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Associations between health literacy proficiencies and health-related quality of life and GP visits among young people in Norway: a population-based cross-sectional study

Christopher Le ,[1] Øystein Guttersrud,[2] Pål Joranger,[3] Orkan Okan,[4] Hanne Søberg Finbråten[1]

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For numbered affiliations see end of article.

Correspondence to
Dr Christopher Le;
christopher.le@inn.no

ABSTRACT

Objectives Despite globally increased attention from policymakers and being recognised as a critical determinant of health, health literacy (HL) research in young people (YP) remains limited. This study aims to describe HL in YP across person factors and explore the associations between HL and health-related quality of life (HRQoL) and the number of visits to general practitioners (GP visits).

Design Cross-sectional study.

Setting Population-based data collection applying country representative strata in Norway.

Participants 890 participants aged 16–25 years.

Primary and secondary measures Rasch modelling and Wright's method were used to identify statistically distinct levels of HL proficiency. Multiple linear regression and negative binomial regression models were applied to explore the associations between HL and HRQoL, and between HL and GP visits, respectively.

Results Among YP, HL was statistically significantly associated with HRQoL and the number of GP visits, when adjusting for age, gender, education, self-perceived social status and financial deprivation. For every logit increase in HL, the number of GP visits decreased by 22%. Four statistically distinct levels of HL proficiency were identified for the 12-item HLS_{19}-YP12 scale, started from a cut-point of 23, 30, 37 and 44 out of 48. Relatedly, 70% of respondents were observed at or below level 2 (30–36 points), indicating a varying lack of central skills. The span from lowest (1) to highest (4) HL level was associated with a decrease of 2.1 GP visits per year and an increase of .12 on the EQ-5D index.

Conclusions This study provides new empirical insights into the impact of HL in YP. Identified cut-points for the HLS_{19}-YP12 may contribute to simplifying the process of adapting information and communication for various HL skills. The study also suggests the need for more efforts in HL policy and structural intervention development to enhance YP health and well-being.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Population-based country representative data were used in this study.
⇒ The predictive margins of health-related quality of life and general practitioner-visits by health literacy in young people (YP) were calculated and graphically presented.
⇒ The EuroQol Group's instrument (EQ-5D-3L) UK crosswalk value set for Norway was used to calculate the EQ-5D-5L index. This may lead to an artificial floor effect on the values of 5L model.
⇒ The cut-points for the HLS_{19}-YP12 scale have been defined exclusively based on the national data as multi-national data is not available.

INTRODUCTION

In recent years, there has been a considerable growth of awareness among policymakers concerning the importance of enhancing and supporting the population's ability to cope with their health: in terms of increasing population health literacy (HL).[1–3] Following Sørensen *et al*'s definition,[4] 'HL is linked to literacy and entails people's knowledge, motivation and competences to access, understand, appraise and apply health information in order to make judgements and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course'. Worldwide, relatively large proportions of the population could be considered having low HL,[1 5–7] and low HL is often associated with worse health outcomes[8] and more use of healthcare services.[8–10]

Single studies have demonstrated that limited HL is a significant challenge among young people (YP).[11 12] Although the knowledge about YP's HL has increased during the last decade,[13 14] many of the studies investigated HL indirectly and through the HL of their peers and caregivers.[15] Existing knowledge points to associations between HL and

health behaviour[16] and health outcomes[17] in YP. However, most studies on HL among adolescents and YP have been limited to measuring functional HL. To get an insight into HL in YP in a broader perspective reflecting, the definition of Sørensen *et al*[4] application of more comprehensive measurements is needed.

In terms of HL measurement, the HLS_{19}-YP12[18] was recently established for measuring generic HL among YP. However, there is a need for identifying statistically distinct levels of HL proficiency and associated cut-points[19]; it will provide a more precise description of what people by different HL proficiencies most likely know and are able to do relative to the item content (skills) in the measurement scale.[20] United Nations defines YP as those between 15 and 24 years of age,[21] which could be used without prejudice to other definitions by Member states. In the recent study, data included people aged 16 years and older. In Norway, many health clinics for adolescents (13–20 years) provide services to persons up to 25 years of age, for instance, in the Bergen municipality.[22] Hence, our study refers to 'YP' for 16–25 age range, in order to include both adolescents and young adults up to 25 years old.

