Health literacy and body mass index

Journal of Public Health | Vol. 43, No. 1, pp. 123–130 | doi:10.1093/pubmed/fdz103 | Advance Access Publication November 25, 2019

Health literacy and body mass index: a population-based study in a South-Eastern European country

Ervin Toçi[1,2], Genc Burazeri[1,2], Haxhi Kamberi[3,4], Dorina Toçi[1], Enver Roshi[1], Naim Jerliu[5,6], Arjan Bregu[1], Helmut Brand[2]

[1]Department of Public Health, Faculty of Medicine, University of Medicine, Tirana 1005, Albania
[2]Department of International Health, School CAPHRI (Care and Public Health Research Institute), Maastricht University, Maastricht 6200, The Netherlands
[3]Faculty of Medicine, University of Gjakova "Fehmi Agani", Gjakova 50000, Republic of Kosovo
[4]Regional Hospital "Isa Grezda", Gjakove 50000, Republic of Kosovo
[5]Faculty of Medicine, University of Prishtina, Prishtina 10000, Republic of Kosovo
[6]National Institute of Public Health of Kosovo, Prishtina 10000, Republic of Kosovo
Address correspondence to Haxhi Kamberi, E-mail: kamberi.dr@gmail.com

ABSTRACT

Background The relationship of health literacy (HL) with objective measures including anthropometric measurements remains an under-researched topic to date.

Objective To assess the association between body mass index (BMI) and HL among Albanian adults.

Methods A cross-sectional study was conducted in Tirana, Albania, in 2012–2014 including a population-based sample of 1154 individuals aged ≥18 years. HL was assessed by the use of HLS-EU-Q instrument. Anthropometrics included measurement of weight and height based on which BMI was calculated. Information on socio-demographic characteristics was also collected. Logistic regression was employed to assess the independent association of BMI and HL controlling all socio-demographic factors.

Results One-fifth of the participants reported an inadequate HL level, whereas almost one-third (31%) reported an excellent HL level. About 41% of study participants were overweight and further 22% were obese. In multivariate analysis, there was evidence of a strong and significant association between BMI and HL: the odds of overweight/obesity were two times higher (OR = 2.0, 95% CI = 1.3–3.1) among inadequate HL individuals compared with excellent HL participants.

Conclusion Our findings, pertinent to a transitional country in the South East Europe, point to a strong, consistent and highly significant association between BMI and HL, irrespective of a wide array of socio-demographic characteristics.

Keywords Albania, body mass index, health literacy, obesity, overweight

Introduction

Health literacy (HL), the ability to use health information in order to make appropriate health decisions, is defined and measured in numerous ways.[1–4]

The interest on HL research has been triggered and boosted by the documentation of numerous associations of low HL with personal characteristics, such as race, age and education level,[1,5–9] and a wide range of poorer health outcomes, including death,[10–12] increased health care costs and utilisation,[1,10,11,13,14] defective use of prevention and promotion services,[1,10] and worse management of disease or medication handling.[15–17] In the context, when limited or inadequate HL is quite prevalent [85% among the individuals aged 15–69 in China,[18] 60% among the individuals aged 15–74 in Australia,[7] 47% among the European adult population

E. Toçi, Researcher
G. Burazeri, Professor of Epidemiology and Research Methods
H. Kamberi, Researcher
D. Toçi, Researcher
E. Roshi, Professor of Epidemiology and Research Methods
N. Jerliu, Researcher
A. Bregu, Researcher
H. Brand, Professor of European Public Health

aged ≥15,[6] or 46% among the US adults aged ≥25[8]]; research on HL and ways to effectively address it remain a priority.[19,20]

HL is also associated with lifestyle factors, including smoking, overweight and physical activity.[21] Previous studies among adults undergoing health check-ups in health care settings,[22] polycystic ovary syndrome women[23] and among children[24] have highlighted the significant negative associations between HL and body mass index (BMI).

