Research

Psychometric Properties and Measurement Invariance of the Parental Health Locus of Control Scale in an Italian Population

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Abstract

Introduction. Parents play a pivotal role in shaping children's health behaviors, preventive practices, and adherence to medical recommendations. The Parental Health Locus of Control (PHLOC) scale measures parental beliefs about the sources of control over child health outcomes. Although an Italian version exists, its psychometric properties had not yet been comprehensively evaluated. This study aimed to validate the Italian version of the PHLOC by assessing its factorial structure, internal consistency reliability, convergent validity with health literacy and vaccine hesitancy measures, and measurement invariance across healthcare professionals and non-healthcare professionals.

Methods. A cross-sectional psychometric study was conducted among 308 Italian parents of children aged 0–18 years using EUSurvey®. Confirmatory factor analysis (CFA) tested the six-factor structure of the PHLOC (Parent, Child, Professionals, Media, Divine, Fate), and internal consistency was assessed with McDonald's omega. Convergent validity was examined through correlations with health literacy (HLS-EU-Q6) and vaccine hesitancy (PACV-5). Measurement invariance by professional status was evaluated using a Multiple Indicators Multiple Causes (MIMIC) model.

Results. CFA supported the six-factor model with good fit indices (CFI=0.954; TLI=0.949; RMSEA=0.068; SRMR=0.070). Internal consistency was satisfactory across subscales

(ω=0.67-0.95). Correlations were consistent with theoretical expectations: higher health literacy and lower vaccine hesitancy were associated with lower endorsement of external attributions (Divine, Fate). The hierarchical second-order model (Internal, External-Powerful Others, External-Chance) yielded inadmissible solutions.

Discussion. The Italian PHLOC demonstrated sound psychometric properties, supporting its validity, reliability, and measurement invariance. Future studies should further investigate higher-order structures and temporal stability to strengthen the scale's theoretical and practical applications in research and clinical contexts.

Keyword: Parental Health Locus of Control, Vaccine Hesitancy, Health Literacy, Health Behavior, Parents, Measurement Invariance, Psychometrics, Surveys, Questionnaires, Psychometric Validation

Introduction

Children's health outcomes are profoundly shaped by parental attitudes, behaviors, and decision-making (Maia et al., 2025). As primary agents of health promotion, disease prevention, and treatment adherence, parents act as role models whose lifestyles and behaviors influence children's health habits and psychological well-being (Chen et al., 2019; Drenowatz et al., 2014), with potential long-term effects on morbidity and mortality (Demakakos et al., 2016). Understanding the psychological and social factors of parental engagement is crucial for improving pediatric outcomes and reducing preventable health risks. In Italy, several pediatric health indicators highlight the central role of parental decision-making in children's health, including childhood obesity, the management of chronic conditions, and the uptake of preventive programs such as vaccination. Previous research has highlighted the role of parental cognitions, such as beliefs about control, trust in healthcare professionals, and perceived self-efficacy, in shaping adherence to preventive care, vaccination decisions, and management of chronic diseases (Magi, Buccione, et al., 2025; Magi et al., 2026).

The Health Locus of Control (HLOC) framework, derived from Rotter's (1966) social learning theory, explains how individuals attribute health outcomes either to their own actions (internal control) or to external factors such as powerful others or chance (external control). Within the parental context, these dimensions reflect how and to what extent mothers and fathers perceive their influence over their children's health. Studies consistently show that an internal parental locus of control is associated with better child health outcomes, including higher vaccination compliance (Amit Aharon et al., 2018; Moreland et al., 2016) and fewer behavioral child problems (Moreland et al., 2016). Conversely, an external parental orientation has been associated with increased obesity risk in adolescents (Golding et al., 2019), and reduced psychological well-being among both parents and children (Nowicki et al., 2017). Accordingly, the assessment of parental HLOC (PHLOC) is pivotal for identifying modifiable psychological factors to promote children's and adolescents' physical and mental health.

The PHLOC scale, developed by DeVellis et al., (1993), is a 28-item self-report questionnaire assessing parents' beliefs about the sources of control over their child's health and comprising the six subscales of Parents, Children, Health Care Professionals (HCPs), Mass Media, Fate, and God. The PHLOC is based on a reflective measurement model and has been widely applied to parents of children under 18 years of age, both in community and clinical settings. Since its initial validation, the PHLOC has demonstrated good internal consistency across several studies and has been used to investigate parental health beliefs related to preventive behaviors (Mozafari et al., 2024), and vaccination (Amit Aharon et al., 2018).