HL is recognised as a critical determinant of health,[23] influencing people's health status, access to and use of health services. In the Vienna Model of Health Literacy,[24] 'health status' in terms of health-related quality of life (HRQoL) and 'illness behaviour' in terms of the extent of health service utilisation–for instance, general practitioner (GP) visits, among others can be influenced by individual HL. Measuring HL, therefore, must take into consideration the skills or abilities that reflect the individuals' HL in different health-related situations, for example, ability to access the health services.[25]

According to the International Health Literacy Survey 2019–2020 (HLS_{19}) measuring HL in adult populations in 17 WHO European member states in 2020–2021,[1] a social gradient for HL was demonstrated to a differing degree for all participating countries. HL varied across genders and levels of age, education, self-perceived social status and financial deprivation. Similar results were found for self-perceived health, limitations in activities due to health problems and long-term illness, whereas the international HLS_{19} survey indicated that higher HL was associated with lower health service utilisation, such as fewer visits to GP,[1] the Norwegian HLS_{19} survey also collected data on HRQoL and identified a positive covariance between HRQoL and population HL.[26] Norwegian studies point at systematic differences in living conditions and quality of life among YP, that YP struggles increase with growing social and economic problems in families,[27–29] and that growing up in high-income families is associated with increased participation in sports and organised leisure activities.[30] YP have the right to reach their full health potential, which includes a better state of HRQoL as possible, regardless of their ethnic, social status, socioeconomic status[31] and HL proficiency. Research among Norwegian adolescents showed that HRQoL is negatively associated with loneliness, stress and pain, while positively associated with self-efficacy, and self-esteem.[32–34] Moreover, HRQoL was reported in a number of studies lower for girls than boys early in adolescence.[32 35–40] However, one study revealed no difference in HRQoL between genders among high school students.[41] Although previous research has found that higher HL correlates positively with HRQoL in YP,[42–44] different HL assessment tools of various quality have been used. Nevertheless, no unidimensional HL scale, based on a conceptual framework, measuring YP's generic HL has been used: particularly, in relation to HRQoL measured by the EuroQol Group's instrument (EQ-5D-5L scale).

In several Western European healthcare systems, and particularly in Norway, the patient's role has been redefined expecting patients to take more active part in his/her care and decision-making.[45] By introducing the concept 'patient's health service',[3] which is somewhat similar to the concept 'patient-centred care',[46] the role of the patient in the Norwegian healthcare system shifted from being a patient who just receives treatments to an active user of healthcare services, who is partially accountable for the treatments received. Relatedly, the concept is understood relative to the WHO's recognition[47] of the active and participatory patient role necessary for improving the quality and efficiency of healthcare. The Organisation for Economic Co-operation and Development[48] also recognised individuals becoming partners in coproduction of their own health, in order to optimise the quality of interaction between individuals and health services and enable them to make informed decisions about care that they receive. In many Western countries, this also applies to YP from the age of 16; as they are expected to take responsibility for health on their own at this age.[49] Although there is still limited knowledge on the relationship between YP's HL and GP service utilisation, Berens *et al*[11] have demonstrated that HL is negatively associated with the number of GP visits among YP. More studies on this topic are, therefore, necessary for strengthening the evidence concerning the degree to which HL has an impact on YP's use of GP services.

To summarise, reliable knowledge on HL among YP is still scarce.[18 50 51] There is also a lack of empirically defined cut-points determining the statistically distinct levels of HL proficiency, concerning any of the existing HL instruments applied to YP. To our best knowledge, research is still very limited in exploring YP's generic HL in association with HRQoL and GP visits. While the overall research objective of this study is to investigate HL among YP in Norway, the study team will explore the following research questions:

1. What are the HL levels among YP aged 16—25 across levels of person factors?
2. What are the statistically distinct levels of HL proficiency and their distribution as well as their cut-points for the HLS_{19}-YP12 scale?
3. How is HL associated with HRQoL and GP visits? And finally;

4. How are HL levels related to HRQoL and GP visits, adjusted for relevant covariates and sociodemographic factors?

MATERIALS AND METHODS

Sampling and data collection

This nation-wide cross-sectional study, with a sample of 890 participants, was based on Norwegian data taken from the HLS 2019–2021 (HLS_{19}).[26] With access to country representative strata, Norstat—a Norwegian market research agency, collected the data using computer-assisted telephone interviewing (CATI) in April—October 2020. Out of 6000 participants, 890 met our inclusion criteria 'YP aged 16–25 years'. The data collection was stratified by 8 age groups, 2 genders and 11 counties, of which the study's sample included two age groups (16–17 and 18–25). However, only 419 responded to the comprehensive scale HLS_{19}-Q47 and EQ-5D-5L instrument due to the stepwise data collection described in Le *et al*.[18]

Measures

In combination with data on HL, measured using the HLS_{19}-YP12 scale,[18] we also collected data on HRQoL using the EQ-5D-5L instrument. In addition, data on person factors and covariates, such as age, gender, education, self-perceived social status, financial deprivation, self-reported health status and health service utilisation (GP visits), were collected.

