Ethnic Differences in Health Literacy Among Young Adults in Amsterdam

Iris M. Blom, BSc, MMSc; Eva S. Cohen, BSc; Lola V. Eshuis, BSc; Anke J. Woudstra, MSc; Marieke B. Snijder, PhD; Anton E. Kunst, PhD; and Mirjam P. Fransen, PhD

ABSTRACT

Background: Ethnic differences in health commence early in life. Ethnic minority young adults have a greater prevalence of unhealthier lifestyles and poorer health outcomes than their peers. Variations in health literacy could contribute to these ethnic inequalities in health but have not yet been investigated in this group. **Objective**: This study investigated ethnic differences in performance-based and self-reported health literacy in young adults and examined whether these differences are explained by educational level, language difficulties, or cultural distance. **Methods**: Young adults (age 18-25 years) from Dutch, African Surinamese, South-Asian Surinamese, Ghanaian, Turkish, and Moroccan ethnic backgrounds ($N = 2,215$) participated in the HELIUS (HEalthy Life in an Urban Setting) study, a cohort study in Amsterdam, the Netherlands. Performance-based health literacy was measured by the Rapid Estimate of Adult Literacy in Medicine in Dutch (REALM-D). Self-reported health literacy was measured by the Chew's Set of Brief Screening Questions (SBSQ). The association between ethnicity and health literacy, and the role of background characteristics was assessed by linear regression analyses. **Key Results**: Performance-based health literacy was low (REALM-D <60; range, 0-66) among 17% of the participants. After adjustment for educational level, average levels of REALM-D were lower among participants from a Ghanaian, Turkish, and Moroccan background than those from a Dutch background, whereas the two Surinamese groups did not differ from the Dutch group. Additional adjustment for language difficulties and cultural distance did not explain the differences between the five ethnic minority groups. Self-reported health literacy was low (SBSQ <3; range, 0-4) among 3% of the participants. There were no differences in levels of SBSQ between the ethnic minority groups and the Dutch group. **Conclusions**: We found ethnic differences in performance-based health literacy, which largely remained after adjustment for educational level. Further research is needed to gain insight into how young adults from different ethnic groups appraise and apply health information in various contexts. **[*HLRP: Health Literacy Research and Practice*. 2018;2(4):e192-e204.]**

Plain Language Summary: We investigated ethnic differences in health literacy among young adults (age 18-25 years) living in the Netherlands. Compared to the Dutch group, some ethnic minority groups scored lower on performance-based health literacy, independent of educational level. Self-reported health literacy did not differ between Dutch and ethnic minority groups.

The period of young adulthood is critical to health outcomes. This transitional period includes the biological changes of puberty, increasing independence, and experimentation involving risky behavior, such as excessive alcohol consumption, smoking, and drug use (Dye et al., 2007; Jackson & Schulenberg, 2013; Johnston, O'Malley, Bachman, & Schulenberg, 2006; Martin, Hamilton, Osterman, Driscoll, & Mathews, 2017). Compared to other adolescents, ethnic minority adolescents have a higher prevalence of unhealthier lifestyles and poorer health outcomes in a variety of areas such as obesity, teen pregnancy, sexually transmitted diseases, and tooth decay (Centers for Disease Control and Prevention, 2017; Forhan et al., 2009; Ogden, Carroll, Fryar, & Flegal, 2015).

Health risk behaviors and mental health problems often persist into adulthood (Hofstra, Van der Ende, & Verhulst, 2002; Kim-Cohen et al., 2003; Viner, 2005). Young adults, especially those from ethnic minority groups, are therefore an important target group for health promotion, as early intervention can prevent chronic illnesses later in life. For that reason, a large amount of educational materials and health care documents target the young adult population. Health promotion is increasingly available through the media, the Internet, and community interventions. Young adults are expected to adequately use this information to remain in good health. However, adequate skills are required to be able to find, understand, appraise, and apply this information (i.e., health literacy). To date, studies that have investigated ethnic differences in health literacy mainly focus on older populations whom have a higher prevalence of health problems and use of health care (Ayotte, Allaire, & Bosworth, 2009; Gazmararian et al., 1999; Lindau et al., 2002; Mantwill, Monestel-Umana, & Schulz, 2015; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005; Sentell & Braun, 2012; Sudore et al., 2006; van der Gaag, van der Heide, Spreeuwenberg, Brabers, & Rademakers, 2017; Wang et al., 2013).

It is not known whether ethnic variations in health literacy also exist among young adults, and how these variations could be explained. This information is essential for the development of interventions to effectively prevent unhealthy lifestyles in this age group and to prevent a further increase of ethnic inequalities in health. Therefore, the general aim of this study was to assess ethnic differences in health literacy in a multiethnic cohort of young adults. Specific objectives were (1) to investigate whether performance-based and self-reported health literacy differs among six ethnic groups of young adults; and (2) to investigate the extent to which ethnic differences in performance-based and self-reported health literacy among young adults can be explained by educational level, difficulties with the Dutch language, or degree of cultural distance.

Corresponding with previous results among the general adult population, we wanted to confirm that young adults with a Dutch ethnic background have a higher level of performance-based and self-reported health literacy compared to ethnic minority young adults. We hypothesized that these ethnic differences in health literacy could partly be explained by educational level, difficulty with the Dutch language, and a degree of cultural distance.