BMI is an interesting indicator because it reflects a mixture of genetic,[25] lifestyle,[26,27] social and psychological mechanisms.[28] Higher proportions of obese people are older, have a low socio-economic status and are unemployed and also experience more unfavourable psychological health compared to non-obese persons.[28] According to the World Health Organization, overweight and obesity account for about 12–20% of deaths in the European Union and 10% of total disease burden in western and central Europe. The prevalence of overweight and obesity is increasing almost everywhere with low socio-economic groups (especially, children and women) being the most affected categories.[29]

The existing knowledge linking lifestyle factors, physical activity and diet with overweight and obesity and the role of socio-economic factors in the obesity epidemics are rather well understood.[29] Conversely, the association of HL and obesity is far less investigated.

In this context, the aim of our study was to assess the association of HL and BMI, controlling for a wide range of demographic and socio-economic characteristics in a population-based sample of adults aged ≥18 in Albania, a South-Eastern European country.

Methods

A cross-sectional study was conducted in Tirana city, the Albanian capital, during September 2012—February 2014.

Study population

The study population consisted of a population-based simple random sample of 1500 individuals aged ≥18 years, drawn from the registries of family physicians working in primary health care centres of Tirana city. Full details on the study population and the sampling procedure have been reported elsewhere.[30] On the whole, among 1302 eligible individuals, 1154 participated in the study, with a response rate of 88.6%.[30]

Data collection

Data collection consisted of administration of a structured questionnaire and anthropometric measurements.

The HL questionnaire consisted of a face-to-face interview administered by trained interviewers. HL was assessed using the original full version of the HLS-EU-Q instrument,[6] which was previously cross-culturally adapted (validated) in a population-based study carried out in Tirana in April–July 2012.[31]

The full version of HLS-EU-Q contained 47 items referring to different HL dimensions namely access, understanding, appraisal and application of health information in the context of three specific domains: health care (16 items), disease prevention (16 items) and health promotion (15 items).[6]

Anthropometrics consisted of measurement of height and weight in all study participants. Weight (with precision of 100 g) was measured on a calibrated beam balance. For all study participants, measurement of weight was performed in light clothing and without shoes. Conversely, height (with precision of 1 mm) was measured using a tape attached to the wall with subjects not wearing shoes. BMI was calculated based on weight and height of participants. In the analysis, BMI was trichotomised into: normal weight (BMI ≤ 25), overweight (BMI: 25.1–29.9) and obesity (BMI ≥ 30), and subsequently dichotomised into: overweight/obese versus normal weight.

In addition, information on a wide array of socio-demographic and socio-economic characteristics was collected for all study participants, including data on age (in the analysis, categorised into: ≤ 25, 26–45, 46–65 and ≥ 66 years), sex (men versus women), marital status (in the analysis, dichotomised into: married versus single, divorced and widowed), employment status (dichotomised into: unemployed versus employed and/or retired), educational attainment (0–8, 9–12 and ≥ 13 years), economic status (trichotomised into: very bad/bad, average and good/very good) and social status (low, middle and high).

All participants signed an informed consent form after being explained the aims and procedures of the survey. The study was approved by the Albanian Committee of Bio-Medical Ethics.

Statistical analysis

Each of the HL items assessed the self-perceived difficulty of performing selected health-related tasks on a 4-point scale ranging from very easy (one) to very difficult (four).[6] The items' coding was reversed so that higher scores would indicate better HL.[6] Subsequently, for each domain, a summary score was calculated based on scores of the respective items, and a general health index (comprising the scores of all 47 items) was also calculated. Next, the four resulting scores (general HL index, health care HL, disease prevention HL and

health promotion HL) were standardised on a scale ranging from 0 to 50,in line with the recommendations and suggestions of the respective experts involved in the development of this instrument.[6]

Measures of central tendency and dispersion were calculated for the general HL score and BMI. Frequency distributions (absolute numbers and their respective percentages) were calculated for the HL levels (inadequate, problematic, sufficient and excellent) and BMI categories (normal weight, overweight and obesity).

The chi-squared test was used to compare the distribution of HL levels (inadequate, problematic, sufficient and excellent) according to socio-demographic characteristics (age, sex, marital status, employment, education, and economic and social status) of study participants.

