



Original research article

Validation of the HLS-Child-Q15 questionnaire in Czech primary school children

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Abstract

Aim: To evaluate the psychometric properties of the Czech version of the HLS-Child-Q15 questionnaire among children aged 9–10 years. **Design:** Cross-sectional validation study.

Methods: The study included 1,333 fourth-grade pupils from three regions of the Czech Republic. The translation process followed forward–backward translation procedures with expert panel review and pilot testing. Internal consistency was assessed using Cronbach's alpha and split-half reliability. Construct validity was examined using exploratory factor analysis (principal axis factoring with Promax rotation). Criterion validity was evaluated through logistic regression analyses investigating associations between health literacy levels and vaccination-related attitudes, knowledge, and behaviours.

Results: The Czech HLS-Child-Q15 demonstrated good internal consistency ($\alpha = 0.80$; 95% CI 0.774–0.823) and satisfactory split-half reliability ($r = 0.79$). Exploratory factor analysis supported a three-factor structure, accounting for 41% of the total variance. Higher health literacy levels were significantly associated with more favourable vaccination-related outcomes.

Conclusion: The Czech adaptation of the HLS-Child-Q15 is a reliable and valid instrument for assessing health literacy in children aged 9–10 years. It can be applied in research and school-based health promotion practice.

Keywords: Children; Health literacy; Prevention; Psychometrics; Public health; Questionnaire validation

Introduction

Health literacy is a highly relevant global topic. According to the World Health Organisation (WHO, 2017), health literacy refers to the cognitive and social skills that determine individuals' motivation and ability to access, understand, and use information to promote and maintain good health. Currently, health literacy is a significant priority on the EU agenda (Sørensen et al., 2015).

Following its inception in 1974, the concept of health literacy (HL) was primarily understood from a biomedical perspective during the 1980s and 1990s; however, its interpretation has since become multidisciplinary (Bröder et al., 2017; Sørensen et al., 2012). While health literacy is a growing field of research, there is still limited literature on HL in young children. Health literacy in childhood is essential for physical, emotional, and cognitive development, as well as the development of health behaviours (Bröder et al., 2017). There

is a consensus among researchers and policymakers that promoting health literacy at an early age can provide a foundation for lifelong health literacy, overall health, and quality of life (Schaeffer et al., 2018). Childhood is a relatively long period in human life and has a fundamental influence on all subsequent developmental stages. The approach taken toward one's health during the earliest developmental periods will influence health status throughout the remainder of life. Investigating young children's health literacy is essential for planning health promotion interventions within early childhood education (Bánfai-Csonka et al., 2022). Although research on children's health literacy has increased in recent years, very few studies remain available for this age group (Bröder et al., 2017). Only 12 research studies were found that directly focused on children's health literacy (Bánfai-Csonka et al., 2022). This is primarily due to the lack of measurement tools suitable for examining their health literacy. To fill this gap, a child version of the European Health Literacy Survey Questionnaire (HLS-Child-Q15) was developed and tested in Germany, suitable for measuring

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the health literacy of children aged 8 or older (Bollweg et al., 2020; Rademakers et al., 2022).

Our study was based on the German study that developed and tested an age-adapted version of the HLS-EU-Q47 for German-speaking children aged 9–10 (Bollweg et al., 2020). Currently, there is no Czech translation of the HLS-Child-Q15 available (nor of any other instrument for assessing children's HL).

The present study aims to evaluate the psychometric properties of the HLS-Child-Q15 in a sample of children aged 9–10 years. Specifically, the study examines internal consistency, explores the instrument's underlying factor structure, and assesses criterion validity by examining associations between health literacy level and vaccination-related attitudes, knowledge, and behaviours. Although the HLS-Child-Q15 has been adapted in other countries, cross-cultural validation is necessary when applying a questionnaire in a new linguistic and sociocultural context. Differences in educational systems, health communication, and cultural norms may influence how children interpret questionnaire items.

In the Czech Republic, validated instruments measuring health literacy in younger school-aged children are still limited. Therefore, validating the Czech version of the HLS-Child-Q15 is necessary to ensure its reliability and validity in this population.