METHODS

Design and Research Population

For this study we used baseline data from the HEalthy Life in an Urban Setting (HELIUS) study, a large-scale prospective cohort study on health and health care use among the urban multiethnic population in Amsterdam. People (age 18-70 years) of Dutch, Surinamese, Ghanaian, Turkish, and Moroccan ethnic origin were invited to take part in the study. They were randomly sampled, stratified by ethnic origin, using the Amsterdam municipal population register. The Dutch, Suri-

Iris M. Blom , BSc, MMSc, is a Medical Student. Eva S. Cohen, BSc, is a Medical Student. Lola V. Eshuis, BSc, is a Medical Student. Anke J. Woudstra, MSc, is a Doctoral Student. Marieke B. Snijder, PhD, is an Assistant Professor. Anton E. Kunst, PhD, is a Professor and the Department Head. Mirjam P. Fransen, PhD, is an Assistant Professor. All authors are affiliated with the Department of Public Health, Amsterdam University Medical Centres, Amsterdam Public Health Research Institute.

Address correspondence to Mirjam P. Fransen, PhD, Department of Public Health, Amsterdam University Medical Centres, Amsterdam Public Health Research Institute, Location AMC, Meibergdreef 9 1105 AZ Amsterdam, the Netherlands; email: m.p.fransen@amc.uva.nl.

Grants: The HEalthy Life in an Urban Setting (HELIUS) study was funded by the Dutch Heart Foundation, the Netherlands Organization for Health Research and Development, the European Union (EU), and the European Fund for the Integration of non-EU immigrants.

Disclaimer: The HELIUS study received core support and has been approved by the Institutional Review Board of the Academic Medical Center, University of Amsterdam.

Disclosure: The authors have no relevant financial relationships to disclose.

Acknowledgment: The authors thank the participants of the HELIUS study and the management team, research nurses, interviewers, research assistants, and other staff who gathered data for this study.

I.M.B., E.S.C., and L.V.E. contributed equally to this article and should be considered equal first authors.

Received: November 3, 2017; Accepted: May 21, 2018

doi:10.3928/24748307-20180926-01

namese, Turkish, and Moroccan ethnic groups are the largest ethnic groups in both Amsterdam and the Netherlands (Statistics Netherlands, 2016). The Ghanaian group is the second largest African group in Amsterdam, as well as a prominent group in other large European cities, such as Berlin and London (Mörath, 2015; Office for National Statistics, 2017).

Selected participants received a written invitation combined with written information and a response card (in Dutch, Turkish, Moroccan Arabic or English for Ghanaian participants). After a positive response, participants received a digital or paper version of the questionnaire (depending on their preference) to complete at home. Questionnaires were also available in English for Ghanaian participants and in Turkish for Turkish participants. Participants who were unable to complete the questionnaire themselves were assisted by a trained ethnically matched interviewer of the same sex, speaking their preferred language. Non-Dutch people who did not respond to the written invitation letter were visited at home by an ethnically matched interviewer to provide additional information if needed (e.g., due to language or reading problems) and to assist in filling out the questionnaire if the person was willing to participate in the study (Snijder et al., 2017).

Baseline HELIUS data were collected from 2011 to 2015. Of those invited, 55% were contacted, either by response card or a home visit by an ethnically matched interviewer. Around 50% of those contacted agreed to participate (Snijder et al., 2017). Both questionnaire data and data from the physical examination were available in 22,165 HELIUS participants. Further details on the aims, design, and response of the study have been published elsewhere (Snijder et al., 2017; Stronks et al., 2013).

In the current study, we included participants age 18 to 25 years with a Turkish, Moroccan, South-Asian Surinamese, African Surinamese, Ghanaian, or Dutch ethnic background who had data on health literacy assessment (N = 2,215).

All study protocols were approved by the Ethical Review Board of the Academic Medical Center, University of Amsterdam, and written informed consent was obtained from all participants.

Information on the Migration History of the Ethnic Groups Included

Most people from Turkey and Morocco came to the Netherlands as guest workers between 1960 and 1970. The initial period of labor migration was followed by a second period (1970-1980) in which many guest workers brought their spouses and children to the Netherlands. Most people from Suriname, a former Dutch colony in South America, migrated to the Netherlands between 1975 and 1980. Their migration was mainly due to the unstable political situation in Suriname. Within this Surinamese population there are two main distinct cultural groups: a group with a West African ancestry and a group with a North Indian ancestry. Both groups migrated to Suriname in the 19th century. Most of the Ghanaian group came to the Netherlands in the 1990s to escape poverty, drought, or political conflicts.

Variables

The ethnic background of a respondent was based on a person's country of birth or that of his or her parents (Stronks, Kulu-Glasgow, & Agyemang, 2009). Specifically, a participant is considered to be of non-Dutch ethnic origin if he or she fulfills either of the following criteria: (1) born abroad and has at least one parent born abroad (first generation) or (2) born in Netherlands but both parents were born abroad (second generation). After data collection, participants of Surinamese origin were further classified according to self-reported ethnic origin (obtained by questionnaire) into "African," "South-Asian," "Javanese," or "other/unknown" Surinamese subgroups.

The variable performance-based health literacy was measured by the Rapid Estimate of Adult Literacy in Medicine–Dutch (REALM-D) (Fransen, Van Schaik, Twickler, & Essink-Bot, 2011). This is a performance-based recognition and pronunciation test, adapted to the Dutch language, that evaluates participants' ability to read from a list of 66 health-related terms. Sum scores were divided following standard cut-offs that are based on grade-level estimates in the United States: very low (0-18); low (19-44); marginal (45-60); and adequate (61-66) (Fransen et al., 2011). The REALM-D was assessed during the physical examination among participants who were able to communicate in Dutch. The research assistants received instructions for the REALM-D assessment in a training session and in a paper protocol. In the training session the words were pronounced and discussed, and the protocol described how to deal with accents and various pronunciations.