Binary logistic regression was used to assess the independent association of BMI (dependent variable, dichotomised into: overweight/obese versus normal weight) with HL levels (inadequate, problematic, sufficient and excellent). Age-adjusted odds ratios (ORs), their respective 95% confidence intervals (95% CIs) and *P*-values were initially calculated. Next, logistic regression models were adjusted for all demographic characteristics (age, sex and marital status). Subsequently, logistic regression models were additionally adjusted for socio-economic factors (education, employment, social status and economic status). Multivariable-adjusted ORs, their respective 95%CIs and *P*-values were calculated. All analyses met the goodness-of-fit criterion as appraised by the Hosmer-Lemeshow test.[32]

In all cases, a *P*-value of ≤ 0.05 was considered as statistically significant.

Statistical Package for Social Sciences (SPSS, version 19.0) was used for all the statistical analyses.

Results

Overall, mean age in this study population was 45.5 ± 16.4 years; 57% of participants were women; mean years of formal schooling were 12.6 years; about 82% of study participants perceived themselves as middle class, and about two-thirds (64%) reported an average economic status.[30]

Overall, mean HL score was 34.4 ± 12.0 (median: 35.8; interquartile range: 27.3–44.0) (Table 1). One-fifth of participants reported an inadequate HL level, whereas almost one-third (31%) reported an excellent HL level. Mean BMI was 26.8 ± 4.8 (median: 26.3; interquartile range: 23.6–29.4). About 41% of study participants were overweight (BMI: 25.1–29.9) and further 22% were obese (BMI ≥ 30) (Table 1).

An excellent HL level was significantly higher in women than in men (34 versus 27%, respectively; $P = 0.02$) (Table 2).

Table 1 Distribution of general health literacy score and BMI among study participants

Variable	*Value*
General health literacy score	
Mean	34.4
Standard deviation	12.0
Median	35.8
Interquartile range	27.3–44.0
General health literacy level [n (%)][a]	
Inadequate	224 (20.4)
Problematic	234 (21.4)
Sufficient	299 (27.3)
Excellent	339 (30.9)
BMI	
Mean	26.8
Standard deviation	4.8
Median	26.3
Interquartile range	23.6–29.4
BMI category [n (%)]	
Normal weight (BMI ≤ 25)	428 (37.1)
Overweight (BMI: 25.1–29.9)	472 (40.9)
Obese (BMI ≥ 30)	254 (22.0)

[a]Discrepancies in the totals are due to the missing values.

Conversely, an inadequate HL level was considerably higher among older participants (≥66 years) compared to the other age-groups ($P < 0.01$). Similarly, the level of inadequate HL was substantially higher among the low-educated category, participants form the low social class and those belonging to a lower economic status (all $P < 0.01$). There was evidence of a gradient relationship with BMI: the level of inadequate HL was the highest among the obese individuals and the lowest among their normal weight counterparts (31 versus 11%, respectively), whereas the level of excellent HL was the lowest among the obese individuals and the highest among those with normal weight (24 versus 40%, respectively; overall $P < 0.001$) (Table 2).

In age-adjusted models (Table 3, model 1), there was evidence of a strong association between BMI (dichotomised into: overweight/obese versus normal weight) and HL: the odds of overweight/obesity were 2.5 times higher (OR = 2.5, 95% CI = 1.6–3.8) among inadequate HL individuals compared with excellent HL participants. Additional adjustment for the other demographic characteristics (model 2) attenuated somehow the estimates (OR = 2.2, 95% CI = 1.4–3.3). Upon adjustment for all demographic characteristics and socio-economic factors (model 3), the association was

Table 2 Distribution of health literacy levels by socio-demographic characteristics of study participants