The PHLOC has been translated and validated

in Norwegian (Kraft & Loeb, 1996), while in Italy, Bonichini et al., (2009) conducted a preliminary validation among mothers of infants aged 0–3 years. Internal consistency was acceptable; however, confirmatory factor analysis, convergent validity, and measurement-invariance testing were not conducted, which limits use of this scale in the Italian context. Therefore, a culturally adapted and psychometrically robust Italian version of the PHLOC is essential to ensure valid measurement of PHLOC within the Italian sociocultural and healthcare context. In Italy, where family-centered care and parental involvement are pivotal in both pediatric and preventive health services, reliable tools to assess these beliefs are particularly valuable for research and for guiding educational and clinical interventions.

Guided by the COnsensus-based Standards for the selection of Health Measurement INstruments (COSMIN) framework (Mokkink et al., 2018), the present study aimed to evaluate the psychometric properties of the Italian PHLOC scale. Specifically, we examined the structural validity of the six-factor model using confirmatory factor analysis, assessed internal consistency reliability, tested convergent validity with theoretically related constructs, and measurement invariance across groups of healthcare (HCP) and non-healthcare professionals (non-HCP).

Methods

Study Design

This was a cross-sectional psychometric study conducted between October 2024 and February 2025 as part of a broader observational project on parental vaccine hesitancy. The study adhered to the COSMIN guidelines for Patient-Reported Outcome Measures (PROMs) (Mokkink et al., 2018) and was preregistered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/38NQG).

Participants and PROM administration

A convenience sample of parents or legal guardians of at least one child aged 0-18 years and residing in Italy was recruited through an anonymous online survey disseminated via social media and parenting networks. Participation was voluntary, and respondents provided informed consent prior to accessing the questionnaire. Data for the PHLOC were extracted from a larger dataset collected for the overarching project and used for the present psychometric analysis.

Data collection procedures

Data were collected using a structured, self-administered questionnaire created on the EUSurvey® platform. The online questionnaire included sociodemographic variables (age, gender, education, occupation, healthcare background, and number of children) and the Italian versions of the PHLOC (Bonichini et al., 2009), the European Health Literacy Survey Questionnaire (HLS-EU-Q6) (Lorini et al., 2019) and the Parent Attitudes about Childhood Vaccines survey (PACV-5) (Magi, El Aoufy, et al., 2025). All tools were used with permission.

Parental Health Locus of Control

The PHLOC is a 28-item self-report scale assessing parents' beliefs about control over their child's health across six subscales: Parents, Children, Health Care Professional, Mass Media, Fate, and God. Items are rated on a 6-point Likert scale ("strongly disagree" to "strongly agree"), with higher scores indicating greater health locus of control in each dimension. Internal consistency was good ($\alpha>0.70$) and test–retest reliability adequate ($r>0.80$), indicating satisfactory stability (Bonichini et al., 2009). Before data collection, the PHLOC underwent cognitive pretesting with ten parents using the think-aloud method to assess clarity, comprehensibility, and cultural relevance (Mokkink et al., 2018). Each interview lasted approximately 30 minutes, and no substantial modifications were required, confirming the suitability of the Italian version for the present population. The final version used in this study is presented in Table S1. The PHLOC served as the target measure for validation, with convergent validity assessed against health literacy and vaccine hesitancy measures.

European Health Literacy Survey Questionnaire

The HLS-EU-Q6 is a 6-item short form

assessing individuals' perceived ability to access, understand, appraise, and apply health information, rated on a 4-point Likert scale ("very difficult" to "very easy"), with higher scores indicating greater health literacy. The Italian version showed good reliability (α=0.67) and construct validity (Lorini et al., 2019). It was used to test convergent validity, with higher health literacy expected to correlate with higher scores on the Parent, Child, Professional, and Media subscales, and lower scores on the Fate and Divine subscales.

Parent Attitudes about Childhood Vaccines

The PACV-5 is a 5-item scale evaluating parental confidence and attitudes toward childhood vaccination. Items are rated on a 5-point Likert scale ("strongly agree" to "strongly disagree") and dichotomous responses ("not at all hesitant" to "very hesitant"), with higher scores indicating greater hesitancy. The Italian version showed good internal consistency (ω=0.81, α=0.80) (Magi, El Aoufy, et al., 2025). It was used to examine convergent validity, with higher vaccine hesitancy hypothesized to align with stronger external (Fate, Divine) and weaker internal (Parent, Child) control beliefs. It was used to assess convergent validity, with higher vaccine hesitancy hypothesized to be associated with higher Fate and Divine subscale scores and lower Parent, Child, Professional and Media subscale scores.