Self-reported health literacy was measured by Chew's Set of Brief Screening Questions (SBSQ), which has been adapted and tested for reliability and validity in the Dutch context (Fransen et al., 2011). The SBSQ consists of the following three statements on a 5-point Likert scale (0-4): How often do you have problems learning about your health because of difficulty understanding written information (0 = *always*; 4 = *never*)? How confident are you filling out medical forms by yourself (0 = *not at all confident*; 4 = *extremely confident*)? How often do you have someone help you read letters from your general practitioner, the hospital, or other health care institutes (0 = *always*; 4 = *never*)? (Chew, Bradley, & Boyko, 2004; Chew

et al., 2008). These items were translated in the HELIUS questionnaires in all required languages. Following Chew's cutoff points, participants had to have a total mean score of at least 3 (range, 0 to 4) to obtain an adequate health literacy score (Chew et al., 2004).

Level of education was classified by the highest obtained educational degree in the Netherlands or the country of origin, as reported by the participants. Participants were divided into four categories: no schooling or elementary schooling only; lower vocational schooling or lower secondary schooling; intermediate vocational schooling or intermediate/higher secondary schooling; or higher vocational schooling or university.

Dutch language skills were measured by two items: perceived difficulty in conversation in the Dutch language and perceived difficulty in reading in Dutch. These items were assessed by two questions: "Do you find it hard to have a conversation in Dutch?" and "If you read the newspaper, letters, or leaflets in Dutch, do you find it hard to understand the language?" A participant was considered to have no difficulty with the Dutch language if both questions were answered with *no, never*.

Cultural distance was based on the level of separation from the host culture in two different domains, i.e., psychological (ethnic identity and cultural orientation) and behavioral (social network) (Berry, 1997). Ethnic identity was assessed by asking participants of non-Dutch ethnic origin about the extent to which they agreed with the following statement: "I feel Dutch." Cultural orientation was assessed by the Psychological Acculturation Scale (Stevens, Pels, Vollebergh, & Crijnen, 2004), consisting of 10 statements regarding the Dutch culture. All items were rated on a 5-point Likert scale (*totally agree* to *totally disagree*). Social network was assessed by a statement concerning having Dutch friends (*none*, *a few*, *quite a few*, *many*, *very many*) and two statements concerning spending free time with Dutch people (*never*, *hardly ever*, *sometimes*, *often*, *always*). For each scale, a mean score of ≥3 was classified as *yes* and a score of <3 as *no*. Participants answering *no* on the scales were classified as "distant from the Dutch culture."

STATISTICAL ANALYSIS

Of the total HELIUS population (N = 22,165), we excluded participants of Javanese Surinamese (n = 233) or another/unknown Surinamese (n = 267) origin due to small numbers, and we also excluded those with another/unknown ethnic origin (n = 48). Of the remaining 21,617 participants, we excluded those older than age 25 years leading to a study sample of 2,356 participants of Dutch, South-Asian Surinamese, African Surinamese, Ghanaian, Turkish, and Moroccan origin. Of these participants, we selected 2,215 participants who had at least one health literacy assessment (either performance-based [n = 1,279], self-reported [n = 2,076], or both [n = 1,140]). There were 139 participants who failed to fill in the self-reported health literacy assessment in the questionnaire; therefore, we did not have their data for this assessment. The performance-based health literacy assessment was conducted among a smaller amount of participants than the self-reported assessment, due to the fact that the performance-based assessment was only assessed between January 2011 and March 2014 (n = 1,324 remained) and subsequently the REALM-D was not assessed among 45 participants because they were unable to communicate in Dutch (n = 1,279 remained).

We used linear regression analysis to assess the association between ethnic background and health literacy (analyzing performance-based and self-reported scores separately). The regression models were applied to two data sets. The first data set included the Dutch ethnic group and used this population as a reference group. The second data set did not include the Dutch ethnic group, as the data regarding cultural distance and Dutch language skills were not available for the Dutch. In this second dataset, the South-Asian Surinamese group was used as the reference group, because Dutch is the national language in Surinam and the results indicated that the Surinamese groups had the highest level of health literacy after the Dutch ethnic group. In both datasets, we excluded participants that missed at least one of the variables in the regression model. In the regression models, we first adjusted for potential confounders (age, sex). Then, to investigate to what extent potential underlying factors are causing these ethnic differences in health literacy, we further adjusted for potential mediators (level of education, Dutch language skills, and cultural distance). Potential mediators are assumed to be in the causal pathway between ethnicity and health literacy, rather than just confounding the association. We used the Pearson correlation coefficient to measure the correlation between performance-based and self-reported health literacy. All analyses were performed with SPSS version 23.0.

RESULTS

Population Characteristics

The mean age of the participants was 21.9 years (standard deviation 2.2), which did not differ between ethnic groups. Further characteristics of the study population are shown in **Table 1**. Educational level was highest among young adults from a Dutch ethnic background: 41% of them reported higher vocational schooling or university, whereas this was

TABLE 1

Characteristics of the Study Population Per Ethnic Group

	Ethnic Background													
	Dutch (*n* = 338)		South-Asian Surinamese (*n* = 307)		African Surinamese (*n* = 260)		Ghanaian (*n* = 197)		Turkish (*n* = 527)		Moroccan (*n* = 586)		Total Population (*N* = 2, 215)	
Characteristic	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Male	120	36	151	49	109	42	71	36	226	43	165	28	842	38
Level of education														
No school or elementary school only	7	2	12	4	10	4	12	6	27	5	24	4	92	4
Lower vocational or lower secondary schooling	12	4	54	18	58	23	69	35	108	21	100	17	401	18
Intermediate vocational or intermediate/higher secondary	179	53	179	59	152	59	95	49	304	58	339	58	1,248	57
Higher vocational or university	139	41	61	20	38	15	20	10	84	16	118	20	460	21
Difficulty with household income	76	23	73	25	81	32	43	24	178	36	167	31	618	29
Difficulty with Dutch language	-	-	40	13	32	12	79	40	129	25	73	13	353	19
Distance from Dutch culture														
Domain: Ethnic identity	-	-	30	10	38	15	43	22	110	21	65	11	286	15
Domain: Cultural orientation	-	-	52	17	52	20	49	25	116	22	120	21	389	21
Domain: Social network	-	-	153	50	167	65	119	61	294	56	408	70	1,141	61