Materials and methods

Study design

A cross-sectional validation study was conducted to examine the psychometric properties of the Czech version of the HLS-Child-Q15 questionnaire and to assess children's health literacy at ages 9 and 10.

Data collection and sampling

Given the cross-sectional nature of the study, the sample was constructed as follows: three regions (South Bohemian, Plzeň, and Vysočina) were randomly selected from the 14 regions of the Czech Republic. The sampling frame consisted of all elementary schools in these selected regions (according to the Ministry of Education, Youth and Sports database as of December 31, 2023). Based on the requirement to conduct research in at least two classes of the same grade per school, all schools meeting this criterion were identified. From this group, 10 schools in each region were selected at random, resulting in a quota selection. It is therefore a combination of both approaches.

The inclusion criteria were age (9–10 years, i.e., 4th-grade pupils), region (South Bohemian, Plzeň, and Vysočina), and proficiency in the Czech language. The sample included a major city (Plzeň), larger provincial cities (Jihlava, České Budějovice), and village-type settlements. The selected regions represent both industrial and agricultural characteristics, which are the predominant types in the Czech Republic. As this is a cross-sectional rather than a representative study, the results will not be generalised to the entire Czech Republic. However, the size and structure of the sample are sufficient for a fundamental mapping of the issues and the development of potential methodological procedures. Exclusion criteria included children from other regions, children outside the specified age range, and children who lacked proficiency in the Czech language (e.g., recently arrived immigrant children), which could bias the collected data.

The sample size was determined using a Sample Size Calculator based on the total population of children aged 9–10 in the selected regions, as reported by the Czech Statistical Office (2024). The calculation utilized a 95% confidence level and a 2% margin of error. Based on this calculation, the minimum required sample size was set at 1,200 4th-grade pupils.

The target group consisted of 4th-grade elementary school pupils (aged 9–10). This age group has received little research attention to date. It was selected because data from 2012–2020 regarding the number of paediatric patients (aged 0–19) treated for infectious diseases indicate a significant increase, from 23,242 in 2013 to 47,364 in 2020 (Institute of Health Information and Statistics of the Czech Republic, 2022). The HLS-Child-Q15 questionnaire (Bollweg et al., 2020) was employed.

The final sample comprised 1,333 elementary school pupils aged 9–10 at the time of the study, from three regions. Of these, 667 (50%) were boys, and 666 (50%) were girls. Regarding age, 664 pupils were born in 2014 (10 years old at the time of the research; 49.8%), and 669 were born in 2015 (9 years old; 50.2%). The regional distribution was: 549 pupils (41.2%) in the South Bohemian Region, 384 (28.8%) in the Plzeň Region, and 400 (30.0%) in the Vysočina Region. The research was conducted in 2025.

Children completed the paper-based questionnaire in groups within their classrooms, under the supervision of a research assistant and a teacher. The time allocated for completion was 45 minutes. Children were allowed to ask questions in case of any ambiguity. The research was strictly anonymous; no names were recorded, and no information subject to data protection legislation was collected or stored. No data regarding specific schools were collected. The study was conducted with the consent of school directors and the children's legal guardians.

Instrument

This work was based on a German study that developed and tested an age-adapted version of the HLS-EU-Q47 for German-speaking children aged 9–10. The development and validation process resulting in the 15-item HLS-Child-Q15-DE questionnaire is described in previous studies (Bollweg et al., 2020). The initial study examining the psychometric properties of the HLS-Child-Q15-DE demonstrated good internal consistency (Bollweg et al., 2020). Since its development, the HLS-Child-Q15 has been translated into other languages (e.g., English, French, Portuguese, Dutch) (Hahnrahs et al., 2021).

General health literacy (HL) consists of three primary domains: (a) Health Care (HC), (b) Disease Prevention (DP), and (c) Health Promotion (HP). Overall health literacy (saturated by all these domains) is denoted by the symbol HL. A 5-point response scale was chosen: *very difficult, fairly complex, relatively easy, very easy, and do not know*. The complete original version was used. The instrument was applied in Czech without changes to scoring or structure, ensuring full comparability with international validation studies.

