one cigarette a day, former smoker or never smoked), body weight (normal, less than or more than normal), and alcohol intake (number of alcoholic drinks consumed at one time). Self-assessed health was measured on a 5-point Likert scale ranging from *not good at all* to *very good*. Health knowledge was measured based on a selection of five health topics (skin cancer, cholesterol, risk of sodium in the diet, Alzheimer's disease, and familiarity with a health navigation term), comprising an index with reliability measured by Cronbach's alpha (.712). Body weight was measured using body mass index based on reported height and weight (weight/[height]^2).

Functional health literacy was also measured for validation of the HLS-EU-16 measure in Israel using the S-TOFHLA (Baker et al., 1999) as mentioned, validated for Israel (Baron-Epel et al., 2007). The research questionnaire was translated from Hebrew and adapted to Arabic and Russian for cultural comparisons and specific analyses for each ethnic population.

Data Source, Sampling, and Data Collection

The study sample size was 600, determined according to intended analyses for sociodemographic characteristics, assuming standard deviations no less than 1.5 for 90% power at the .05 level of significance. The sampling framework was the database of Clalit Health Services members. As mentioned, the Israeli health system is based on universal coverage for all citizens; thus, it is possible to extract a sample that reflects the population at large from a database that includes 54% of the country's population. A random sample of 20,000 members older than the age of 19 was extracted. We oversampled the Arab population to ensure that we had a large enough sample to analyze the major variables in this study and to enable comparative and weighted analysis of the results with regard to ethnicity. National sampling points ensured a representative sample from urban and rural residential areas. The procedure for contacting the interviewees was to initiate contact with a random sample of the names and phone numbers on the sample list. In the event of no answer when contact was initiated, the next name on the list was contacted. The interviewers randomly initiated contact with 1,331 individuals in order to reach 600 study participants. The refusal rate was 16.2%; all others were not immediately available when the first contact was initiated, and the interviewers continued to the next potential participants randomly chosen. The study was conducted via face-to-face home interviews. Prior to the analysis, the sample was checked to ensure its similarity to the sociodemographic profile

of the population of Israel, with the exception of the Jewish-Arabic proportion. Of the 600 interviews, 242 were conducted among adults from the Arab population and 358 were conducted among the Jewish population, including 55 new immigrants from the former Soviet Union. No significant differences were found between the participants and nonparticipants in the study for either age, gender, or ethnicity ($p = .50$).

Data Analyses

Data were automatically recorded and coded during the interviews. Analyses included univariate and multivariate analyses using SPSS Version 21. Tests for significance included analysis of variance and multiple regression, depending on the type of variable analyzed. In order to conduct multiple regression analyses, including all of the relevant independent variables, we redefined the measure of health literacy as a dichotomous variable, as it did not demonstrate a normal distribution (see Figure 1). Thus, a logistic regression model was applied, with health literacy defined as either low (0–12) or adequate (13–16). Likewise, in order to conduct the analysis, we recoded ordinal variables dichotomously (as dummy variables). Multivariate regression models were used to analyze the relative association of the specific variables that were significantly associated with health literacy after we adjusted for other independent variables. Likewise, the analysis of self-assessed health was based on the multinomial logistic regression test, as it complied with the parallel of lines test. A level of $p < .05$ was used as a test for significance.

Results

Sample Description

The average age of the study participants was 49.9 ($SD = 19.6$), 57% were female, 80.2% defined themselves as either secular or traditional, 66% were Israeli born, 72% reported at least 12 years of formal education, 51% reported earning an average income, and 48% reported that they were able to pay their monthly expenses most of the time.

Health Literacy in Israel

The average score of health literacy in Israel was 13.1 ($SD = 3.26$) out of a potential 16 points. When the scale was categorized into the three levels described previously, the findings (see Figure 1) showed that more than 10% of the sample had inadequate health literacy, 21% had problematic health literacy, and 69% showed likely sufficient health literacy. The HLS-EU-16 scores correlated significantly and positively with the S-TOFHLA results measuring functional health literacy in the sample ($r = .34$, $p < .0001$).