Note. This table presents the characteristics of the study population. Different categories of characteristics are provided and for level of education and distance to Dutch culture the categories are subdivided in different levels.

only the case in 10% to 21% of the other ethnic groups. Participants from a Ghanaian ethnic background had the highest prevalence of reporting difficulties with the Dutch language (40%). The lowest prevalence of reporting language barriers was among people from an African Surinamese ethnic background (12%). Distance from the Dutch culture in the psychological domain was highest among participants from a Ghanaian ethnic background (prevalence of 22% for ethnic identity and 25% for cultural orientation). Participants from a Moroccan ethnic background scored highest on distance from the Dutch culture in the behavioral domain (prevalence of 70% for social network). The participants with a South-Asian Surinamese ethnic background scored lowest on distance from the Dutch culture (prevalence of 10% for ethnic identity, 17% for cultural orientation, and 50% for social network).

Performance-Based and Self-Reported Health Literacy Scores

Table 2 presents the levels of performance-based health literacy (REALM-D) and self-reported health literacy (SBSQ). The SBSQ was assessed among 2,076 participants (139 missing) and the REALM-D was assessed among 1,279 participants (936 missing). Performance-based health literacy was low (REALM-D score <60) among 17% of the participants. Self-reported health literacy was low (SBSQ score <3) among 3% of the participants. For both health literacy measures, the prevalence of adequate health literacy was highest in Dutch young adults (94% and 100%, respectively). Of the Ghanaian group, 71% had an adequate score on the performance-based measure, whereas this figure was between 80% and 89% in the other non-Dutch ethnic groups. Adequate self-reported health literacy was found to be 92% in the Ghanaian ethnic group and 98% in the other ethnic groups. The correlation between self-reported and performance-based scores was moderately low in the Dutch ethnic group (0.38) and low in the other ethnic groups, ranging from a correlation coefficient of 0.14 in the African Surinamese group to 0.25 in the Turkish group.

Ethnic Differences in Performance-Based Health Literacy

Compared to the Dutch young adults, the other groups all scored lower on performance-based health literacy (**Table 3**, model 1.1). After the addition of sex and age to the model, the differences between the Dutch and South-Asian Surinamese group was no longer statistically significant (model 1.2). After the addition of educational level to the model, the differences between the Dutch and African Surinamese group was also no longer statistically significant (model 1.3). For the Ghanaian, Turkish, and Moroccan groups, ethnic differences in health literacy could, to a minor extent, be explained by differences in educational level, but remained statistically significant (model 1.3). **Table 3** also presents the outcomes of linear regression analyses with the exclusion of the Dutch group. Compared to South-Asian Surinamese young adults, all the other ethnic groups, except those from African Surinamese background, scored significantly lower on performance-based health literacy (model 2.1). These ethnic differences remained almost unchanged after adjustment for sex, age, educational level, language barriers, and cultural distance (models 2.2-2.5).

Ethnic Differences in Self-Reported Health Literacy

Table 4 (model 1.1) shows that self-reported health literacy only differed between the Dutch and Ghanaian participants. When adjusted for sex, age, and educational level, the difference was reduced by 50% and the remaining difference was not statistically significant (model 1.3). Differences were smallest between the Dutch and Turkish group; this difference remained the same after adjustment for sex, age, and educational level (model 1.3). After adjustment for differences in sex, age, and educational level, Moroccan young adults had significantly higher self-reported health literacy than the Dutch (model 1.3) and South-Asian Surinamese young adults (model 2.5).

DISCUSSION

Performance-based health literacy was low among 17% of the young adults that participated in this study. After adjustment for sex, age, and educational level, Ghanaian, Turkish, and Moroccan young adults scored lower on performance-based health literacy than those from a Dutch, African Surinamese, and South-Asian Surinamese ethnic background. Additional adjustment for differences in language difficulties and cultural distance between the non-Dutch ethnic groups did not change these results. Self-reported health literacy was low among 3% of the participants. There were no differences in average levels of SBSQ between the ethnic minority groups and the Dutch. Levels were lower for Ghanaians, but this difference was no longer significant after adjustment for educational level and language difficulties.

The levels of performance-based health literacy that we found among young adults from a Dutch, South-Asian Surinamese, and African Surinamese background (5%, 13%, and 11%, respectively, scored low on REALM-D) are higher than those reported in a previous Dutch study. In the previous study, low REALM-D scores were found among 19%

TABLE 2

Health Literacy Scores Per Ethnic Group

	Ethnic Background													
	Dutch ($n = 338$)		South-Asian Surinamese ($n = 307$)		African Surinamese ($n = 260$)		Ghanaian ($n = 197$)		Turkish ($n = 527$)		Moroccan ($n = 586$)		Total Population ($N = 2,215$)	
Health Literacy Score	(%)	M (*SD*)	(%)	M (*SD*)	(%)	M (*SD*)	(%)	M (*SD*)	(%)	M (*SD*)	(%)	M (*SD*)	(%)	M (*SD*)
Self-reported (SBSQ)[a]		3.7 (0.4)		3.6 (0.5)		3.6 (0.6)		3.5 (0.8)		0.6 (0.6)		3.7 (0.5)		3.6 (0.5)
Low	1 (0)		7 (3)		6 (3)		15 (8)		12 (2)		10 (2)		51 (3)	
Adequate	322 (100)		272 (98)		236 (98)		169 (92)		489 (98)		537 (98)		2,025 (98)	
Performance-based (REALM-D)[b]		64.6 (3)		63.7 (2.8)		63.5 (3.1)		60.9 (6.2)		62.6 (3.1)		62.4 (3.8)		62.9 (3.8)
Very low	0 (0)		0 (0)		0 (0)		0 (0)		0 (0)		0 (0)		0 (0)	
Low	1 (1)		0 (0)		1 (1)		4 (3)		0 (0)		2 (1)		8 (1)	
Marginal	9 (6)		22 (11)		19 (12)		35 (26)		57 (19)		62 (19)		204 (16)	
Adequate	146 (94)		183 (89)		137 (87)		94 (71)		246 (81)		261 (80)		1,067 (83)	

Note. REALM-D = Rapid Estimate of Adult Literacy in Medicine in Dutch; SBSQ = Set of Brief Screening Questions.
[a]139 missing on self-reported health literacy. [b]936 missing on performance-based health literacy.