Sample size calculation

Following established psychometric recommendations (De Vet et al., 2011), a minimum ratio of 5-10 participants per item was considered appropriate for factor analyses. Given the 28-item structure of the PHLOC, the target sample size ranged from 140 to 280 participants. To ensure adequate statistical power and compensate for potential data exclusions or missing data, this target was increased by 10%, yielding a final analytic sample of 308 complete responses.

Statistical analysis

Descriptive analyses were conducted for all sociodemographic and clinical variables, which were summarized as frequencies and percentages for categorical variables, and as means and standard deviations for continuous variables. Floor and ceiling effects were explored for each item, considering values above 15% as indicative of potential issues with score distribution (Klapproth et al., 2023). The factorial structure of the scale was examined through confirmatory factor analysis using Mplus version 8.9 (Muthén & Muthén, 2009). Given the 6-point Likert format of the items, all variables were treated as ordinal and estimated with the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimator, applying the THETA parameterization (Li, 2016) to ensure more stable residual variances with ordinal indicators. Consistent with the theoretical conceptualization of the PHLOC (DeVellis et al., 1993), we tested a confirmatory factor analysis with six first-order latent factors (*Parent, Child, Professionals, Media, Divine, Fate*). We also specified a second-order confirmatory factor analysis where these first-order factors were indicators of three second-order dimensions: (i) Internal (Parent, Child), (ii) External – Powerful Others (Professionals, Media), and (iii) External – Chance (Divine, Fate). This step was exploratory and aimed to evaluate the broader internal–external theoretical framework (Wallston et al., 1978).

Model fit was evaluated using multiple indices: (i) χ^2 and degrees of freedom, acknowledging its sensitivity to sample size; (ii) Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI), with values ≥0.95 indicating good fit; (iii) Root Mean Square Error of Approximation (RMSEA) with its 90% confidence interval, with values ≤0.06 considered acceptable; (iv) Standardized Root Mean Square Residual (SRMR), with values ≤0.08 considered acceptable (Hu & Bentler, 1999). Internal consistency reliability was assessed using McDonald's omega coefficient (ω), with values ≥0.70 considered satisfactory (Hayes & Coutts, 2020). Omega was preferred over Cronbach's alpha because it provides a more accurate estimate of reliability when items have heterogeneous factor loadings and when the scale is multidimensional, as in the case of the PHLOC (Dunn et al., 2014). Convergent validity was examined through Pearson's r correlations between the scale scores and selected external variables, including demographic characteristics, health literacy, and other clinically relevant indicators. Standardized factor loadings were reported, along with item R^2 values as indicators

of the proportion of variance explained by the latent factor. Model diagnostics included the inspection of standardized residuals and modification indices to detect possible sources of misfit. To examine measurement invariance by professional status, we estimated a multiple indicators multiple causes (MIMIC) model (Wang & Shih, 2010). In the baseline model, healthcare professional status (HCP vs non-HCP) was regressed onto the six latent PHLOC factors (Fate, Professionals, Media, Parent, Child, Divine) to test for group differences at the latent level. Subsequently, direct effects of HCP status on individual items were added one at a time to test for differential item functioning (DIF). Items with significant direct effects were retained in the model, indicating potential non-invariance, while items without evidence of DIF were treated as anchors (Wang & Yeh, 2003). Standardized regression coefficients (STDYX) and p-values were used to evaluate significance.

Ethical considerations

This study was approved by the Research Ethics Board of the University of Parma (Approval No. 119–2024-N). Informed consent was obtained electronically before participation in the survey. Data confidentiality and anonymity were ensured throughout the study.

Results

Descriptive statistics and distributional properties

Sociodemographic and clinical characteristics of the participants are summarized in Table 1. The sample (n=308) had a mean age of 43.6 years (SD=8.3), 20.5% were male, and the majority were married or partnered (85.1%). Almost half of the participants were healthcare professionals (48.7%), and 81.2% had a university degree or higher. Most participants reported having more than one child (57.4%). The mean health literacy score (HLS-EUQ6) was 2.54 (SD=0.60), indicating limited but sufficient health literacy on average. Item-level analyses (Table 2) showed that response distributions were skewed, with several items demonstrating floor or ceiling effects exceeding 15% of responses. This pattern justified the use of a categorical estimator in subsequent confirmatory factor analyses. More than 54-59% of participants endorsed the top response categories (scores 5-6) of items i1, i2, and i3, with mean scores above 5.0. Similarly, most participants (56-69%) selected the lowest categories (scores 1-2) of items i11, i16, i18, i21, and i28, with mean scores consistently below 2.0.

Table 1. Sociodemographic and clinical characteristics of the Sample (n = 308).