Linguistic validation process of HLS-Child-Q15

In the first phase, permission for translation was obtained from the author of the original HLS-Child-Q15 (Bollweg et al., 2020). Two independent Czech translations were created from the original English. One translation was performed by a professional translator, and the second by a specialist (a registered nurse) with extensive healthcare experience. Both translators met the established selection criteria: they are native speakers

of the target language (Czech), fluent in the source language (English), reside in the target country, and have experience translating medical topics. These two versions were compared and synthesised by an expert panel (four paediatric nurses, a physician, a sociologist, and a statistician) to create a single unified Czech version.

This unified version was presented to a user panel (children aged 9–10 from the Children’s University at the Faculty of Health and Social Sciences, University of South Bohemia) and subsequently revised based on their feedback. This served as a pre-test to obtain qualitative feedback.

In the next step, the Czech version was back-translated into the original English by a native English speaker unfamiliar with the original instrument. The Czech version and its back-translation were sent to the original authors for approval (Fig. 1).

In December 2024, pilot testing was conducted to evaluate the validity of the proposed quantitative methodology and the internal consistency of the Czech items using Cronbach’s alpha. A total of 40 children (9–10 years old; 29 boys, 11 girls) were included via purposive sampling. Participation was contingent upon the consent of the school management (T. G. Masaryk Elementary School, Písek) and legal guardians. An informed consent form was designed by the research team

and distributed by the school. Pupils completed the anonymous questionnaires in approximately one school hour (40–45 minutes). Following the successful pilot test, the full-scale research investigation was initiated (Fig. 1).

Psychometric analysis

Reliability

Internal consistency of the HLS-Child-Q15 scale was assessed using Cronbach’s alpha coefficient with 95% confidence intervals. Given the ordinal nature of the five-point response scale, reliability estimates were interpreted with caution and complemented by item–total correlations (corrected item–total correlation, ITC) and split-half reliability using the Spearman–Brown coefficient. Item performance was evaluated by examining ITC values and changes in Cronbach’s alpha if individual items were deleted. Values of ITC ≥ 0.30 were considered acceptable. Internal consistency was additionally examined across regions to assess the stability of reliability estimates in different subsamples.

Exploratory factor analysis

The dimensional structure of the HLS-Child-Q15 was examined using exploratory factor analysis (EFA). Prior to factor extraction, the suitability of the data for factor analysis was