TABLE 3

Ethnic Differences in Performance-Based Health Literacy Score Measured by REALM-D (*N* =1,270)

	Ethnic Background					
	Dutch (*n* = 156)	South-Asian Surinamese (*n* = 204)	African Surinamese (*n* = 156)	Ghanaian (*n* = 132)	Turkish (*n* = 302)	Moroccan (*n* = 320)
Regression Model	**B [95% CI]**	**B [95% CI]**	**B [95% CI]**	**B [95%CI]**	**B [95%CI]**	**B [95%CI]**
Model 1						
Model 1.1 Ethnic group	0.00 (ref)	-0.84 [-1.62, -0.07]	**-1.06 [-1.89, -0.24]**	**-3.69 [-4.55, -2.83]**	**-1.96 [-2.68, -1.25]**	**-2.17 [-2.88, -1.46]**
Model 1.2 Ethnic group + sex + age	0.00 (ref)	-0.74 [-1.52, 0.04]	**-0.99 [-1.81, -0.16]**	**-3.55 [-4.41, -2.68]**	**-1.85 [-2.57, -1.13]**	**-2.15 [-2.86, -1.44]**
Model 1.3 Ethnic group + sex + age + education	0.00 (ref)	-0.18 [-0.94, 0.59]	-0.34 [-1.16, 0.47]	**-2.85 [-3.71, - 2.00]**	**-1.21 [-1.92, -0.50]**	**-1.62 [-2.32, -0.92]**
Model 2a						
Model 2.1 Ethnic group	-	0.00 (ref)	-0.25 [-1.04, 0.54]	**-2.91 [-3.74, -2.07]**	**-1.10 [-1.78, -0.43]**	**-1.37 [-2.04, -0.70]**
Model 2.2 Ethnic group + sex + age	-	0.00 (ref)	-0.27 [-1.06, 0.52]	**-2.86 [-3.70, -2.02]**	**-1.09 [-1.76, -0.41]**	**-1.45 [-2.12, -0.78]**
Model 2.3 Ethnic group + sex + age + education	-	0.00 (ref)	-0.18 [-0.94, 0.59]	**-2.72 [-3.54, -1.91]**	**-1.00 [-1.66, -0.34]**	**-1.47 [-2.12, -0.82]**

TABLE 3 (*continued*)

Ethnic Differences in Performance-Based Health Literacy Score Measured by REALM-D (*N* = 1,270)

	Ethnic Background					
	Dutch (*n* = 156)	South-Asian Surinamese (*n* = 204)	African Surinamese (*n* = 156)	Ghanaian (*n* = 132)	Turkish (*n* = 302)	Moroccan (*n* = 320)
Regression Model	**B [95% CI]**	**B [95% CI]**	**B [95% CI]**	**B [95%CI]**	**B [95%CI]**	**B [95%CI]**
Model 2.4 Ethnic group + sex + age + education + difficulty with Dutch language	-	0.00 (ref)	-0.21 [-0.97, 0.54]	**-2.46 [-3.27, -1.65]**	**-0.83 [-1.48, -0.19]**	**-1.50 [-2.15, -0.86]**
Model 2.5 Ethnic group + sex + age + education + difficulty with Dutch language + acculturation	-	0.00 (ref)	-0.25 [-1.00, 0.51]	**-2.43 [-3.24, -1.62]**	**-0.77 [-1.42, -0.12]**	**-1.57 [-2.21, -0.92]**

Note. Bold numbers represent a significant difference ($p \leq .05$). B = beta; CI = confidence interval; REALM-D = Rapid Estimate of Adult Literacy in Medicine in Dutch.

[a]168 participants less due to the exclusion of participants with a Dutch ethnicity ($n = 156$) and participants with missing data for the variables "difficulty Dutch language" and "acculturation" ($n = 12$).

TABLE 4

Ethnic Differences in Self-Reported Health Literacy Measured by a Set of Brief Screening Questions (*N*= 2,065)