Characteristic	n (%) or Mean (SD)
Age (years)	43.55 (8.3)
Gender (male)	63 (20.5)
Marital status	
Married/partnered	262 (85.1)
Single/divorced/widowed	46 (14.9)
Occupation	
Unoccupied	21 (5.5)
Employed/other	287 (94.5)
Educational attainment	
University degree or higher	250 (81.2)
≤ High school	58 (18.8)
Healthcare professional	150 (48.7)
Number of children	
1	131 (42.5)
>1	177 (57.5)
Health literacy (HLS-EU-Q6, 1–4)	2.54 (0.60)
PACV-5	
PHLOC subscales (1–6)	
Parent	3.84 (0.85)
Fate	1.69 (0.92)
Divine	1.40 (1.05)
Child	2.54 (0.95)
Professional	4.01 (1.00)
Media	3.29 (1.49)

Note. SD = standard deviation; HLS-EU-Q6: European Health Literacy Survey Questionnaire short-short form; PHLOC: Parental Health Locus of Control; PACV-5: Parent Attitudes about Childhood Vaccines.

Internal consistency reliability

McDonald's omega values supported the internal consistency of the PHLOC subscales: Fate (ω=0.86), Divine (ω=0.95), Professionals (ω=0.67), Media (ω=0.78), Parent (ω=0.82), Child (ω=0.79). The total PHLOC score also showed good reliability (ω=0.86).

Confirmatory factor analyses

The hypothesized six-factor model of the

Table 2. Distribution of responses for each PHLOC item (n = 308).

Item	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Mean (SD)
1. Health professionals keep my child from getting sick.	17 (5.5%)	6 (1.9%)	24 (7.8%)	40 (13.0%)	53 (17.2%)	168 (54.5%)	5.09 (1.33)
2. I have the ability to influence my child's well-being	10 (3.2%)	11 (3.6%)	19 (6.2%)	47 (15.3%)	54 (17.5%)	167 (54.2%)	5.02 (1.29)
3. My child can avoid illness with regular professional care.	10 (3.2%)	5 (1.6%)	25 (8.1%)	33 (10.7%)	52 (16.9%)	183 (59.4%)	5.09 (1.26)
4. My child is in control of his/her own health.	151 (49.0%)	56 (18.2%)	48 (15.6%)	20 (6.5%)	11 (3.6%)	22 (7.1%)	1.95 (1.35)
5. Having regular contact with a physician is the best way for my child to avoid illness.	48 (15.6%)	35 (11.4%)	62 (20.1%)	50 (16.2%)	36 (11.7%)	77 (25.0%)	3.42 (1.72)
6. What my child sees in T.V. commercials can affect my child's health.	76 (24.7%)	21 (6.8%)	54 (17.5%)	48 (15.6%)	33 (10.7%)	76 (24.7%)	3.45 (1.84)
7. Whether my child avoids injury is just a matter of luck.	132 (42.9%)	57 (18.5%)	52 (16.9%)	30 (9.7%)	13 (4.2%)	24 (7.8%)	2.23 (1.38)
8. Some of the comic books around today can affect my child's health.	122 (39.6%)	35 (11.4%)	53 (17.2%)	42 (13.6%)	18 (5.8%)	38 (12.3%)	2.68 (1.67)
9. My child is the one who determines his/her own well being.	77 (25.0%)	40 (13.0%)	71 (23.1%)	55 (17.9%)	21 (6.8%)	44 (14.3%)	3.16 (1.66)
10. Only trained health professionals can influence my child's health	72 (23.4%)	48 (15.6%)	63 (20.5%)	62 (20.1%)	20 (6.5%)	43 (14.0%)	3.11 (1.65)
11. God will decide what will happen to my child's health.	212 (68.8%)	26 (8.4%)	29 (9.4%)	15 (4.9%)	7 (2.3%)	19 (6.2%)	1.73 (1.25)
12. Luck plays a big part in determining how healthy my child is.	142 (46.1%)	67 (21.8%)	44 (14.3%)	33 (10.7%)	4 (1.3%)	18 (5.8%)	2.02 (1.35)
13. I can do a lot to prevent my child from getting hurt.	35 (11.4%)	29 (9.4%)	88 (28.6%)	65 (21.1%)	35 (11.4%)	56 (18.2%)	3.51 (1.58)
14. What my child sees in T.V. programs can affect my child's health.	51 (16.6%)	37 (12.0%)	61 (19.8%)	55 (17.9%)	41 (13.3%)	63 (20.5%)	3.58 (1.66)
15. My child's safety depends mostly on what my child does.	40 (13.0%)	44 (14.3%)	91 (29.5%)	71 (23.1%)	28 (9.1%)	34 (11.0%)	3.36 (1.44)
16. My child's well being is in God's hands.	192 (62.3%)	45 (14.6%)	28 (9.1%)	12 (3.9%)	7 (2.3%)	24 (7.8%)	1.85 (1.37)
17. I can do a lot to prevent my child from getting sick.	22 (7.1%)	18 (5.8%)	67 (21.8%)	91 (29.5%)	44 (14.3%)	66 (21.4%)	3.88 (1.44)
18. Whether my child avoids sickness is just a matter of luck.	178 (57.8%)	61 (19.8%)	41 (13.3%)	13 (4.2%)	4 (1.3%)	11 (3.6%)	1.78 (1.13)
19. The things I do at home with my child are an important part of my child's well being.	7 (2.3%)	9 (2.9%)	30 (9.7%)	60 (19.5%)	76 (24.7%)	126 (40.9%)	4.83 (1.29)
20. Health professionals control my child's well being.	51 (16.6%)	56 (18.2%)	87 (28.2%)	70 (22.7%)	22 (7.1%)	22 (7.1%)	3.24 (1.44)
21. God will keep my child safe.	194 (63.0%)	46 (14.9%)	27 (8.8%)	18 (5.8%)	5 (1.6%)	18 (5.8%)	1.92 (1.32)
22. My child's safety depends on me.	20 (6.5%)	21 (6.8%)	71 (23.1%)	87 (28.2%)	53 (17.2%)	56 (18.2%)	3.77 (1.45)
23. My child can do a lot to avoid getting sick.	45 (14.6%)	59 (19.2%)	82 (26.6%)	55 (17.9%)	24 (7.8%)	43 (14.0%)	3.25 (1.57)
24. I can do a lot to help my child stay well.	7 (2.3%)	11 (3.6%)	50 (16.2%)	77 (25.0%)	58 (18.8%)	105 (34.1%)	4.55 (1.29)
25. My child's good health is largely a matter of good fortune.	173 (56.2%)	65 (21.1%)	37 (12.0%)	20 (6.5%)	3 (1.0%)	10 (3.2%)	1.84 (1.09)
26. To a large degree my child can determine his/her own health.	51 (16.6%)	53 (17.2%)	66 (21.4%)	67 (21.8%)	29 (9.4%)	42 (13.6%)	3.25 (1.57)
27. I can do a lot to help my child be strong and healthy.	8 (2.6%)	14 (4.5%)	40 (13.0%)	75 (24.4%)	69 (22.4%)	102 (33.1%)	4.43 (1.27)
28. Whether my child stays healthy or gets sick is just a matter of fate.	179 (58.1%)	47 (15.3%)	46 (14.9%)	17 (5.5%)	3 (1.0%)	16 (5.2%)	1.84 (1.24)