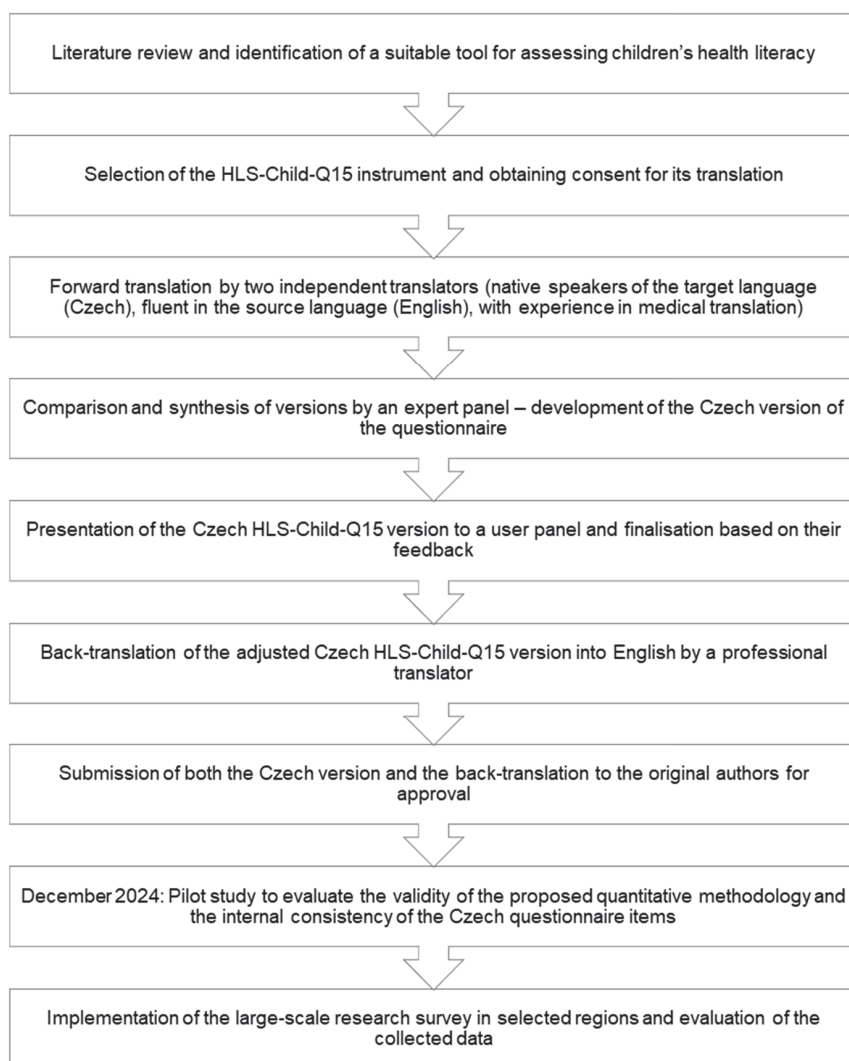


Fig. 1. Flowchart of the linguistic validation process of the instrument

evaluated using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity. A KMO value ≥ 0.60 and a statistically significant Bartlett’s test were considered indicative of adequate factorability.

Factors were extracted using principal axis factoring, which is appropriate for identifying latent constructs underlying observed variables. Given the theoretical expectation that dimensions of health literacy are correlated, an oblique rotation (Promax) was applied. The number of factors retained was determined based on eigenvalues greater than one, inspection of the scree plot, and the conceptual interpretability of the factor solution.

Factor loadings ≥ 0.40 were considered salient. Items with substantial cross-loadings or low communalities were examined for potential conceptual ambiguity; however, item retention decisions were guided primarily by theoretical relevance and content validity rather than purely statistical criteria. The proportion of variance explained by the retained factors was reported to provide an overall indication of model adequacy.

Validity

Construct validity

Construct validity was evaluated by examining the factor structure derived from EFA and assessing the internal consistency of the identified dimensions. Given the absence of an external health literacy instrument administered concurrently, convergent and discriminant validity could not be formally tested. Instead, construct validity was inferred from the coherence of the factor structure with the theoretical domains of health literacy and the consistency of reliability estimates across subsamples.

Criterion validity

Criterion validity was assessed by examining associations between health literacy levels and vaccination-related outcomes. Health literacy scores were categorised into levels based on the quintile distribution. Binary logistic regression analyses were conducted, with vaccination-related behaviours, attitudes, and knowledge as outcome variables, and health literacy level as the independent variable. The lowest health literacy level served as the reference category. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to quantify the strength of associations. These analyses were performed separately for each outcome variable. Statistical significance was set at $p < 0.05$.

Handling of missing data and “do not know” responses

Responses coded as “do not know” and incomplete item responses were treated as missing values and excluded from scale score calculation and regression analyses. The number of valid responses varied slightly across analyses. Given the exploratory nature of the study and the participants’ ages, no imputation procedures were applied.

Statistical analysis

All statistical analyses were conducted using standard statistical software. Descriptive statistics were used to summarise sample characteristics and scale scores. Reliability and factor analyses were performed on complete cases for each item. Logistic regression analyses were based on available data for each outcome.

Ethical aspects

The Ethics Committee of the Faculty of Health and Social Sciences of the University of South Bohemia in České Budějovice approved the study (No. 7/2023 on 12 June 2023) in accordance with the Declaration of Helsinki. The research was strictly anonymous; no respondents’ names were recorded, and no information subject to data protection laws was collected or stored. Furthermore, no data regarding the specific schools where the research was conducted were collected.

Results

Sample characteristics

The study sample comprised 1,333 children aged 9–10 years. Girls and boys were almost equally represented. Participants were recruited from three regions of the Czech Republic. Detailed characteristics of the study sample are presented in Table 1.

Reliability

The HLS-Child-Q15 demonstrated good internal consistency. Cronbach’s alpha for the total scale was 0.80, and split-half reliability yielded a Spearman–Brown coefficient of 0.79. Corrected item–total correlations ranged from 0.28 to 0.55, with only one item slightly below the recommended threshold of 0.30; removal of this item did not result in a meaningful improvement in overall reliability (Table 2). Internal consistency estimates were comparable across regions, with Cronbach’s alpha values ranging from 0.78 to 0.82 (Table 3).