Health Literacy and Ethnicity

The score for health literacy among LTIJ was 13.5, for fSU immigrants 12.9, and for Arab participants 12.7 ($p < .05$). Analysis of the questions making up the measure showed significant differences between the LTIJ, fSU immigrant, and Arab populations for three of the 16 questions, namely, perceived difficulty in (a) understanding the way to treat health problems (highest in the fSU immigrant population [91.7%] and lowest in the Arab population [71.7%]), (b) ways of coping with mental health problems (highest in the LTIJ population [75.3%] and lowest in the Arab population [55.5%]), and (c) what action to take in order to reduce stress (highest in the LTIJ population [80.2%] and lowest in the Arab population [53.7%]).

Health Literacy and Other Socioeconomic/Personal Determinants

Univariate analyses (see Table 2) showed that health literacy was significantly ($p < .001$) associated with age ($r = -.172$), income (above average = 14.66, below average = 12.83), education (>12 years = 13.91, <12 years = 11.69), and employment status (employed = 13.82, unemployed = 12.69). A borderline association ($p = .05$) was found between health literacy and religiosity. No significant association was found between gender and health literacy (male = 13.27, female = 12.98) or between marital status and health literacy (married = 13.14, single/no relationship = 13.02).

Health Literacy, Health Behavior, and Self-Assessed Health

Univariate analyses (see Table 3) showed that low health literacy was significantly associated with less physical activity (high level of physical activity = 13.96, low level of physical activity = 12.22; $p < .0001$), higher body mass index scores (normal weight = 13.54, obese = 12.40; $p < .05$), and lower levels of sun protection ($r = .14$, $p < .01$). Health literacy was not associated with cigarette smoking (smoker = 13.23, nonsmoker = 13.08) or with alcohol consumption (light drinker = 12.98, heavy

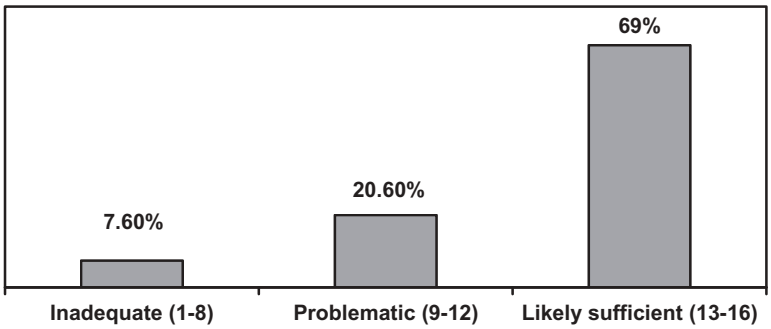

Fig. 1. The health literacy distribution ($N = 600$).

Table 2. Health literacy by personal/socioeconomic variables (analysis of variance)

Independent variable	HL score (*n*)	*p*
Gender		
Female	12.98 (345)	*ns*
Male	13.27 (255)	
Marital status		
Married/in a relationship	13.14 (411)	*ns*
Single/not in a relationship	13.02 (189)	
Ethnicity		
LTIJ	13.47 (300)	<.05
Arab	12.71 (254)	
fSU	12.87 (46)	
Religiosity		<.05
Secular	13.62 (231)	
Religious	12.78 (369)	
Education		
<12 years	11.69 (172)	<.001
12 years	13.43 (175)	
>12 years	13.91 (248)	
Employment status		
Employed	13.83 (313)	<.001
Unemployed	12.69 (269)	
Unemployed because of medical reasons	12.44 (18)	
Ability to cover monthly expenses		
Usually able	13.70 (287)	<.001
Sometimes	12.35 (142)	
Rarely/never	12.83 (151)	
Monthly income (relative)		
Above average	14.66 (87)	<.001
Average	13.33 (150)	
Below average	12.67 (307)	
Monthly income (reported)		
<4,000 NIS	11.57 (56)	<.001
4,001–6,500 NIS	12.53 (159)	
6,501–9,500 NIS	13.59 (153)	
9,501–13,000 NIS	13.64 (80)	
13,001+ NIS	15.33 (43)	

Note. HL = health literacy; LTIJ = long-term Israeli Jews; fSU = former Soviet Union; NIS = New Israeli shekel.

drinker = 13.38). Health literacy was significantly associated with self-assessed health (r = .329, p < .0001); the lower the health literacy, the lower the self-assessed health.