Note. SD = standard deviation.

PHLOC demonstrated an overall good fit to the data: $\chi^2(335)=812.05$, $p< 0.001$; CFI=0.954; TLI=0.949; RMSEA=0.068, 90% CI [0.062–0.074]; SRMR=0.070 (Figure 1; Table 3). Although the chi-square test was significant, the alternative indices indicated an acceptable model fit. Standardized factor loadings were generally high, ranging from 0.45 (i2) to 0.98 (i16), with the majority exceeding the 0.60 threshold. The Divine factor showed the strongest loadings (0.95–0.98), followed by Fate (0.61–0.90), Parent (0.45–0.85), Child (0.50–0.82), Media (0.77–0.84), and Professional (0.45–0.72). Item-level R^2 values indicated that the latent factors explained between 20% (i10) and 97% (i16) of the variance in individual items. Latent factor correlations were consistent with theoretical expectations. Fate was strongly correlated with Divine (r=0.64, p<0.001) and Child (r=0.56, p<0.001), while Parent showed moderate correlations with Professional (r=0.42, p<0.001) and Media (r=0.37, p<0.001). Lower but significant associations were observed between Professional and Fate (r=0.18, p=0.005), as well as between Professional and Divine (r=0.17, p=0.011).

A theory-driven second-order confirmatory factor analysis (Internal, Powerful Others, Chance) showed acceptable global fit ($\chi^2(342)=857.14$, p<0.001; CFI=0.951; TLI=0.946; RMSEA=0.070 [0.064–0.076]; SRMR=0.078) but yielded inadmissible solutions. Specifically, the second-order latent covariance matrix was not positive definite due to a Heywood case, with an over-unity correlation between the Internal and Powerful Others factors (r>1) and a near-zero variance estimate for Powerful Others. Moreover, the first-order factor Fate exhibited a residual variance of zero under Chance. Given these identification/collinearity issues—likely exacerbated by the weak definition of Powerful Others with only two indicators and by the dominance of Fate within Chance—the hierarchical specification was not retained.