The HLS_{19}-YP12 instrument

The HLS_{19}-YP12 (online supplemental table 1) is a short version of the HLS_{19}-Q47[1] and reflects the conceptual framework of Sørensen *et al*.[4 52] The instrument uses a 4-point rating scale with the response categories: (1) very difficult, (2) difficult, (3) easy and (4) very easy, by which higher score indicates higher HL. The HLS_{19}-YP12 scale is considered a valid and reliable instrument for measuring HL in YP, with high internal consistency and reliability. The development and validation of the HLS_{19}-YP12 scale is described in Le *et al*.[18]

The EQ-5D-5L instrument

As recommended by The Norwegian Medicines Agency,[53 54] we collected data on HRQoL by using the five-level version of the EuroQol Group's instrument (EQ-5D-5L). This scale assesses HRQoL through five aspects of health (mobility, self-care, usual activities, pain/discomfort and anxiety/depression), summarising to 3125 possible health states, where each state is assigned a HRQoL value between 0 and 1. The HRQoL value reflects the health preferences of general public towards the health state in which 0 refers to death and 1 to perfect health.[53] The 5L version has the five response categories 1—no, 2—slight, 3—moderate, 4—severe and 5—extreme problems. This scale has been applied to a broad range of target groups and settings, including population health surveys among YP.[53 55 56] However, a Norwegian value set and scoring algorithm for EQ-5D-5L have yet to be developed.[53] For calculating the EQ-5D-5L index score in Norwegian data, The Norwegian Medicines Agency recommends using the EQ-5D-3L UK crosswalk value set.[57] A one-factorial confirmatory factor analysis model was contemporarily fitted to the data from the EQ-5D-5L scale, showing high internal consistency and reliability (Omega=0.90) and goodness-of-fit indices (Root-mean-squared error of approximation (RMSEA)=0.077, Comparative fit index (CFI)=0.987, Tucker-Lewis index (TLI)=0.974, and Standardized root-mean-square residual (SRMR)=0.054) were considered acceptable.

Statistical analyses

We used the independent samples t-test to compare the mean score of HL (logits) for two independent groups. A power analysis of the sample n=419 was conducted to support the results due to relatively large attrition rate of participants. For variables categorised into more than two independent groups, we performed the one-way analysis of variance followed by a Tukey's post hoc test. The χ^2 test was used to explore if there is a relationship between two categorical variables, that is, HL levels (categorical) and dichotomised sociodemographic variables.

A multiple linear regression model with HRQoL as the dependent variable and HL (measured in logits) and covariates as independent variables were estimated by using robust estimation.[58] Using GP visits as the dependent variable, which is a count, we applied negative binomial (NB) regression model instead of Poisson as variance significantly exceeds the mean.[59] The assumption of the Poisson is that the mean and the variance are equal, and using NB will relax this assumption and allow the variance in the model to be greater than the mean.[59] The same models were applied replacing HL (logits) with the categorical variable of HL (levels). The latter regression models were used as a basis for further analyses (figures 1 and 2) in Stata using the commands 'margins' and 'marginsplot'.

Applying the procedures set forth in Guttersrud *et al*,[60] we estimated four statistically distinct levels of HL proficiency based on the sum scores from the HLS_{19}-YP12 scale, when applied to YP aged 16–25 years responding by using CATI. Together with information from the items' content and the scoring thresholds, this forms the basis for description of the cut-point scores representing statistically distinct levels of HL proficiency.[26 60] The calculation procedures for cut-points are available and fully described in Guttersrud *et al*.[60]

The study's statistical analyses and calculations were carried out using Microsoft Excel, Stata/SE V.16.1 for Windows, Mplus V.8.6 and RUMM2030 Plus softwares. Statistical significance was set at 5% level.

Patient and public involvement

Prior to the main data collection, we conducted a pilot of the instruments in several institutions and organisations, such as directorates, universities, hospitals, municipalities and NGOs. Some amendments in the HL instruments