	Ethnic Background					
	Dutch (*n* = 156)	South-Asian Surinamese (*n* = 204)	African Surinamese (*n* = 156)	Ghanaian (*n* = 132)	Turkish (*n* = 302)	Moroccan (*n* = 320)
Regression Models	**B [95% CI]**	**B [95% CI]**	**B [95% CI]**	**B [95% CI]**	**B [95% CI]**	**B [95% CI]**
Model 1						
Model 1.1 Ethnic group	0.00 (ref)	-0.04 [-0.13, 0.04]	-0.09 [-0.17, 0.01]	**-0.19 [-0.29, -0.09]**	-0.04 [-0.12, 0.03]	0.05 [-0.03, 0.12]
Model 1.2 Ethnic group + sex + age	0.00 (ref)	-0.03 [-0.11. 0.06]	-0.08 [-0.17, 0.01]	**-0.19 [-0.29, -0.09]**	-0.04 [-0.11, 0.04]	0.04 [-0.03, 0.11]
Model 1.3 Ethnic group + sex + age + educational l evel	0.00 (ref)	0.03 [-0.05, 0.12]	0.00 [-0.09, 0.09]	-0.09 [-0.19, 0.01]	0.03 [-0.04, 0.12]	**0.10 [0.03, 0.17]**
Model 2a						
Model 2.1 Ethnic group		0.00 (ref)	-0.02 [-0.12, 0.07]	**-0.16 [-0.26, -0.05]**	0.00 [-0.08, 0.08]	**0.09 [0.01, 0.17]**
Model 2.2 Ethnic group + sex + age		0.00 (ref)	-0.03 [-0.13, 0.07]	**-0.17 [-0.28, -0.07]**	-0.01 [-0.09, 0.07]	0.07 [-0.01, 0.15]
Model 2.3 Ethnic group + sex + age + educational level		0.00 (ref)	-0.02 [-0.11, 0.08]	**-0.13 [-0.23, -0.03]**	0.00 [-0.08, 0.08]	0.07 [-0.01, 0.15]
Model 2.4 Ethnic group + sex + age + educational level + difficulty with Dutch language		0.00 (ref)	-0.02 [-0.11, 0.07]	-0.02 [-0.12, 0.08]	0.05 [-0.03, 0.12]	0.07 [-0.01, 0.14]

TABLE 4 *(continued)*

Ethnic Differences in Self-Reported Health Literacy Measured by a Set of Brief Screening Questions (*N*= 2,065)

	Ethnic Background					
	Dutch (*n* = 156)	South-Asian Surinamese (*n* = 204)	African Surinamese (*n* = 156)	Ghanaian (*n* = 132)	Turkish (*n* = 302)	Moroccan (*n* = 320)
Regression Models	B [95% CI]	B [95% CI]	B [95% CI]	B [95% CI]	B [95% CI]	B [95% CI]
Model 2.5 Ethnic group + sex + age + educational level + difficulty with Dutch language + acculturation		0.00 (ref)	-0.01 [-0.10, 0.08]	-0.02 [-0.11, 0.08]	0.05 [-0.02, 0.13]	**0.08 [0.00, 0.15]**

Note. Bold numbers represent a significant difference ($p \leq .05$). [a]341 participants less due to the exclusion of participants with a Dutch ethnicity (n = 322) and participants with missing data for the variables "difficulty Dutch language" and "acculturation" (*n* = 19). B = beta; CI = confidence interval.

of patients who were chronically ill, mainly from Dutch and Surinamese ethnic backgrounds (Fransen et al., 2011). This discrepancy can be explained by the fact that these patients had an average age of 60 years and research has shown that this age group has a lower health literacy (Kobayashi, Wardle, Wolf, & von Wagner, 2016). However, the Moroccan, Turkish, and Ghanaian young adults' REALM-D scores were comparable to or even lower than the older Dutch patients' scores, which emphasizes that low health literacy can commence early in life in specific ethnic minority groups.

Other international studies have also reported lower health literacy levels among ethnic minority groups compared to the host population (Mantwill et al., 2015). However, many studies are not comparable because they either used other measures or did not specifically include young adults. In the Netherlands, van der Gaag et al. (2017) investigated ethnic differences in self-reported health literacy among older adults. They found lower levels of health literacy (measured by the Health Literacy Questionnaire) among Turkish respondents, although not among respondents from a Moroccan and Surinamese background. However, none of the studies that report ethnic variations in health literacy specifically focused on young adults (Mantwill et al., 2015). Studies among younger age groups (10-39 years) found rates of adequate health literacy ranging from 52% to 99% but did not describe ethnic variations in health literacy (Sansom-Daly et al., 2016).

We found that educational level, language barriers, and cultural distance could only partially explain ethnic differences in health literacy levels. Although the association between ethnic background and educational level is well established and the association between health literacy and educational level has been confirmed in various studies (Levin-Zamir, Baron-Epel, Cohen, & Elhayany, 2016; Mantwill et al., 2015; Wångdahl, Lytsy, Mårtensson, Westerling, 2014), educational differences could only partly explain ethnic differences in performance-based health literacy. This means that other variables play a more important role in the association between ethnic background and health literacy. Previous studies found that limited proficiency in the national language has been associated with lower levels of self-reported health literacy (Beauchamp et al., 2015; Sentell & Braun, 2012). Given this, it was of interest to compare young adults originating from Suriname, where Dutch is an official language, to those originating from other countries. As expected, the two Surinamese groups had higher levels of performance-based literacy than the other minority groups. Yet, this difference remained after adjustment for difficulty with Dutch language and after adjustment for levels of cul-

tural distance. Language difficulty possibly played a role, but in ways that were too subtle to be captured in our self-reported measure of language difficulty.

The use of a large sample size is one of the strengths of our study. Additionally, the use of both performance-based and self-reported health literacy measures enabled us to compare both measures in this multiethic population. Moreover, we were able to assess self-reported health literacy among participants who were unable to speak or read Dutch as the questionnaires were translated in to different languages. In previous Dutch studies, participants who were unable to communicate in Dutch were either excluded from health literacy research or were not questioned about their level of ability to speak and read the Dutch language (Fransen et al., 2011; Koster, Philbert, & Bouvy, 2015; Pander Maat, Essink-Bot, Leenaars, & Fransen, 2014; van der Heide et al., 2013). By adjusting for language barriers in our analyses, we sought to distinguish between health literacy caused by language barriers and health literacy caused by other factors.

STUDY LIMITATIONS

A limitation of this study is that health literacy was only measured by an assessment of reading skills (REALM-D) and self-perceived skills concerning understanding medical information and filling out medical forms (SBSQ). These measures may not optimally assess the abilities that young adults need to understand, appraise, and apply information in an actual and context-specific situation; the SBSQ might be less meaningful for young people because they are generally healthy and, therefore, deal with health-related information less often. Both measures had ceiling effects, meaning that there could have been higher scores than the ones we observed, but the REALM-D and SBSQ did not extend far enough to capture them. This also indicates that there is more variance in a concept than the REALM-D and SBSQ can measure. The low correlation between REALM-D and SBSQ indicate that these instruments measure different concepts of health literacy. However, the differences in correlations between the ethnic groups may also raise questions regarding the cross-culture comparability of the actual responses.