Variable	*Total*	*Health literacy*				*P*
		Inadequate	*Problematic*	*Sufficient*	*Excellent*	
Gender						
Men	471(43.0)[a]	88(18.7)[a]	108(22.9)	146(31.0)	129(27.4)	0.021[b]
Women	625(57.0)	136(21.8)	126(20.2)	153(24.5)	210(33.6)	
Age group						
≤25 years	163(14.9)	11(6.7)	45(27.6)	55(33.7)	52(31.9)	<0.001
26–45 years	323(29.5)	39(12.1)	60(18.6)	91(28.2)	133(41.2)	
46–65 years	470(42.9)	98(20.9)	102(21.7)	129(27.4)	141(30.0)	
≥66 years	140(12.8)	76(54.3)	27(19.3)	24(17.1)	13(9.3)	
Educational level						
0–8 years	141(12.9)	72(51.1)	24(17.0)	24(17.0)	21(14.9)	<0.001
9–12 years	572(52.2)	117(20.5)	117(20.5)	151(26.4)	187(32.7)	
≥13 years	383(34.9)	35(9.1)	93(24.3)	124(32.4)	131(34.2)	
Employment status						
Unemployed	211(19.6)	48(22.7)	58(27.5)	48(22.7)	57(27.0)	0.042
Employed and/or retired	865(80.4)	171(19.8)	174(20.1)	246(28.4)	274(31.7)	
Marital status						
Not married[c]	380(35.0)	73(19.2)	81(21.3)	107(28.2)	119(31.3)	0.881
Married	707(65.0)	150(21.2)	150(21.2)	190(26.9)	217(30.7)	
Social status						
Low	96(9.2)	39(40.6)	22(22.9)	18(18.8)	17(17.7)	<0.001
Middle	863(82.3)	171(19.8)	193(22.4)	238(27.6)	261(30.2)	
High	89(8.5)	7(7.9)	10(11.2)	26(29.2)	46(51.7)	
Economic status						
Very bad/bad	134(12.7)	44(32.8)	42(31.3)	26(19.4)	22(16.4)	<0.001
Average	668(63.3)	148(22.2)	139(20.8)	175(26.2)	206(30.8)	
Good/very good	253(24.0)	27(10.7)	46(18.2)	78(30.8)	102(40.3)	
BMI						
Normal	400(36.5)	45(11.3)	78(19.5)	119(29.8)	158(39.5)	<0.001
Overweight	453(41.3)	104(23.0)	104(23.0)	121(26.7)	124(27.4)	
Obese	243(22.2)	75(30.9)	52(21.4)	59(24.3)	57(23.5)	

[a]Absolute numbers and percentages in parentheses (row percentages for the health literacy categories, but column percentages for the totals). Discrepancies in the total numbers are due to the missing values.

[b]*P*-values from the chi-squared test.

[c]Single, divorced and widowed.

attenuated further but, nevertheless, it remained strong and statistically significant (OR = 2.0, 95% CI = 1.3–3.1).

Discussion

Main findings of this study

Salient findings of our study included a remarkably strong and highly significant association between BMI and HL in this population-based sample of adult men and women in a transitional South-Eastern European country undergoing deep and intensive reforms in the past decades. The association between BMI and HL was consistent in different models and persisted in logistic regression models even upon multivariable adjustment for a full range of demographic characteristics and socio-economic factors.

Inadequate HL levels were considerably higher among vulnerable and disadvantaged population categories including older people and the low socio-economic groupings distinguished either by a lower educational attainment, income level

Table 3 Association of HL with BMI; multivariable-adjusted odds ratios (ORs: obese/overweight versus normal weight) from binary logistic regression

Model	*OR*	*95%CI*	*P*
Model 1[b]			<0.001 (3)[a]
Health literacy			
Inadequate	2.46	1.60–3.78	<0.001
Problematic	1.76	1.21–2.56	0.003
Sufficient	1.32	0.94–1.85	0.108
Excellent	1.00	Reference	—
Model 2[c]			0.002 (3)
Health literacy			
Inadequate	2.17	1.42–3.31	<0.001
Problematic	1.60	1.10–2.32	0.014
Sufficient	1.23	0.87–1.73	0.230
Excellent	1.00	Reference	—
Model 3[d]			0.015 (3)
Health literacy			
Inadequate	1.98	1.27–3.10	0.003
Problematic	1.55	1.05–2.29	0.028
Sufficient	1.38	0.96–1.97	0.079
Excellent	1.00	Reference	—

[a]Overall *P*-value and degrees of freedom (in parentheses).

[b]Age-adjusted.

[c]Adjusted for all demographic characteristics (age, sex and marital status).