Convergent validity

Pearson correlations between PHLOC subscales and external variables provided preliminary evidence of convergent validity (Table 4). Higher health literacy scores were inversely associated with Fate (r=–0.18, p<0.01), Divine (r=–0.16, p<0.01), Child (r=–0.12, p<0.05), and Media (r=–0.14, p<0.05), suggesting that greater functional health literacy is linked to lower endorsement of external attributions of control. PACV-5 vaccine hesitancy was negatively correlated with Parent (r=–0.12, p<0.05) and Professional (r=–0.14, p<0.05), while showing positive associations with Fate (r=0.19, p<0.01) and Divine (r=0.11, p<0.05), indicating that stronger external health beliefs were linked to greater hesitancy. Demographic patterns also emerged. Women scored significantly higher on Parent (r=–0.09, ns but in expected direction) and Professional (r=–0.21, p<0.01), while men tended to endorse Child beliefs less strongly (r=–0.15, p<0.01). Age was positively correlated with Child (r=0.24, p<0.01), indicating that older participants were more likely to ascribe health outcomes to children's actions. Education showed small but consistent effects: participants with a university degree reported lower reliance on Fate (r=–0.12, p<0.05) and Professional (r=–0.11, p<0.05). Compared to non-HCPs, HCPs showed lower endorsement of Professional (r=–0.18, p<0.01) and Fate (r=–0.11, p< 0.05). Together, these patterns supported the construct validity of the PHLOC, linking external attributions to lower health literacy and higher vaccine hesitancy, and revealing

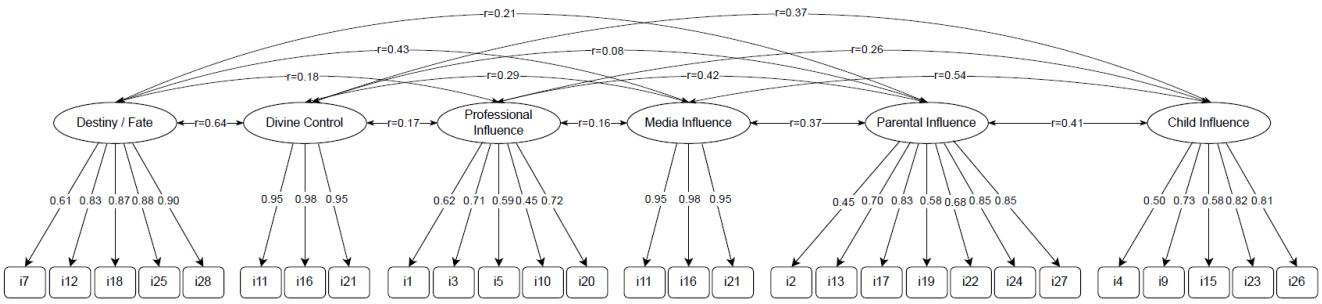

Figure 1. Confirmatory factor analysis model of the Parental Health Locus of Control Scale (PHLOC).

Note. Standardized factor loadings are shown on the paths from latent factors to observed items, and latent factor correlations are displayed on the double-headed arrows. All parameters are standardized and statistically significant at p < .001 unless otherwise specified. The model was estimated using the WLSMV estimator, which treats item responses as ordinal.

Table 2. Distribution of responses for each PHLOC item (n = 308).