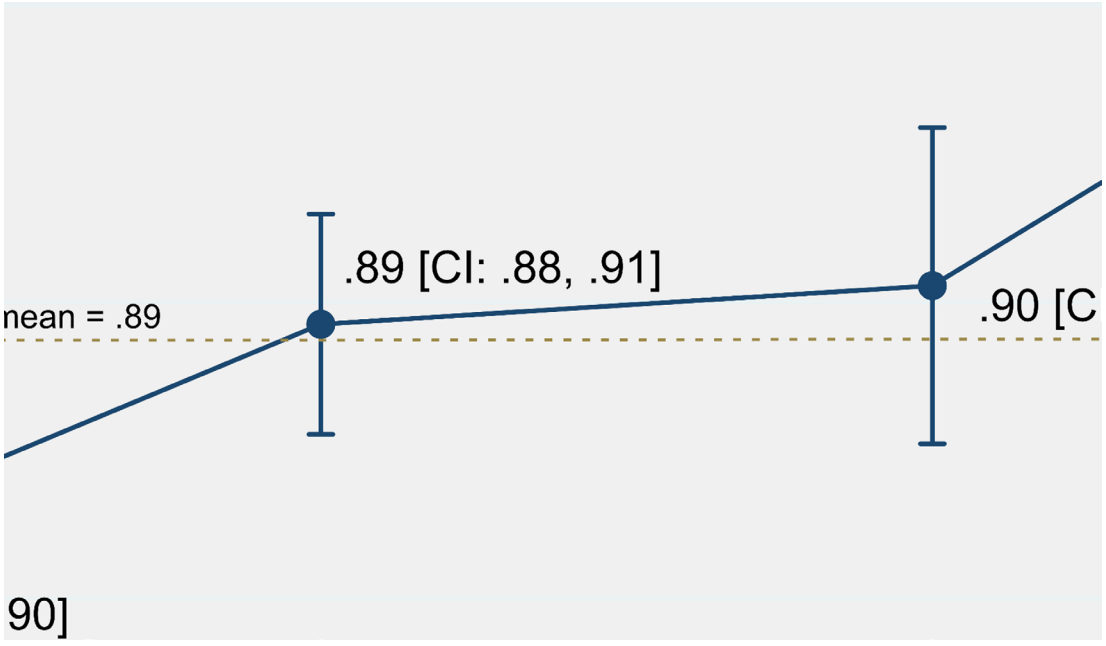

Figure 1 Predictive margins of health-related quality of life by health literacy level, controlled for age, gender, education, social status and financial deprivation (95% CI).

were made based on empirical observations interpreted in light of theoretical expectations.

RESULTS

HL by sociodemographic factors and health-related outcomes

The study included n=890 participants with a slight predominance of men (table 1) . Due to the stepwise data collection as described in Le *et al*,[18] a smaller sample (n=419) responded to health-related outcomes, that is, the EQ-5D-5L scale. Therefore, we used the smaller sample when estimating HL levels and exploring associations between HL and health-related outcomes such as HRQoL and GP visits.

As expected from the age range, just above one-fifth of the participants had completed education above level 3 of International Standard Classification of Education.[1 61 62] Most YP (79%) reported no financial problems. Financially deprived YP had statistically significantly lower HL than others (p<0.001). Although HRQoL among the target population was relatively high with a mean

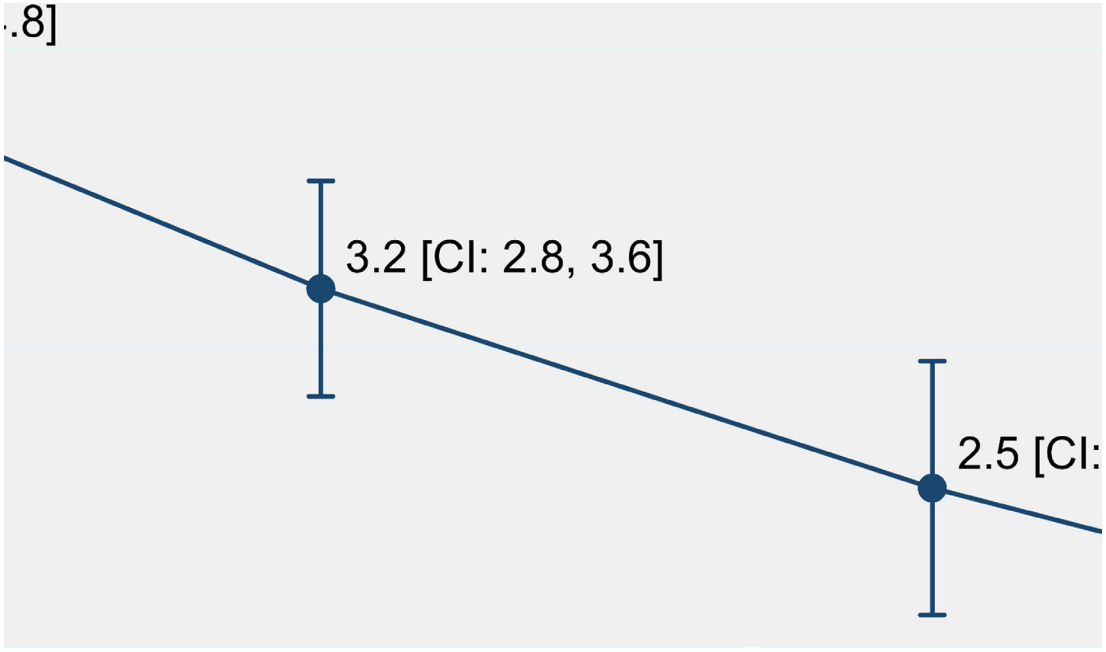

Figure 2 Predictive margins of GP visits by health literacy level, controlled for age, gender, education, social status and financial deprivation (95% CI). GP, general practitioner.