Another limitation is that the REALM-D was only assessed among participants who were able to communicate in Dutch, as it was not available in other languages. Because the outcome variable (performance-based health literacy) is lacking for a specific group (non–Dutch-speaking participants), we were unable to apply special procedures to handle missing data.

The findings of our study are relevant for practice and further research. Young adults are an important target group for health promotion. The ethnic differences that we found in REALM-D and SBSQ scores indicate that health promotion materials might not be equally accessible to all young adults. Professionals in health care and preventive health care should know that health literacy differences also exist among young adults. There is a need for tailored information and communication for young people, especially those from a non-Western ethnic background, even if they speak the language of the host country.

Our findings also indicate that health literacy research should specifically include young adults from various ethnic backgrounds and that further research is needed on how they appraise and apply health information in various health-related contexts, and how this can be measured.

REFERENCES

Ayotte, B. J., Allaire, J. C., & Bosworth, H. (2009). The associations of patient demographic characteristics and health information recall: The mediating role of health literacy. *Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition*, *16*(4), 419-432. doi:10.1080/13825580902741336

Beauchamp, A., Buchbinder, R., Dodson, S., Batterham, R. W., Elsworth, G. R., McPhee, C., . . . Osborne, R. H. (2015). Distribution of health literacy strengths and weaknesses across socio-demographic groups: A cross-sectional survey using the Health Literacy Questionnaire (HLQ). *BMC Public Health*, *15*, 678. doi:10.1186/s12889-015-2056-z

Berry, J. W. (1997). Immigration, acculturation, and adaptation. *Applied Psychology*, *46*(1), 5-34. doi:10.1111/j.1464-0597.1997.tb01087.x

Centers for Disease Control and Prevention. (2017). *Alcohol and other drug use*. Retrieved from https://www.cdc.gov/healthyyouth/data/topics/index.htm

Chew, L. D., Bradley, K. A., & Boyko, E. J. (2004). Brief questions to identify patients with inadequate health literacy. *Family Medicine*, *36*(8), 588-594.

Chew, L. D., Griffin, J. M., Partin, M. R., Noorbaloochi, S., Grill, J. P., Snyder, A., . . . Vanryn, M. (2008). Validation of screening questions for limited health literacy in a large VA outpatient population. *Journal of General Internal Medicine*, *23*(5), 561-566. doi:10.1007/s11606-008-0520-5

Dye, B. A., Tan, S., Smith, V., Lewis, B. G., Barker, L. K., Thornton-Evans, G., . . . Li, C. H. (2007). Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Statistics*. *11*(248), 1-92.

Forhan, S. E., Gottlieb, S. L., Sternberg, M. R., Xu, F., Datta, S. D., McQuillan, G. M., . . . Markowitz, L. E. (2009). Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. *Pediatrics*, *124*(6), 1505-1512. doi:10.1542/peds.2009-0674

Fransen, M. P., Van Schaik, T. M., Twickler, T. B., & Essink-Bot, M. L. (2011). Applicability of internationally available health literacy measures in the Netherlands. *Journal of Health Communications*, *16*(Suppl. 3), 134-149. doi:10.1080/10810730.2011.604383

Gazmararian, J. A., Baker, D. W., Williams, M. V., Parker, R. M., Scott, T. L., Green, D. C., . . . Koplan, J. P. (1999). Health literacy among Medicare enrollees in a managed care organization. *The Journal of the American Medical Association*, *281*(6), 545-551.

Hofstra, M. B., Van der Ende, J., & Verhulst, F. C. (2002). Pathways of self-reported problem behaviors from adolescence into adulthood.

American Journal of Psychiatry, *159*(3), 401-407. doi:10.1176/appi.ajp.159.3.401

Jackson, K. M., & Schulenberg, J. E. (2013). Alcohol use during the transition from middle school to high school: National panel data on prevalence and moderators. *Developmental Psychology*, *49*(11), 2147-2158. doi:10.1037/a0031843

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2006). *Monitoring the future: National survey results on drug use, 1975-2005*. Retrieved from Monitoring the Future website: http://www.monitoringthefuture.org/pubs/monographs/vol1_2006.pdf

Kim-Cohen, J., Caspi, A., Moffitt, T. E., Harrington, H., Milne, B. J., & Poulton, R. (2003). Prior juvenile diagnoses in adults with mental disorder: Developmental follow-back of a prospective-longitudinal cohort. *Archives of General Psychiatry*, *60*(7), 709-717. doi:10.1001/archpsyc.60.7.709

Kobayashi, L. C., Wardle, J., Wolf, M. S., & von Wagner, C. (2016). Aging and functional health literacy: A systematic review and meta-analysis. *Journals of Gerontology. Series B: Psychological Sciences and Social Sciences*, *71*(3), 445-457. doi:10.1093/geronb/gbu161

Koster, E. S., Philbert, D., & Bouvy, M. L. (2015). Health literacy among pharmacy visitors in the Netherlands. *Pharmacoepidemiology and Drug Safety*, *24*(7), 716-721. doi:10.1002/pds.3803

Levin-Zamir, D., Baron-Epel, O. B., Cohen, V., & Elhayany, A. (2016). The association of health literacy with health behavior, socioeconomic indicators, and self-assessed health from a national adult survey in Israel. *Journal of Health Communications*, *21*(Suppl. 2), 61-68. doi:10.1080/10810730.2016.1207115

Lindau, S. T., Tomori, C., Lyons, T., Langseth, L., Bennett, C. L., & Garcia, P. (2002). The association of health literacy with cervical cancer prevention knowledge and health behaviors in a multiethnic cohort of women. *American Journal of Obstetrics and Gynecology*, *186*(5), 938-943.