Subscale / Item	λ	SE	p-value	R^2
Parent				
2. I have the ability to influence my child's well-being.	0.45	0.05	<.001	0.20
13. I can do a lot to prevent my child from getting hurt.	0.70	0.03	<.001	0.49
17. I can do a lot to prevent my child from getting sick.	0.83	0.02	<.001	0.69
19. The things I do at home with my child are an important part of his/her well-being.	0.58	0.04	<.001	0.33
22. My child's safety depends on me.	0.68	0.03	<.001	0.46
24. I can do a lot to help my child stay well.	0.84	0.02	<.001	0.71
27. I can do a lot to help my child be strong and healthy.	0.85	0.02	<.001	0.72
Child				
4. My child is in control of his/her own health.	0.50	0.05	<.001	0.25
9. My child is the one who determines his/her own well-being.	0.73	0.03	<.001	0.53
15. My child's safety depends mostly on what my child does.	0.58	0.04	<.001	0.33
23. My child can do a lot to avoid getting sick.	0.82	0.03	<.001	0.68
26. To a large degree my child can determine his/her own health.	0.81	0.03	<.001	0.66
Divine				
11. God will decide what will happen to my child's health.	0.95	0.01	<.001	0.91
16. My child's well-being is in God's hands.	0.98	0.01	<.001	0.97
21. God will keep my child safe.	0.95	0.01	<.001	0.90
Fate				
7. Whether my child avoids injury is just a matter of luck.	0.61	0.04	<.001	0.37
12. Luck plays a big part in determining how healthy my child is.	0.83	0.02	<.001	0.69
18. Whether my child avoids sickness is just a matter of luck.	0.87	0.02	<.001	0.76
25. My child's good health is largely a matter of good fortune.	0.88	0.02	<.001	0.78
28. Whether my child stays healthy or gets sick is just a matter of fate.	0.90	0.02	<.001	0.81
Professional				
1. Health professionals keep my child from getting sick.	0.62	0.05	<.001	0.38
3. My child can avoid illness with regular professional care.	0.70	0.05	<.001	0.50
5. Having regular contact with a physician is the best way for my child to avoid illness.	0.59	0.05	<.001	0.35
10. Only trained health professionals can influence my child's health.	0.45	0.05	<.001	0.20
20. Health professionals control my child's well-being.	0.72	0.06	<.001	0.52
Media				
6. What my child sees in TV commercials can affect my child's health.	0.77	0.03	<.001	0.59
8. Some of the comic books around today can affect my child's health.	0.84	0.03	<.001	0.71
14. What my child sees in TV programs can affect my child's health.	0.77	0.04	<.001	0.60

Note. λ = standardized factor loading; SE = standard error; R^2 = proportion of variance explained by the factor. All loadings are standardized (STDYX). p-values refer to the significance of the loading different from zero.

Table 4. Correlations between PHLOC subscales and external variables (n = 308).

PHLOC subscale	Health literacy	PACV-5	Gender	Age	Education (>8y)	Health profession
Parent Parent	−0.02 (ns)	−0.12*	−0.09 (ns)	−0.02 (ns)	−0.03 (ns)	0.08 (ns)
Fate	−0.18**	0.19**	−0.11 (ns)	−0.05 (ns)	−0.12*	−0.11*
Divine	−0.16**	0.11*	0.03 (ns)	−0.06 (ns)	−0.03 (ns)	−0.08 (ns)
Child	−0.12*	0.09 (ns)	−0.15**	0.24**	−0.09 (ns)	0.06 (ns)
Professional	−0.04 (ns)	−0.14*	−0.21**	0.09 (ns)	−0.11*	−0.18**
Media	−0.14*	0.07 (ns)	−0.11 (ns)	−0.02 (ns)	0.01 (ns)	0.09 (ns)

Note. *p < .05, **p < .01; ns = not significant; PACV-5, Parent Attitudes about Childhood Vaccines Survey. Health literacy and PACV-5 scores were treated as continuous. Gender was coded 0 = female, and 1 = male. Age was treated as continuous. Education was coded as 0 =≤ 8 and 1 = > 8 years. Health profession was coded as 0 = non healthcare professional, and 1 = healthcare professional.

sociodemographic gradients across subscales.

MIMIC model results

In the baseline MIMIC model, healthcare professional status significantly predicted lower latent scores on the Professional factor (Estimate=-0.25, SE=0.10, p=0.010), indicating that HCPs were less likely to attribute health control to professionals compared with non-HCPs. At the item level, none of the five indicators (i1, i3, i5, i10, i20) showed significant direct effects of HCP status (all p>0.10), suggesting the absence of DIF. These findings support measurement invariance of the Professional domain, confirming that the observed group difference reflects a true latent effect rather than item-level bias.

Discussion

This study examined the psychometric properties and measurement invariance of the Italian version of the PHLOC among parents of children aged 0-18 years. Overall, the findings support the validity and reliability of the instrument in this cultural context. The six-factor model proposed DeVellis et al., (1993) showed good fit and strong item loadings; internal consistency was satisfactory across all subscales, and measurement invariance was demonstrated across HCPs and non-HCPs, indicating comparable interpretation of the items across these groups.

The PHLOC assesses the extent to which parents believe that health outcomes depend on their own actions, their children, or external influences. Validating this scale in Italian parents is important because parental cognitions are key determinants of preventive behaviors, adherence to medical recommendations, and communication with healthcare providers (Feinberg et al., 2022). Understanding these belief patterns can help tailor interventions to enhance parental engagement and shared decision-making in pediatric and public health contexts.