Table 1 Health literacy across levels of person factors and health-related outcomes

	n (%) /mean (SD)*	HL mean (SD)	P value
Sociodemographic/person factors (n=890)			
Age			
Mean (SD)	21 (2.9)		
Median	21		
16–20 years	436 (49.0)	−0.033 (0.80)	0.669
21–25 years	454 (51.0)	0.059 (0.94)	
Gender			
Male	459 (51.6)	0.008 (0.87)	0.689
Female	431 (48.4)	−0.104 (0.87)	
Education			
Education years, mean (SD)	13 (2.3)		
Below and equal to upper secondary school	684 (76.9)	−0.035 (0.85)	0.686
Above upper secondary school	201 (22.6)	−0.063 (0.96)	
Missing	5 (0.5)		
Self-perceived social status			
Mean (SD)	6 (1.6)		
Lower (1–5)	245 (27.5)	−0.103 (0.93)	0.207
Higher (6–10)	591 (66.4)	−0.019 (0.85)	
Missing	54 (6.1)		
Financial deprivation†			
No	704 (79.1)	−0.009 (0.88)	<0.001
Yes	90 (10.1)	−0.401 (0.84)	
Missing	96 (10.8)		
Health-related outcomes (n=419)			
Self-reported health status			
Mostly healthy	370 (88.3)	−0.059 (0.90)	0.112
Increased risk or having chronic health problem	47 (11.2)	0.167 (0.99)	
Missing	2 (0.5)		
GP visits‡			
Mean (SD)	3 (4.3)		
≤ 3	300 (71.6)	0.020 (0.92)	0.014
≥ 4	115 (27.5)	−0.224 (0.85)	
Missing	4 (0.9)		
Health-related quality of life (EQ-5D-5L index)§			
Mean (SD)	.89 (.15)		
≤ 0.89	191 (45.6)	−0.188 (0.83)	0.002
≥ 0.89	225 (53.7)	0.091 (0.96)	
Missing	3 (0.7)		

HL: standardised score (Rasch-based z-score with mean = 0 and SD = 1) of health literacy by means of the HLS_{19}-YP12 by Le *et al*. Higher values indicate higher HL.
*Categorical data: frequencies, n (%); continuous data: mean (SD).
†How easy or difficult is it for you to pay all bills at the end of month?
‡In the last12 months, about how many times have you been to a GP or family doctor?
§Health-related quality of life, measured by EQ-5D-5L instrument, calculated by using the UK crosswalk index for Norway
EQ-5D-5L, EuroQol Group's instrument; GP, general practitioner; HL, health literacy.

EQ-5D-5L index score at 0.89, there was a statistically significant difference in HL between YP below and above the mean EQ-5D-5L index score (p=0.002). Likewise, the results indicated a statistically significant difference between people who reported three or fewer and those who had four or more GP visits in a year (p=0.014). A power analysis was conducted for the sample n=419 by variables with statistically significant difference between groups. The power was 73% and 89% for variables GP-visits and HRQoL, respectively.

In other words, financially deprived YP have a statistically significantly lower mean HL score than others. Similarly, those who have three or fewer GP visits in a year or a score of EQ-5D-5L index equal to or higher than mean (0.89) have a statistically significant higher mean HL score than the opposite group.

Statistically distinct levels of HL measured by the HLS_{19}-YP12 instrument

Using the HLS_{19}-YP12 instrument to measure HL among YP, we identified four empirical levels of HL. The levels (1—4) started from a cut-point of 23, 30, 37 and 44 out of 48. These cut-points represent four statistically distinct levels of HL proficiency: level 1 as the lowest and level 4 as the highest.

The different HL levels were explored and interpreted considering the items' content and thresholds associated with the items' response categories. Consequently, the HL proficiencies were thus determined by the content of the actual items. This likely indicates the skills of people at or above a specific point score.

Linking the proficiency (person estimate) typically associated with each HL level to the thresholds associated with the items' response categories, we interpreted the results such that level 3 and above indicates sufficient to good HL. While participants at level 3 typically would experience all items as 'easy' and item 4, item 41 and item 46 as 'very easy', only participants at level 4 would do the latter concerning item10 (please, see online supplemental file 1 for the item wording).