[d]Adjusted for all demographic characteristics and socio-economic factors (education, employment, social status and economic status).

or social status. Surprisingly though, an excellent HL level was found to be more prevalent in women than in men in this sample of Albanian adults.

What is already known on this topic

The inverse association between HL and BMI is compatible with previous reports, in different populations and using different HL instruments.[6,21–24,33,34] For example, a population-based study among individuals aged 18–93 years in Portugal, using the validated Portuguese version of HLS-EU-Q, reported a significant inverse association between BMI and HL, with inadequate HL individuals having higher BMI index and those with excellent BMI exhibiting lower BMI index.[33] The Portugal study also reported a negative association of HL with age and positive associations with education, economic and social status,[33] similarly to our results. Another population-based study among 713 women, using the Health Literacy Questionnaire instrument, reported that low HL was significantly associated with unhealthy behaviours such as smoking and sedentary lifestyle and higher BMI.[34] The HL survey in eight European countries found significant inverse association of HL and BMI only in Greece and Austria, but an overall weak negative and significant association.[6]

The inverse association between Hl and BMI would be suggestive of more advantageous lifestyle and/or nutrition patterns in high HL individuals. The EPIC study, a multicentre population-based prospective cohort study conducted in 10 European countries found a significant negative association between BMI and education and the association held true regardless of smoking and alcohol intake.[35] The authors argued that differences in energy intake and physical activity across different socio-economic status (SES) categories might explain a part of this association, even though energy intake did not differ strongly among education levels in EPIC study,[35] suggesting complex interactions. On the other hand, education is indicative of SES status and low education could negatively affect diet and physical activity patterns, thus affecting overweight and obesity.[35] Given the strong significant positive association of HL and education[1,5–9] and the significant association of education and BMI, it is likely that HL could be a predictor of BMI as well.

In addition, the negative association between HL and BMI could be affected by the presence of chronic conditions, in the context when the prevalence of chronic diseases increases with increased BMI[36,37]; the increased BMI is usually indicative of shorter healthy and chronic disease-free life expectancy[38] and the likelihood of low HL is higher among persons with chronic conditions.[39] Even though we did not address the presence of chronic conditions in the actual study, this could be partly explaining the observed association between HL and BMI.

Interestingly, we found that higher proportions of women have excellent HL (and inadequate HL, too) compared to men. These results find some support in international literature. A study assessing the role of education in HL during the life course reported that 60.3% of women and 52.6% of men had high HL and the difference was significant.[40] In this case, the difference was explained by the use of a specific HL instrument with the questions of which (including food labelling) women might have been more familiar than men, whereas gender differences in education attainment did not play a significant role.[40] Another study reported that women had a significantly higher level of HL regarding 'understanding and filling out medical forms, understanding directions of medication bottles and understanding written information provided by health care professionals', compared to men.[41] The authors argued that the higher literacy level among women could be attributed to their higher familiarity in navigating the health care system due to more health issues they experience

compared to men and the higher engagement in looking after family members, including children and the elderly.[41] Related to this aspect, another study on the actual sample of individuals reported that in women, the independent variable most strongly associated with HL was age whereas in men it was education.[30] This finding further supports the idea that women's experience and frequent contacts with the health care system could play a major role in their HL literacy levels.

Being in a marriage union might expose women to everyday tasks and responsibilities, including health problems, and therefore men rely on their spouses for addressing health issues, subsequently being reflected in less engagement of men with health care system and lower HL, suggesting that marriage does not increase men's level of HL.[41]. Such association between marital status and HL is also noted in our study, with higher proportions of married individuals exhibiting inadequate HL, although the difference is not significant. In Albania, although the communist regime was overthrown about three decades ago and the country has since been open up to democracy and free market, the society is still predominantly patriarchal and women are mainly assigned the domestic sphere responsibilities, imposing greater role in taking care of children, elderly and other family members, including health problems and implying more contacts with the health care system.[42] This could explain the higher prevalence of excellent HL among women in our study. The association between marital status and HL, nevertheless, remains controversial.[43–46]

On the other hand, the prevalence of inadequate HL was also higher among women than men in our sample, similar to other studies from Albanian speaking settings.[47]. According to a study among primary care users aged 18 years and older in Kosovo, men and women had similar mean functional HL scores but women were more likely to report inadequate HL, and this was explained by the significantly lower education of women in Kosovo.[47] The finding in Albania could be again partly explained by the patriarchal nature of the Albanian society, still impeding certain groups of women towards empowerment and self-fulfilment. In any case, this finding from our study needs further investigation in the future.