Item-level analyses revealed some ceiling and floor effects for several items, particularly within the Divine and Fate subscales, suggesting that these external attributions are less frequently endorsed among Italian parents (Di Battista et al., 2018). In contrast, high scores in the Parent and Child subscales reflect a strong sense of personal and familial responsibility for child health, consistent with the increasing individualistic and participatory parenting culture in Italian parents, who perceive health management as a shared responsibility within the family rather than an externally controlled process (Feinberg et al., 2022; Kone et al., 2022).

Confirmatory factor analysis supported the six-factor structure, with excellent comparative fit indices. Although the RMSEA value slightly exceeded the conventional 0.06 threshold, this deviation is common in cross-cultural validations and likely reflects minor response pattern variations rather than model misspecification (Zhao et al., 2024). In fact, factor loadings were robust across domains, indicating that each subscale effectively captured its intended construct. The alternative second-order model based on Rotter's internal–external dichotomy did not yield admissible solutions, reinforcing the notion that a multidimensional structure provides a more accurate representation of parental control beliefs in this cultural context. These results mirror findings from the Norwegian validation (Kraft & Loeb, 1996) and are consistent with the theoretical assumption that PHLOC encompasses distinct but interrelated sources of influence rather than a single continuum of internal versus external orientation.

Convergent validity was supported by associations in the expected directions. Parents with higher health literacy exhibited lower endorsement of external control attributions (Divine, Fate, Media), whereas greater internal control orientation (Parent subscale) was correlated with lower vaccine hesitancy. From a health education perspective, parents with limited health literacy may rely more on external or transcendent explanations, suggesting that empowerment strategies should integrate both informational and motivational components (Truong & Fenton, 2022). These findings reinforce previous evidence linking internal control to parental self-efficacy and adherence to preventive practices (Amit Aharon et al., 2018; Moreland et al., 2016). Similarly, a previous Italian study conducted among parents of both term and preterm infants highlighted a correlation between higher educational levels and lower influence of media information on their child's health. The study also found that younger parents with higher education were more likely to engage in healthy preventive

behaviors (Morniroli et al., 2022).

Internal consistency was satisfactory for all subscales, exceeding the threshold of 0.70 for most domains, which was comparable to those reported in the original US validation (α ranging from 0.70 to 0.92) and in the Norwegian version (α ranging from 0.69 to 0.90), confirming the internal coherence of the Italian PHLOC version. In this study, reliability was assessed using McDonald's omega rather than Cronbach's alpha, as omega provides a more accurate and robust estimate when factor loadings are heterogeneous and the scale is multidimensional (Dunn et al., 2014; Hayes & Coutts, 2020). This methodological choice further supports the strength of the reliability evidence for the Italian version. The slightly lower reliability of the Professional subscale may reflect the pluralistic nature of the Italian healthcare system, where pediatric and preventive services are often shared among multiple professionals (Corsello et al., 2016). However, this does not compromise the interpretability of the domain, as all items displayed satisfactory loadings and theoretical coherence with the construct.

The MIMIC analysis confirmed measurement invariance across HCP and non-HCP participants. HCPs reported significantly lower scores on the Professional factor, indicating that they attribute less control to medical staff compared with non-HCPs meaning that greater health knowledge and self-efficacy reduce external attribution to medical staff. This difference reflects their higher health literacy and self-efficacy, which enables them to perceive greater personal and familial responsibility for health outcomes. Conversely, non-HCPs tended to view professionals as the main agents of control, emphasizing dependence on expert guidance for child health management. The absence of differential item functioning further indicates that these differences reflect genuine latent variations rather than measurement bias.

Strengths and limitations

This study offers several strengths. First, the procedures followed the COSMIN framework (Mokkink et al., 2018) for evaluating patient-reported outcome measures, including adequate sample size for robust factor analysis, and adoption of cognitive pretesting to ensure semantic and cultural equivalence. The inclusion of both HCP and non-HCP participants allowed assessment of invariance across professional backgrounds. However, some limitations must be acknowledged. The use of a convenience sample, characterized by a predominance of well-educated parents, a notably high proportion of healthcare professionals, and female participants, may limit the representativeness of the sample and the generalizability of the findings. The cross-sectional design prevented assessment of test-retest reliability and predictive validity. The second-order factorial model could not be confirmed, suggesting the need for further investigation in larger and more diverse samples.

Implications for clinical practice and research

The Italian PHLOC represents a reliable and culturally appropriate tool for assessing parental beliefs about control over child health. In clinical and public health contexts, this scale may support the identification of parents who predominantly attribute health outcomes externally and may therefore exhibit lower adherence to preventive behaviors. Integrating PHLOC assessment into health education and counselling programs could support tailored interventions aimed at strengthening parental self-efficacy, health literacy and autonomy (Náfrádi et al., 2017). Future studies should examine temporal stability and responsiveness to interventions.

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