At the lower part of level 2, people may typically view the tasks associated with item 10, item 18, item 26, item 36 and item 41 as 'difficult'. The content in these items represent a central knowledge and skills necessary for the 'patient's health service'—comparable to the concept of patient-centred care[46]—that expects actively participating patients.[3 47] Therefore, people scoring at level 2 may also meet challenges in handling health promotion, assessing whether a treatment option is more preferrable, or disease prevention in terms of finding information concerning mental health problems and judging which vaccinations they may need.

YP at or below level 1 are likely to face major challenges in critically assessing health information as people below level 1 typically perceive all items in online supplemental table 1 as 'very difficult', while people at level 1 will likely perceive all items as 'difficult'.

Having used a recognised statistical method[20] to define the cut-points for the HLS_{19}-YP12 scale, these are assumed to describe better the skills typically associated with each HL level than 'randomly' labelled categories commonly set by experts and based on personal and/or professional experiences.

Almost one-fifth scored at or below level 1. For these people, all items in the HLS_{19}-YP12 scale are typically experienced either 'difficult' or 'very difficult'. Approximately, three quarters of YP score at or below level 2, indicating that they may lack essential skills relative to the 'patient's health service' concept in terms of the expected active and participatory patient role (online supplemental table 2). Nevertheless, just above one quarter are at or above level, meaning that these YP probably are enabled to manage several skills that are expected from them.

While there is no statistically significant difference in HL levels between men and women (p=0.332), the results in online supplemental table 2 indicate that there is a statistically significant difference in HL levels for age (p=0.010) as well as financial deprivation (p=0.013) and self-perceived social status (p=0.015).

Associations between HRQoL, GP visits and HL

Controlled for age, gender, education, self-perceived social status and financial deprivation, table 2 shows that HL is statistically significantly associated with HRQoL (*b*=0.02, p=0.014) and with the number of GP visits (incidence rate ratios (IRR)=0.78, p<0.001). The latter – said in other words, for every unit (logit) increase in HL, the number of GP visits decreases by 22% (table 2). Similarly, the number of GP visits for females would increase by 73% (IRR=1.73, p<0.001) compared with males, whereas a decrease of 12% (IRR=0.88, p<0.001) for each more education year. The independent variables explain only 9% of the variance in HRQoL. For the NB regression model of the number of GP visits, the pseudo-R^2 is 4%.

Estimating the effects of HL proficiencies based on the same regression models as in table 2, in which HL (logits) was replaced by the categorical variable of HL (levels), figure 1 shows that HL has a considerable effect on HRQoL among YP. Controlled for age, gender, education, social status and financial deprivation, the difference in HRQoL between HL level 1 (lowest) and level 4 (highest), and level 2 and level 4, was calculated at 0.12 and 0.08 (EQ-5D index), respectively. Figure 2 indicates that higher HL decreases the number of GP visits. The number of GP visits per year decreases from 4.1 to 2.0 visits when changing from the lowest to the highest level of HL.

DISCUSSION

This study provides a descriptive analysis of HL among YP in Norway. The distribution of the study's sample concerning age and gender is highly comparable with Statistics Norway.[63] Using the measurement scale HLS_{19}-YP12, four statistically distinct levels of HL

Table 2 Multiple linear regression model of health-related quality of life (EQ-5D-5L index) and negative binomial regression model of GP visits as dependent variables, by generic health literacy (measured by HLS_{19}-YP12) as independent variable and covariates as control variables

		EQ-5D-5L index			GP visits*		
Independent variables		**b**	**CI**	**P value**	**IRR**	**CI**	**P value**
Generic health literacy†		0.02	.00; .04	0.014	0.78	.69; .88	< 0.001
Age		−0.00	−0.01; .01	0.897	1.01	.95; 1.06	0.851
Gender (female)		−0.04	−0.07; −0.01	0.008	1.73	1.39; 2.16	< 0.001
Education years		0.00	−0.01; .01	0.462	0.88	.82; .94	< 0.001
Self-perceived social status		0.01	−0.00; .02	0.160	1.08	1.01; 1.15	0.020
Financial deprivation (yes)		−0.07	−0.13; −0.01	0.024	1.21	.87; 1.70	0.245
R^2/pseudo R^2		0.09			0.04		
lnalpha					−0.37	−0.60; −0.15	
Alpha					0.69	.55; .86	
Valid count	356						
Total count	419						