What this study adds

In the present study, we found that BMI and HL are strongly and inversely correlated, even after controlling various socio-demographic and socio-economic factors. Women exhibit different patterns of BMI-HL association compared to men, suggesting for complex social interactions. To the best of our knowledge this is the first time that HL is evaluated against objective measures, such as BMI, in a full-scale population-based study in Albania.

Limitations of this study

There may be several potential limitations of our study including the possibility of selection bias, information bias, as well as the cross-sectional design. Overall, we obtained a high response rate in our sample (89%). However, non-respondents were slightly younger than study participants in both sexes. Also, our study was restricted only in Tirana city and, therefore, findings from this study may not necessarily be representative to the overall Albanian adult population. BMI was objectively assessed by measuring height and weight employing a strict protocol among all study participants, which is comforting. Furthermore, our measuring instrument for HL was based on a well-established and standardised instrument[6] previously validated in Albania,[31] which is reassuring. Seemingly, there is no reason to assume a differential reporting of HL between normal weight individuals and their overweight and/or obese counterparts. Nonetheless, we cannot entirely exclude the possibility of information bias in our study, especially regarding the self-reporting of different socio-economic indicators including economic status and social status. Finally, associations observed from cross-sectional studies are not assumed to be causal. Hence, the association between HL and BMI should be assessed in future prospective studies in Albania and elsewhere in order to determine properly the sequence of events.

Conclusion

In conclusion, our findings, pertinent to a transitional country in the Western Balkans, point to a strong, consistent and highly significant association between BMI and HL, irrespective of a wide array of socio-demographic characteristics.

Future studies should further examine the independent association of HL with anthropometric measurements and other objective measures in order to provide valuable clues for intervention at a population level.

Conflicts of interest

None declared.

Authors' contribution

ET, GB, HK, DT and HB contributed to the study conceptualisation and design, analysis and interpretation of the data and writing of the article. ER, NJ and AB commented comprehensively on the manuscript. All authors have read and approved the submitted manuscript.

References

1 Sørensen K, Van den Broucke S, Fullam J *et al.* Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health* 2012;**12**:80.

2 Ratzan SC. Health literacy: communication for the public good. *Health Promot Int* 2001;**16**(**2**):207–14.

3 van der Heide I, Wang J, Droomers M *et al.* The relationship between health, education, and health literacy: results from the Dutch adult literacy and life skills survey. *J Health Commun* 2013;**18**(**Suppl 1**):172–84.

4 Altin SV, Finke I, Kautz-Freimuth S *et al.* The evolution of health literacy assessment tools: a systematic review. *BMC Public Health* 2014;**14**:1207.

5 Protheroe J, Whittle R, Bartlam B *et al.* Health literacy, associated lifestyle and demographic factors in adult population of an English city: a cross-sectional survey. *Health Expect* 2017;**20**(**1**):112–9.

6 HLS-EU Consortium. Comparative report of health literacy in eight EU member states. The European Health Literacy Survey HLS-EU. (Second revised and extended version, date July 22th, 2014). http://www.heatlh-literacy.eu (16 September 2018, date last accessed).

7 Adult Literacy and Life Skills Survey. Summary Results. Australian Bureau of Statistics. 2006 (Reissue). https://www.ala.asn.au/wp-content/uploads/research/ADULT_LITERACY_AND_LIFE_SKILLS.pdf (17 September 2018, date last accessed).

8 Paasche-Orlow MK, Parker RM, Gazmararian J *et al.* The prevalence of limited health literacy. *J Gen Intern Med* 2005;**20**(**2**):175–84.

9 Eneanya ND, Olaniran K, Xu D *et al.* Health literacy mediates racial disparities in cardiopulmonary resuscitation knowledge among chronic kidney disease patients. *J Health Care Poor Underserved* 2018;**29**(**3**):1069–82.