The Association Between Health Literacy, Socioeconomic/ Personal Determinants, Health Behavior, and Self-Assessed Health

The results (see Table 4) showed that 12 years of formal education (odds ratio [OR] = 1.865, confidence interval [CI] [1.05, 3.32], p = .034) and above-average income (OR = 2.123, CI [1.0, 4.50], p = .049) remained significantly associated with health literacy. The association between physical activity (OR = 1.63, CI [0.964, 2.770], p = .068) and health literacy was borderline.

Table 3. Health literacy and health behavior

Health behavior	HL (*n*)	*p*
Smoking		
Smoker	13.23 (153)	*ns*
Nonsmoker	13.08 (446)	
Alcohol		
Drinker	12.98 (423)	*ns*
Nondrinker	13.38 (177)	
Physical activity		
High level	13.96 (192)	<.0001
Low level	13.65 (136)	
None	12.22 (272)	
BMI		
Underweight (BMI <20)	12.92 (25)	<.05
Normal weight (BMI = 20–25)	13.54 (227)	
Overweight (BMI = 25–29)	13.05 (219)	
Obese (BMI >30)	12.40 (94)	
Sun protection index	r = .140	<.01

Note. HL = health literacy; BMI = body mass index.

Health Literacy and Self-Assessed Health

Univariate analysis (data not shown) showed that self-assessed health was significantly correlated with health literacy (r^2 = .33 p < .0001); consequently, the role of health literacy as a determinant of self-assessed health was analyzed using a multinomial logistic regression model (see Table 5). The results showed that health literacy (OR = 1.34, CI [1.21, 1.49], p < .0001), followed by age (OR = 0.92, CI [0.90, 0.94], p < .0001) and physical activity (OR = 0.349, CI [0.20, 0.59], p < .0001), contributed to self-assessed health more significantly than all other independent variables in the model.

Table 4. Health literacy and socioeconomic/personal determinants and health behavior: Logistic regression

		95% CI	
Independent variable	OR	Lower	Upper
Gender	0.826	0.523	1.305
Age	0.997	0.983	1.013
Ethnicity	0.608	0.353	1.047
12 years of education	1.753	0.989	3.109
>12 years of education	1.865	1.049	3.317
Income	2.128	1.004	4.509
Sun protection	1.268	0.912	1.763
Smoking	1.151	0.694	1.908
Less physical activity	1.222	0.688	2.170
More physical activity	1.634	0.964	2.770
Overweight	0.842	0.513	1.383
Obesity	0.665	0.376	1.177

Note. The dependent variable was health literacy. Reference groups were females, <12 years of education, average income, no physical activity, and normal weight. OR = odds ratio; CI = confidence interval.

Table 5. Health literacy and self-assessed health: Multinomial logistic regression model

Independent variable	*B*	*SE*	Wald	*df*	Exp (*B*)	95% CI for Exp (*B*)	
						Lower	Upper
Intercept	0.879	1.318	0.445	1			
Age	−0.086	0.010	72.490	1	0.918	0.900	0.936
Health literacy	0.296	0.051	33.235	1	1.344	1.215	1.486
Married = no (ref = yes)	−0.442	0.439	1.013	1	0.643	0.272	1.520
Divorced = no (ref = yes)	0.086	0.631	0.019	1	1.090	0.316	3.757
Arab = no (ref = yes)	−0.507	0.315	2.587	1	0.602	0.325	1.117
12 years of education = no (ref = yes)	−0.190	0.370	0.264	1	0.827	0.400	1.707
More than 12 years of education = no (ref = yes)	0.017	0.379	0.002	1	1.017	0.484	2.136
Exercise = no (ref = yes)	−1.054	0.272	14.985	1	0.349	0.204	0.594
Average income = no (ref = yes)	0.039	0.325	0.015	1	1.040	0.550	1.967
Above-average income = no (ref = yes)	0.168	0.411	0.166	1	1.182	0.529	2.646

Note. The dependent variable was self-assessed health. CI = confidence interval; ref = reference group.