Table 1. Characteristics of the study sample (N = 1,333)

Characteristic	n (%)
Sex	
Girls	666 (50.0)
Boys	667 (50.0)
Age (year of birth)	
2014 (10 years)	664 (49.8)
2015 (9 years)	669 (50.2)
Region	
South Bohemian Region	549 (41.2)
Pilsen Region	384 (28.8)
Vysočina Region	400 (30.0)

Table 2. Item statistics for the HLS-Child-Q15

Item	Item wording	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation (ITC)	Cronbach's α if item deleted
1	Find out how to recover quickly when you have a cold	46.04	31.29	0.38	0.79
2	Find out what you can do so that you do not become too fat or too thin	45.54	30.15	0.41	0.79
3	Find out how you can best relax	45.52	31.63	0.28	0.80
4	Find out which food is healthy for you	45.20	31.03	0.47	0.78
5	Understand when and how you should take your medicine when you are ill	45.80	30.64	0.38	0.79
6	Understand what your doctor says to you	45.69	30.72	0.42	0.79
7	Understand why you sometimes need to see the doctor even though you are not ill	45.33	30.36	0.48	0.78
8	Understand why you need vaccinations	45.31	31.32	0.35	0.79
9	Understand what your parents tell you about your health	45.33	30.45	0.55	0.78
10	Understand why you need to relax sometimes	45.28	31.61	0.34	0.79
11	Judge what helps you stay healthy and what does not	45.59	30.45	0.46	0.78
12	Do what your parents tell you to do so that you can get well again	45.42	30.34	0.50	0.78
13	Take your medicine in the way you are told	45.54	30.41	0.40	0.79
14	Stick to what you have learned in road safety lessons	45.49	31.01	0.38	0.79
15	Have a healthy diet	45.42	31.29	0.38	0.79

Note: ITC values ≥ 0.30 indicate acceptable item discrimination. Cronbach's alpha for the total scale was 0.80.

Table 3. Internal consistency of the HLS-Child-Q15 by region

Region	Cronbach's α	Cronbach's α (standardised items)	Number of items
South Bohemian Region	0.78	0.79	15
Pilsen Region	0.80	0.81	15
Vysočina Region	0.82	0.83	15

Note: Cronbach's alpha values indicate good internal consistency across all regions. All items were measured on the same five-point Likert scale.

Additivity

Tukey's test for nonadditivity did not indicate a violation of the additivity assumption ($F = 0.463$, $p = 0.496$), supporting the use of the total scale score in subsequent analyses (Table 4).

Exploratory factor analysis

The data were suitable for factor analysis, as indicated by adequate sampling adequacy and a statistically significant Bartlett's test of sphericity ($p < 0.001$). An exploratory factor analysis using principal axis factoring with Promax rotation identified a three-factor solution, accounting for approximately 41% of the total variance. Factor loadings were generally

Table 4. Tukey's test for nonadditivity

Test	F	p -value
Nonadditivity	0.463	0.496
Grand mean: 3.25		

Note: Tukey's estimate of the power to which observations must be raised to achieve additivity was 1.199

satisfactory (≥ 0.32), although several items showed minor cross-loadings.

The extracted factors were interpreted as: (1) *Assessing and understanding health information*, (2) *Applying health-related information*, and (3) *Health-related self-management and judgement*. Rotated factor loadings for individual items are presented in Table 5.

Criterion validity

Criterion validity was examined through associations between health literacy levels and vaccination-related outcomes. Logistic regression analyses showed that higher health literacy levels were consistently associated with more favourable outcomes, including higher odds of regular vaccination-related physician visits, lower odds of fear of vaccination, and higher odds of perceiving vaccination as applicable and understanding its benefits. The results of the regression analyses are summarised in Table 6.