*Negative binomial regression models were used due to count variable, whereas mean ≠ variance alpha: estimate of the dispersion parameter. If *alpha* is significantly greater than zero, then the data are over-dispersed and are better estimated using a negative binomial model than a Poisson model. Likelihood-ratio test of alpha=0: chibar2(01) = **458.53**; Prob >=chibar2 < **0.001**. The large test statistic would suggest that the response variable is over-dispersed and is not sufficiently described by the simpler Poisson distribution *b:* Unstandardised coefficients were reported for EQ-5D-5L index.
†Generic health literacy in logits, measured by the HLS_{19}-YP12 scale EQ-5D-5L index: Health-related quality of life measured by the EQ-5D-5L instrument GP visits: the number of doctor visits (GP: general practitioner). Self-perceived social status (from 1=lowest level to 10=highest level in society). Financial deprivation (dichotomised into two categories: 1) Yes and 2) No). Due to rounding the numbers to two significant decimals, .00 may represent a value in the range of −.005 to .005
EQ-5D-5L, EuroQol Group's instrument; IRR, incidence rate ratios.

proficiency were identified. We explored the relationships between HL (continuous variable) and HRQoL, and YP's use of GP services, and then observed the associations between HL proficiency levels (categorical variable) on the same health outcomes.

We observed a statistically significant positive association between YP's HL as measured by the HLS_{19}-YP12 scale and their HRQoL as measured by the EQ-5D-5L scale, while there is a statistically significant negative incidence-rate ratio between HL and number of GP visits. However, the results should be read with caution as the explained variances in either regression models were quite small.

HL in YP

Our findings to some degree support previous research that revealed a social gradient for HL among adolescents (aged 14—17 years).[64] Specifically, there are statistically significant differences in HL levels by age, education (trend; p=0.057), self-perceived social status and financial deprivation (online supplemental table 2). The results from the studies might have been differently affected by the age range defined, the measurement scale used, the measurement context, and how HL proficiencies have been calculated. For instance, the 11-item 'scale A' applied in the study of Loer *et al*[64] measuring generic HL among adolescents aged 14—17 years, was also developed and adapted based on the HLS-EU-Q47. However, this scale was not aligned with the HL conceptual model of Sørensen *et al*[4] reflecting the three health domains (healthcare, disease prevention and health promotion) and the four cognitive domains (finding, understanding, appraising and applying health information).

International studies have shown that socioeconomic determinants have impacts on HL in adult populations, including a systematic review of the prevalence of limited HL in Southeast Asian countries.[1 65–67] Hence, parents with low socioeconomic status could be more likely associated with low HL. While financial deprivation is more likely based on individual financial ability in the general adult population,[1 26] YP is more likely financially dependent on their parents' socioeconomic status.[30 68] For the youngest age group, this measure may read 'relative' to parents' financial ability, which would indirectly affect, for instance, the 16-year-old adolescent's ability to 'pay the bills at the end of the month'. This may contribute to explaining the difference in HL between YP with and without financial deprivation. However, having access to information about parents' educational level and socioeconomic status would be beneficial, confirming the associations discussed.

HL, HRQoL and GP visits

The difference in HRQoL (EQ-5D index) between the highest and the lowest HL proficiency level is 0.12 (figure 1), illustrating that HL may have a not negligible effect on YP's HRQoL. Comparing the gravity of

this finding, Yabroff *et al*[69] found that the difference in HRQoL between cancer survivors and a control group without cancer was 0.06, which was considered a fairly significant difference. As such, the difference in HRQoL (0.08) between HL level 2 and level 4 is also considerable. Although the EQ-5D-5L scale is widely applied to all target groups,[53 55] future studies may consider other available instruments that are unambiguously developed for measuring HRQoL of adolescents and young adults. Further research may include investigation of the causality of such a relationship, preferably based on the content in the HL scale and beyond.

Statistics Norway[70] reported slight decrease in GP visits among YP aged 16—19 years and an increase among those aged 20—29 years from year 2019 to 2020. On average, the 16—19 years group had 1.86 visits in 2020 while 2.24 in 2019, and the 20—29 years group had 2.29 and 2.49 visits, respectively.[70] Our data showed a mean at three GP visits for people aged 16—25 years, and the median value was 2. However, the results may not be directly comparable as our data were based on self-reported number of GP visits in the last 12 months, while Statistics Norway reported register-based data per calendar year. Notwithstanding, our study suggested that the number of GP visits is positively associated with gender (women) and self-reported social status, and negatively associated with education years and HL (table 2). The latter is in line with the findings from Berens *et al*[11] but contradicts other research on adults[10] claiming that HL is not significantly associated with the number of GP visits. While most studies on associations between HL and utilisation of healthcare services concern-specific patient groups[71] and adult populations,[10] the present study (figure 2) shows a tendency that could contribute to confirming that HL proficiency might have effects on the use of GP services among young 'healthy' people. This is demonstrated by a decrease of 2.1 GP visits when changing from HL level 1 to level 4 (figure 2). Alternatively, it is also been observed (table 2) a 22% decrease in GP visits by increasing one HL unit (logits).