Discussion

This study contributes to the growing field of research that seeks to understand health literacy, its association with determinants of health, and implications for health promotion and other interventions in the health system and beyond. In addition, this study contributes to the understanding of health disparities and the new frontiers to be explored to reduce them either through improving health literacy or through systems that are more adapted to health literacy. The results of this study provide a basis for understanding the relationship between health literacy, health behavior, and self-assessed health as a health indicator.

In this study we measured health literacy on a national scale based on a validated international tool in order to estimate self-perceived competencies necessary for the public to make empowered and informed decisions regarding health. Because this instrument was used in our study, comparisons may be made with the HLS-EU study, the conclusions of which provide a basis for public health and health promotion planning.

This is the first study that we know of to have used the HLS-EU-Q16 tool to measure health literacy on a national scale and by having done so to learn of the significant association of health literacy with self-assessed health, following the apparent influence of income and education on health literacy. Although from the results of this study we learn that income and education do not apparently affect self-assessed health directly, their significant contribution to health literacy may reflect a sequence in which income and education influence health literacy, which in turn could be a mediator contributing to self-assessed health. This hypothesis would be the basis for a future study examining health literacy as a mediator in relation to health outcomes. Regarding the strong relationship between self-assessed health and health literacy when other factors are controlled, our findings support those of the HLS-EU study. It is interesting that this was a finding in a study conducted among adolescents in Taiwan (Chang, 2011). Although Chang used a different measure of health literacy, her study among adolescent populations also suggests a strong and positive association between health literacy and self-assessed health, suggesting that this finding is evident at an earlier age and then continues throughout the life cycle. Our results support those from the European countries of the HLS-EU study that demonstrated a significant association between self-assessed health and health literacy beyond most other socioeconomic, personal, and behavioral covariates with the exception of physical activity. Follow-up research is warranted to understand the pathways between health literacy and self-assessed health as well as to examine other measures of health outcomes, including the use of health services. Furthermore, in a comprehensive review, Berkman and colleagues (2011) called for the need to examine more closely the factors that mediate the relationship between health literacy and health outcomes. Future analysis of data from the current study can help to achieve this goal.

Similar to the results of the HLS-EU study, our results showed that health literacy is dependent on various measures of socioeconomic status and years of education. From this study, we understand that the profile of individuals with low health literacy in Israel can be characterized by having difficulty covering monthly expenses and less years of formal education. The gap between levels of health literacy attributed to social determinants is clear; however, the reason for this association must still be explored. Note that this finding may be critical in helping to understand the distinct health disparities and the socioeconomic divide in Israel noted by the Organisation for Economic Co-operation and Development (2013) in recent reports. Further research is required to understand the strong association between health literacy and socioeconomic measures.

An interesting aspect of this study is the fact that no significant difference between the Arab and LTIJ populations was observed for health literacy after we adjusted for the sociodemographic variables, indicating that there may be no ethnic or cultural difference in health literacy between the two groups. Rather, bivariate differences may be due to socioeconomic differences between the two groups.

Unlike the results of the European study, in addition to others from the United States (Baker et al., 2007), health literacy in Israel was not seen to be significantly dependent on age after we controlled for other independent variables. This finding may

have several explanations. This may be attributed to the Israeli health system providing universal coverage and highly integrated primary health care in the community for all populations, including extensive and accessible primary care, proactive communication, and specific investment in services for the elderly. Thus, perhaps the indicators making up the measure of health literacy applied in this study reflect the nature of the Israeli health system, in which the elderly are entitled to, and utilize, health services, health consultations, and ongoing public discourse on health with minimal stigma or taboo (Kaye, 2009).