Table 5. Exploratory factor analysis of the HLS-Child-Q15 (rotated factor loadings)

Item	Factor 1: Accessing and understanding health information	Factor 2: Applying health-related information	Factor 3: Health-related self-management and judgement
2	0.78	–	–
7	0.53	–	0.41
1	0.52	–	–
11	0.52	–	–
4	0.52	0.35	–
12	–	0.69	–
15	0.32	0.61	–
3	–	0.54	–
9	–	0.49	0.43
6	–	0.49	0.40
10	–	0.45	–
5	–	–	0.73
13	–	–	0.65
14	0.32	–	0.41
8	0.36	–	0.40

Note: Only factor loadings ≥ 0.32 are shown. Primary loadings are shown in bold. Factor 1 reflects abilities related to accessing and understanding health information. Factor 2 reflects the ability to apply health-related information in everyday situations. Factor 3 reflects self-management and judgement related to health behaviours. Factors were extracted using principal axis factoring with Promax rotation.

Table 6. Association between health literacy level and vaccination-related outcomes (binary logistic regression)

Outcome variable	Health literacy level	OR	95% CI
Regular physician visits for vaccination	Low (reference)	1.00	–
	Medium	2.48	1.38–4.45
	High	1.69	0.83–3.45
Fear of vaccination	Low (reference)	1.00	–
	Medium	0.78	0.56–1.09
	High	0.34	0.22–0.54
Perceived usefulness of vaccination	Low (reference)	1.00	–
	Medium	1.82	1.09–3.03
	High	2.71	1.30–5.66
Understanding the benefits of vaccination	Low (reference)	1.00	–
	Medium	2.17	1.44–3.27
	High	5.43	2.56–11.50

Note: OR – odds ratio, CI – confidence interval. Binary logistic regression models were estimated separately for each outcome. Health literacy level was entered as a categorical predictor, with the lowest health literacy level used as the reference category.

Discussion

Psychometric considerations

The present study evaluated the psychometric properties of the HLS-Child-Q15, focusing on reliability, factor structure, and criterion validity in a sample of primary school-aged children. Overall, the findings indicate that the instrument demonstrates satisfactory psychometric performance and provides meaningful measurement of health literacy in this age group.

Internal consistency of the scale was good, as reflected by Cronbach's alpha and supported by split-half reliability esti-

mates. Item–total correlations were generally acceptable, with only one item marginally below the recommended threshold. Importantly, removing this item did not result in a meaningful improvement in overall reliability, suggesting that its inclusion does not compromise the scale's internal consistency. This pattern is consistent with previous validation studies of child-adapted health literacy instruments, which often report slightly lower item–total correlations for conceptually complex items while retaining them for reasons of content validity.

Exploratory factor analysis supported a multidimensional structure of the HLS-Child-Q15. The three-factor solution identified in this study aligns with theoretical models of health literacy that conceptualise the construct as comprising

multiple, interrelated domains. The proportion of explained variance was comparable to that reported in similar studies involving child and adolescent populations, where moderate levels of explained variance are commonly observed due to the abstract nature of the construct and the developmental stage of respondents. The use of an oblique rotation was justified by the observed conceptual overlap among the factors, reflecting the interconnectedness of the health literacy dimensions.

Construct validity was further supported by the coherence of the factor structure and the stability of reliability estimates across regions. Comparable internal consistency across subsamples suggests that the scale functions similarly across contexts, although formal tests of measurement invariance were beyond the scope of the present study. Future research should address this limitation by examining invariance across demographic groups using confirmatory approaches.

The observed associations between health literacy level and vaccination-related outcomes provided evidence for criterion validity. Higher health literacy was consistently associated with more favourable attitudes, better understanding, and reduced fear related to vaccination. These findings align with previous research demonstrating that health literacy is closely linked to preventive health behaviours and health-related knowledge. The graded associations observed across health literacy levels further support the instrument's sensitivity in distinguishing among different levels of the construct.

It is important to interpret these findings in light of the study's cross-sectional design. While the observed associations support criterion validity, causal relationships cannot be inferred. Additionally, responses coded as "do not know" were treated as missing values, potentially leading to conservative estimates of associations if these responses were more prevalent among children with lower health literacy. Nevertheless, the consistency of findings across multiple vaccination-related outcomes strengthens confidence in the scale's validity.