Accordingly, the predictive margins demonstrated the strength of covariance between HL proficiency levels and HRQoL and GP visits. Distinguished from study designs like cohort or randomised controlled trial, data from a cross-sectional study are less preferable for studying cause-and-effect conditions. However, findings from the present study suggest a tendency, in which HL is significantly associated with, for example, increased score of EQ-5D-5L index and decreased number of GP visits.

LIMITATIONS

We used the EQ-5D-3L UK crosswalk value set for Norway to calculate the EQ-5D-5L index.[53 57] The limitation of using a crosswalk is that the range of index values is restricted to the range of the EQ-5D-3L value sets. This restriction leads to an artificial floor effect on the values of 5 L model, which conflicts with the expectation that the measurement continuum of the five-level system is broadened, resulting in lower values when compared with the three-level system.

Whether increased numbers of GP visits of YP have beneficial and substantial health effects remain open and constitute an important question that could not be investigated in the present study but should be addressed in the context of further exploration. Such studies could combine both qualitative and quantitative methods in order to triangulate the findings and create a more in-depth look into the matter. In particular, qualitative methods would enable insights into the views, perceptions and perspective of YP and provide evidence on their subjective experiences.

Another limitation of this study is that the cut-points for the HLS_{19}-YP12 scale have been defined exclusively based on the national data, which was collected using CATI. The technique should also be tested in multinational data using different data collection modes. Furthermore, the lowest HL level was defined starting from a 4 points score as no participant was observed with less than 4 points score. This may have affected the distribution and/or number of HL levels estimated.

Finally, although cross-sectional study design is less preferable for drawing conclusions on cause-and-effect conditions, the evidence generated by the present study has provided new empirical insight relative to potential association of HL on health outcomes in YP.

CONCLUSION

The study provides new empirical insights on the association between HRQoL, number of GP visits, and HL in YP. The findings have implications for further HL research, especially within cause-and-effect studies on HL and relevant health outcomes. Having identified statistically distinct levels of HL proficiency translated into sum point scores for the HLS_{19}-YP12 scale, we may have introduced a new economically practical measure that helps establishing the extent to which information and communication needs to be adapted in due time.

Author affiliations
[1]Department of Health and Nursing Sciences, Inland Norway University of Applied Sciences Faculty of Health and Social Sciences, Elverum, Norway
[2]Norwegian Centre for Science Education, University of Oslo Faculty of Mathematics and Natural Sciences, Oslo, Norway
[3]Department of Nursing and Health Promotion, Oslo Metropolitan University Faculty of Health Sciences, Oslo, Norway
[4]Department of Sport and Health Sciences, Technical University of Munich, Munich, Germany

X Orkan Okan @orkanokan_

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the basis for those presented in the submitted manuscript. CL was responsible for performing all statistical analyses (Rasch modelling, CFA, and other statistical analyses) and manuscript drafting, the other authors (ØG, PJ, OO and HF) were actively involved in reading and critically revising various manuscript draft versions. All authors approved the final version of the manuscript for submission and agreed to be accountable for all aspects of the work in accordance with the ICMJE criteria for authorship, while CL, the corresponding author, is the guarantor and responsible for the overall content.

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Ethics approval The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The study was considered outside the Norwegian Act of Medical and Health Research, thereby, waiver for ethical approval of the study was taken from the Norwegian Regional Committees for Medical and Health Research Ethics. The Data protection services at the Norwegian Centre for Research Data (NSD) was notified about the project and has approved the use of personal/private data such as questionnaires, consent form, storage of data, etc. (project number 896850). Participation was voluntary, and the questionnaire was completed anonymously. As data were collected using telephone interviews, verbal informed consent was obtained from the participants and parents/legal guardians of illiterate and minor participants and the NSD has approved the verbal form of informed consent. From 1 January 2022, NSD was merged with two other Norwegian organisations, Uninett and The Directorate for ICT and joint services in higher education and research, to form the new Norwegian Agency for Shared Services in Education and Research (Sikt). Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data may be obtained from a third party and are not publicly available. The datasets used and/or analysed during the current study are not publicly available but can be accessed by applying to the Norwegian Study Centre of HLS19 via this website: https://www.oslomet.no/forskning/forskningsprosjekter/befolkningens-helsekompetanse-hls19.

ORCID iD

Christopher Le http://orcid.org/0000-0002-6150-0629

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