10 Institute of Medicine. *Health Literacy: A Prescription to End Confusion*. Washington, DC, The National Academies, 2004.

11 Berkman ND, Sheridan SL, Donahue KE *et al.* Health literacy interventions and outcomes: an updated systematic review. *Evid Rep Technol Assess (Full Rep)* 2011;**199**:1–941.

12 Bush R, Boyle F, Ostini R *et al.* Advancing health literacy through primary health care systems. Australian Primary Health Care Research Institute, 2010. https://openresearch-repository.anu.edu.au/bitstream/1885/119189/1/Bush_Health_literacy_final_report.pdf (16 September 2018, date last accessed).

13 Baker DW, Gazmararian JA, Williams MV *et al.* Health literacy and use of outpatient physician services by Medicare managed care enrollees. *J Gen Intern Med* 2004;**19**(**3**):215–20.

14 Mitchell SE, Sadikova E, Jack BW, Paasche-Orlow MK. Health literacy and 30-day postdischarge hospital utilization. *J Health Commun* 2012;**17**(**Suppl 3**):325–38.

15 Gazmararian JA, Williams MV, Peel J, Baker DW. Health literacy and knowledge of chronic disease. *Patient Educ Couns* 2003;**51**(**3**):267–75.

16 Lenahan JL, McCarthy DM, Davis TC *et al.* A drug by any other name: patients' ability to identify medication regimens and its association with adherence and health outcomes. *J Health Commun* 2013;**18**(**Suppl 1**):31–9.

17 Niknami M, Mirbalouchzehi A, Zareban I *et al.* Association of health literacy with type 2 diabetes mellitus self-management and clinical outcomes within the primary care setting of Iran. *Aust J Prim Health* 2018;**24**(**2**):162–70.

18 Wu Y, Wang L, Cai Z *et al.* Prevalence and risk factors of low health literacy: a community-based study in Shanghai, China. *Int J Environ Res Public Health* 2017;**14**(**6**):E628.

19 McDaid D. Investing in health literacy: What do we know about the co-benefits to the education sector of actions targeted at children and young people? Policy Brief 19. World Health Organization. 2016. http://www.euro.who.int/__data/assets/pdf_file/0006/315852/Policy-Brief-19-Investing-health-literacy.pdf (19 September2018, date last accessed).

20 Poureslami I, Nimmon L, Rootman I, Fitzgerald MJ. Health literacy and chronic disease management: drawing from expert knowledge to set an agenda. *Health Promot Int* 2017;**32**(**4**):743–54.

21 Jayasinghe UW, Harris MF, Parker SM *et al.* The impact of health literacy and life style risk factors on health-related quality of life of Australian patients. *Health Qual Life Outcomes* 2016;**14**:68.

22 Cheng YL, Shu JH, Hsu HC *et al.* High health literacy is associated with less obesity and lower Framingham risk score: sub-study of the VGH-HEALTHCARE trial. *PLoS One* 2018;**13**(**3**):e0194813.

23 Al-Ruthia YS, Balkhi B, AlGhadeer S *et al.* Relationship between health literacy and body mass index among Arab women with polycystic ovary syndrome. *Saudi Pharm J* 2017;**25**(**7**):1015–8.

24 Sharif I, Blank AE. Relationship between child health literacy and body mass index in overweight children. *Patient Educ Couns* 2010;**79**(**1**):43–8.

25 Silventoinen K, Jelenkovic A, Sund R *et al.* Genetic and environmental effects on body mass index from infancy to the onset of adulthood: an individual-based pooled analysis of 45 twin cohorts participating in the COllaborative project of development of anthropometrical measures in twins (CODATwins) study. *Am J Clin Nutr* 2016;**104**(**2**):371–9.

26 Gutiérrez-Pliego LE, Camarillo-Romero Edel S, Montenegro-Morales LP *et al.* Dietary patterns associated with body mass index (BMI) and lifestyle in Mexican adolescents. *BMC Public Health* 2016;**16**(**1**):850.

27 Jean-Luc Gradidge P, Cohen E. Body mass index and associated lifestyle and eating behaviours of female students at a South African University. *South Afr J Clin Nutr* 2018;**31**(**4**):89–91.