Similar to the results of the HLS-EU study (Sørensen et al., 2015) in the bivariate analysis, our study showed a positive initial relationship between health literacy and various health behaviors, namely, physical activity, sun protection habits, and body weight (reflecting eating habits and physical activity), but a weaker association between health literacy and other health-promoting behaviors. Yet when we controlled for social determinants, these associations were not significant, with the exception of a significant association with physical activity. Thus, based on this study, with regard to the logic model proposed by Berkman and colleagues (2011), the pathway leading from health literacy to behavior to health outcomes might be reexamined for the complexity of the associations, with social determinants brought into the model as well. A study conducted in Taiwan among adolescents revealed a strong association between health literacy and nutrition but no association with other health behaviors studied (Chang, 2011). The difference may be attributed to the different age groups and life experience of the participants in the studies as well as the contexts within which the studies were conducted (school compared to home). The results testify to the understanding that although health literacy skills help gain access to appropriate sources of information critical for the adoption of health behaviors, they are not the only determinant influencing the adoption of health behaviors. Further longitudinal research would help reveal the intrinsic association and the way in which health literacy may act as a mediator between social determinants and health behavior.

Finally, this is the first study to measure health literacy in Israel on a national scope using a comprehensive tool to examine various aspects of health literacy. Although the results of the study showed that the measure of health literacy in Israel is skewed toward likely sufficient health literacy (69%), 31% still have insufficient health literacy—21% problematic and 10% inadequate levels of health literacy. This finding is somewhat more encouraging than what was shown in the European study, in which 1 out of every 2 Europeans had limited (problematic or inadequate) health literacy (Sørensen, 2013). As the measure includes a wide variety of facets regarding access, facility of use, and application of health information, the results of the risk factors analysis clearly indicate who is at risk for low health literacy. Regarding the validity of the measure, although the HLS-EU measure does not measure functional literacy, the results of this study show that it correlates well with an accepted measure of functional literacy (S-TOFHLA) and correlates with health knowledge (Baker et al., 1999; Berkman et al., 2011). This is in accordance with the results of the HLS-EU study that used the Newest Vital Sign measure of functional literacy (Osborn et al., 2007), confirming the predictive validation of the measure.

Several limitations of this study are acknowledged. Although the size of the sample was sufficient to achieve the research objectives, an even larger sample would allow for expansion of the analysis to learn of the needs of smaller subgroups, such as specific ethnic groups, beyond those that were analyzed in the current study. Where possible, it would be useful to learn more about the nonparticipants who were in the sampling frame regarding their socioeconomic status and education to ensure that there was no selection bias in the study group. Thus, generalizability to the subgroups is limited until a larger study is conducted. In addition, the possible desire of some of the participants to please the interviewer may have biased the responses of some of the study's participants. Lastly, as this study was cross-sectional, we cannot attribute causality to the factors associated with health literacy. A strength of this study is its rigorous methodology for collecting the data, both to ensure face validity by conducting home interviews and to be as culturally sensitive as possible, offering three different languages. In addition, we used an internationally validated tool, which lays the foundation for future comparability of results with those of international collaborating partners while currently identifying populations at risk within Israeli society. As well, the significance of the results of this study should be recognized for guiding health education and promotion intervention to improve health literacy levels while also supporting health systems to adapt to the levels of health literacy in the population, as suggested in the model of health literate organizations (Brach et al., 2012).

Conclusions

First, the results of this study represent an important first step in demonstrating the strong relationship between health literacy and a health indicator, namely, self-assessed health. Second, the results strongly indicate a clear social gradient with regard to levels of health literacy in a nationally representative sample. Third, through this study, a population-based measure of health literacy was established and tested in the Israeli population. The understanding gained from the study contributes to an understanding of the comprehensive logic model suggested by Berkman, beginning with health literacy, mediated by a wide variety of factors—behavioral and social—and resulting in a health outcome measure. The study serves as a broad baseline for understanding the significance of health literacy in its multiple facets, supporting empowerment of the public for promoting health and well-being.

The high health cost of low health literacy, demonstrated in other countries, indicates the need to invest in promoting health literacy while also adapting services to various levels of health literacy. This study provides a basis on which future long-term research can be conducted to determine the extent to which low health literacy as a risk factor can be improved and transformed into an asset. Finally, the results not only provide a basis on which low health literacy can be estimated but also provide necessary information for policymakers to make informed decisions and engage in long-term planning in reducing disparities to meet the health needs of populations on a national basis. We foresee that the results of this study will contribute significantly to discussion

regarding the role of health literacy as a priority area in the health promotion, health care, and health policy arenas.

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