Taken together, the results indicate that the HLS-Child-Q15 is a reliable and valid instrument for assessing health literacy in children aged 9–10 years. The scale demonstrates adequate internal consistency, a theoretically coherent factor structure, and meaningful associations with relevant external criteria. These psychometric properties support its use in both research and practice, particularly for monitoring health literacy and evaluating interventions targeting health-related knowledge and attitudes in childhood.

Addressing health literacy in children and young people should be based on empirically reliable, measurable definitions and conceptual frameworks that are valid, practical, and tailored to the target group (Bröder et al., 2017).

A 15-item scale based on the HLS-Child-Q15 questionnaire was used in this study. The suitability of the HLS-Child-Q15 questionnaire for the given target group of children has been confirmed by studies (Bollweg et al., 2020; Hahnraaths et al., 2021; Khanal et al., 2024).

The HLS-Child-Q15 questionnaire was translated into Czech and subsequently tested on a sample of primary school children in three regions in the Czech Republic. The questionnaire is multidimensional because it covers various health-related topics, including "health-related communication", "nutrition", "healthcare", and "treatment adherence". The lowest average value is achieved by the Health Care domain, and the highest by the Health Support domain. Psychometric analyses revealed high internal consistency and moderate to strong ITC.

The questionnaire shows high internal consistency across all involved regions, ranging from 0.784 (95% CI = 0.741–

0.822) in the JČ region, through 0.799 (95% CI = 0.741–0.843) in the PL region, to 0.822 (95% CI = 0.780–0.859) in the VYS region. The internal consistency of the questionnaire is comparable to that of the Dutch version (Hahnraaths et al., 2021).

The internal consistency of the health literacy scale is 0.800 (95% CI = 0.774–0.823), and the split-half reliability, measured by the Spearman–Brown coefficient ($r = 0.788$), indicates high internal consistency. The results also align with the reliability estimates reported in available studies (Polit, 2014; Polit et al., 2007). Criterion validity was assessed using the Chi-square test, and the measure of association was Cramér's V. All tested relationships were statistically significant.

Overall, the findings indicate that the HLS-Child-Q15 demonstrates adequate reliability, a theoretically coherent factor structure, and meaningful associations with relevant external criteria, supporting its use to assess health literacy in children aged 9–10 years across research and applied settings.

Conclusion

The HLS-Child-Q15 is a reliable and valid instrument for assessing health literacy in children aged 9–10 years. The scale demonstrates satisfactory internal consistency, a coherent multidimensional structure, and meaningful associations with vaccination-related attitudes, knowledge, and behaviours. These findings support its application in research and practice to monitor health literacy and inform the development and evaluation of health education and prevention strategies in childhood.

Research limitations

This study has several limitations. First, its cross-sectional design does not allow causal interpretation of the observed associations. Although the sample size was relatively large, data were collected in selected schools and regions, which may limit the generalisability of the findings. Responses coded as "do not know" were treated as missing values and excluded from analyses, which may have resulted in conservative estimates.

Furthermore, psychometric evaluation was limited to internal consistency and exploratory factor analysis. Confirmatory factor analysis (CFA) and measurement invariance across demographic subgroups were not tested and should be addressed in future studies.

Despite these limitations, the overall pattern of findings supports the use of the HLS-Child-Q15 as a practical tool for assessing health literacy in children aged 9–10 years.

Ethical approval and consent to participate

The study was approved by the Ethics Committee of the Faculty of Health and Social Sciences, University of South Bohemia in České Budějovice (Approval No. 7/2023, 12 June 2023) and conducted in accordance with the Declaration of Helsinki.

Authors' contributions

All authors contributed to the conception and design of the study, data analysis and interpretation, drafting or critically revising the manuscript, and approved the final version for publication.

Availability of data and materials

The source data are available in the National Repository: DOI: 10.48700/datst.bvjne-3a708. Available from: <https://data.narodni-repozitar.cz/general/datasets/bvjne-3a708>

Declaration of generative AI and AI-assisted technologies

Artificial intelligence tools were used solely for language editing and text refinement under the authors' supervision. The authors take full responsibility for the content of the manuscript.

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Conflict of interest

The authors have no conflict of interest to declare.

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