28 Marcellini F, Giuli C, Papa R *et al.* Obesity and body mass index (BMI) in relation to life-style and psycho-social aspects. *Arch Gerontol Geriatr* 2009;**49**(**Suppl 1**):195–206.

29 Loring B, Robertson A. Obesity and inequities. Guidance for addressing inequities in overweight and obesity. World Health Organization, 2014. http://www.euro.who.int/__data/assets/pdf_file/0003/247638/obesity-090514.pdf (20 September 20 2018, date last accessed).

30 Toci E, Burazeri G, Myftiu S *et al.* Health literacy in a population-based sample of adult men and women in a south eastern European country. *J Public Health (Oxf)* 2016;**38**(**1**):6–13.

31 Bregu A, Toci E, Rrumbullaku L *et al.* Prevalence of diabetes mellitus in a population-based sample of adults in Tirana, Albania. *Br J Med Med Res* 2014;**4**(**3**):852–61.

32 Hosmer D, Lemeshow S. *Applied Logistic Regression*. New York, Wiley & Sons, 1989.

33 Cunha M, Gaspar R, Fonseca S *et al.* Implications of literacy for health for body mass index. *Aten Primaria* 2014;**46**(**Suppl 5**):180–6.

34 Hosking SM, Brennan-Olsen SL, Beauchamp A *et al.* Health literacy in a population-based sample of Australian women: a cross-sectional profile of the Geelong Osteoporosis Study. *BMC Public Health* 2018;**18**(**1**):876.

35 Hermann S, Rohrmann S, Linseisen J *et al.* The association of education with body mass index and waist circumference in the EPIC-PANACEA study. *BMC Public Health* 2011;**11**:169.

36 Toci E, Burazeri G, Jerliu N *et al.* Health literacy, self-perceived health and self-reported chronic morbidity among older people in Kosovo. *Health Promot Int* 2015;**30**(**3**):667–74.

37 Kearns K, Dee A, Fitzgerald AP *et al.* Chronic disease burden associated with overweight and obesity in Ireland: the effects of a small BMI reduction at population level. *BMC Public Health* 2014;**14**:143.

38 Stenholm S, Head J, Aalto V *et al.* Body mass index as a predictor of healthy and disease-free life expectancy between ages 50 and 75: a multicohort study. *Int J Obes* 2017;**41**(**5**):769–75.

39 Friis K, Lasgaard M, Osborne RH *et al.* Gaps in understanding health and engagement with healthcare providers across common long-term conditions: a population survey of health literacy in 29,473 Danish citizens. *BMJ Open* 2016;**6**(**1**):e009627.

40 Clouston SAP, Manganello JA, Richards M. A life course approach to health literacy: the role of gender, educational attainment and lifetime cognitive capability. *Age Ageing* 2017;**46**(**3**):493–9.

41 Lee HY, Lee J, Kim NK. Gender differences in health literacy among Korean adults: do women have a higher level of health literacy than men? *Am J Mens Health* 2015;**9**(**5**):370–9.

42 Lerch M. Patriarchy and fertility in Albania. *Demogr Res* 2013;**29**(**6**):133–6.

43 Gazmararian JA, Parker RM, Baker DW. Reading skills and family planning knowledge and practices in a low-income managed-care population. *Obstet Gynecol* 1999;**93**(**2**):239–44.

44 Jovic-Vranes A, Bjegovic-Mikanovic V. Which women patients have better health literacy in Serbia? *Patient Educ Couns* 2012;**89**(**1**):209–12.

45 Jović-Vraneš A, Bjegović-Mikanović V, Marinković J *et al.* Evaluation of a health literacy screening tool in primary care patients: evidence from Serbia. *Health Promot Int* 2014;**29**(**4**):601–7.

46 Liu Y, Wang Y, Liang F *et al.* The health literacy status and influencing factors of older population in Xinjiang. *Iran J Public Health* 2015;**44**(**7**):913–9.

47 Toçi E, Burazeri G, Kamberi H *et al.* Socio-economic correlates of functional health literacy among patients of primary health care in Kosovo. *Public Health* 2014;**128**(**9**):842–8.