Mantwill, S., Monestel-Umana, S., & Schulz, P. J. (2015). The relationship between health literacy and health disparities: A systematic review. *PLoS One*, *10*(12), e0145455. doi:10.1371/journal.pone.0145455

Martin, J. A., Hamilton, B. E., Osterman, M. J., Driscoll, A. K., & Mathews, T. (2017). Births: Final data for 2015. *National Vital Statistics Reports*, 66(1), 1.

Mörath, V. (2015). *The Ghanaian diaspora in Germany*. Retrieved from Deutsche Gesellschaft für Internationale Zusammenartbeit (GIZ) website: https://www.giz.de/fachexpertise/downloads/giz2016-en-ghana-diaspora.pdf

Ogden, C. L., Carroll, M. D., Fryar, C. D., & Flegal, K. M. (2015). *Prevalence of obesity among adults and youth: United States, 2011-2014*. Retrieved from the Centers for Disease Control and Prevention website: https://www.cdc.gov/nchs/data/databriefs/db219.pdf

Office for National Statistics. (2017). *Population of the UK by country of birth and nationality*. Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/datasets/populationoftheunitedkingdombycountryofbirthandnationality

Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T., & Rudd, R. R. (2005). The prevalence of limited health literacy. *Journal of General Internal Medicine*, *20*(2), 175-184. doi:10.1111/j.1525-1497.2005.40245.x

Pander Maat, H., Essink-Bot, M. L., Leenaars, K. E., & Fransen, M. P. (2014). A short assessment of health literacy (SAHL) in the Netherlands. *BMC Public Health*, *14*, 990. doi:10.1186/1471-2458-14-990

Sansom-Daly, U. M., Lin, M., Robertson, E. G., Wakefield, C. E., McGill, B. C., Girgis, A., & Cohn, R. J. (2016). Health literacy in adolescents and young adults: An updated review. *Journal of Adolescent and Young Adult Oncology*, *5*(2), 106-118. doi:10.1089/jayao.2015.0059

Sentell, T., & Braun, K. L. (2012). Low health literacy, limited English proficiency, and health status in Asians, Latinos, and other racial/ethnic groups in California. *Journal of Health Communication*, *17*(Suppl. 3), 82-99. doi:10.1080/10810730.2012.712621

Snijder, M. B., Galenkamp, H., Prins, M., Derks, E. M., Peters, R. J., Zwinderman, A. H., & Stronks, K. (2017). Cohort profile: The Healthy Life in an Urban Setting (HELIUS) study in Amsterdam, the Netherlands. *BMJ Open*, *7*(12), e017873. doi:10.1136/bmjopen-2017-017873

Statistics Netherlands. (2016). *Bevolking naar migratieachtergrond [Population by migration background]*. Retrieved from Centraal Bureau voor de Statistiek website: https://www.cbs.nl/nl-nl/achtergrond/2016/47/bevolking-naar-migratieachtergrond

Stevens, G. W. J. M., Pels, T. V. M., Vollebergh, W. A. M., & Crijnen, A. A. M. (2004). Patterns of psychological acculturation in adult and adolescent Moroccan immigrants living in the Netherlands. *Journal of Cross-Cultural Psychology*, *35*(6), 689-704. doi:10.1177/0022022104270111

Stronks, K., Kulu-Glasgow, I., & Agyemang, C. (2009). The utility of 'country of birth' for the classification of ethnic groups in health research: The Dutch experience. *Ethnicity & Health*, *14*(3), 255-269. doi:10.1080/13557850802509206

Stronks, K., Snijder, M. B., Peters, R. J., Prins, M., Schene, A. H., & Zwinderman, A. H. (2013). Unravelling the impact of ethnicity on health in Europe: The HELIUS study. *BMC Public Health*, *13*, 402. doi:10.1186/1471-2458-13-402

Sudore, R. L., Yaffe, K., Satterfield, S., Harris, T. B., Mehta, K. M., Simonsick, E. M., . . . Schillinger, D. (2006). Limited literacy and mortality in the elderly: The health, aging, and body composition study. *Journal of General Internal Medicine*, *21*(8), 806-812. doi:10.1111/j.1525-1497.2006.00539.x

van der Gaag, M., van der Heide, I., Spreeuwenberg, P. M. M., Brabers, A. E. M., & Rademakers, J. J. D. J. M. (2017). Health literacy and primary health care use of ethnic minorities in the Netherlands. *BMC Health Services Research*, *17*(1), 350. doi:10.1186/s12913-017-2276-2

van der Heide, I., Rademakers, J., Schipper, M., Droomers, M., Sorensen, K., & Uiters, E. (2013). Health literacy of Dutch adults: A cross sectional survey. *BMC Public Health*, *13*, 179. doi:10.1186/1471-2458-13-179

Viner, R. (2005). Co-occurrence of adolescent health risk behaviors and outcomes in adult life: Findings from a national birth cohort. *Journal of Adolescent Health*, *36*(2), 98-99. doi:10.1016/j.jadohealth.2004.11.012

Wang, C., Li, H., Li, L., Xu, D., Kane, R. L., & Meng, Q. (2013). Health literacy and ethnic disparities in health-related quality of life among rural women: Results from a Chinese poor minority area. *Health and Quality of Life Outcomes*, *11*, 153. doi:10.1186/1477-7525-11-153

Wångdahl, J., Lytsy, P., Mårtensson, L., & Westerling, R. (2014). Health literacy among refugees in Sweden - a cross-sectional study. *BMC Public Health*, *14*, 1030. doi:10.1186/1471-2458-14-1030