

Original Research



Measuring adolescents' wellbeing in Sri Lanka: psychometric properties of the Sinhala version of EPOCH

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DOI: <https://doi.org/10.4038/jccpsl.v31i3.8829>

Received on 15 Feb 2025

Accepted on 31 Jul 2025

Abstract

Introduction: The EPOCH Measure of Adolescent Well-being assesses the five positive factors of well-being of adolescents: engagement, perseverance, optimism, connectedness and happiness under hedonic and eudemonic aspects of well-being. The original English version of the EPOCH measure ensures a five-factor structure along with other validity and reliability indicators.

Objectives: To culturally adapt and assess the psychometric properties of EPOCH Measure of Adolescent Well-being among Sinhala-speaking adolescents in Sri Lanka

Methods: A cross-sectional validation study was conducted. The original EPOCH Measure of Adolescent Well-being was translated into Sinhala language, culturally adapted and validated. The construct validity of psychometric properties was assessed with SPSS AMOS with a sample size of 262 study participants to test for confirmatory factor analysis. Internal consistency was used to evaluate the reliability.

Results: Sinhala version of the EPOCH Measure of Adolescent Well-being demonstrated good model fit with a five-factor model. The fit indices were GFI of 0.906, SRMR of 0.031, NNFI of 0.919, TLI of 0.903, CFI of 0.963, and RMSEA of 0.054. Internal consistency was good for all five EPOCH subscales (Cronbach's $\alpha=0.88-0.92$) and the total scale (Cronbach's $\alpha=0.84$).

Conclusions & Recommendations: This study signified that the Sinhala version of the EPOCH Measure of Adolescent Well-being is suitable for assessing the five positive dimensions of well-being in Sinhala-speaking adolescents in Sri Lanka.

Key words: EPOCH Measure of Adolescent Well-being, Psychometric property, Validation, Sri Lanka

Introduction

Adolescence is a unique phase of life during which individuals experience rapid physical, cognitive, and psychosocial growth. It might affect how they feel, make decisions, think, and interact with the world around them (1). Adolescence is a period more prone to developing psychological disorders and symptoms, including anxiety, depression, mood swings, and emotional outbursts. However, adolescents with a sense of positive well-being are more likely to enjoy a better quality of life and engage in fewer risky health behaviours in their young adulthood (2).

The well-being of adolescents extends beyond academic performance. However, it encompasses various dimensions, including health-related quality of life, family and parental relationships, and perceptions of their own health status (3). Moreover, it is strongly related to positive mental health. Therefore, it cannot be merely conceptualized as the absence of mental health problems such as depression, anxiety, and stress, but as positive psychological well-being with perseverance, optimism, and happiness. Furthermore, both hedonic ('feeling good') and eudemonic ('functioning well') aspects comprise well-being and should be taken into consideration. Therefore, it is essential to assess adolescent well-being using a multidimensional approach (4).

Various approaches exist for defining or conceptualising the well-being of adolescents, and these variations, depending on the specific research context, can be seen. As a result, different tools are available to measure the various conceptual models and well-being of different age ranges (5). The Student Subjective Well-being Questionnaire has been developed, mainly focusing on students' well-being in schools, and it predominantly tackles the hedonic dimension of well-being (5). The Strengths and Difficulties Questionnaire (SDQ) is a brief behavioural screening tool that assesses behavioural and emotional difficulties in children aged 10 years

and older (6). The PERMA model for adolescents features a distinct factor structure comprising positive emotions, engagement, relationships, meaning, and accomplishment. However, it is mainly used as a theoretical framework for school applications to assess positive psychology (7) and in positive educational studies (4). Hence, despite numerous tools being available for measuring children's well-being, each has its inherent advantages and limitations (5).

The EPOCH Measure was developed by Kern et al. (2016) as a multidimensional tool to assess key positive psychological dimensions of adolescents' well-being, including engagement, perseverance, optimism, connectedness, and happiness. These five dimensions have been designed to measure well-being traits that contribute to positive developmental and flourishing outcomes (8). It draws inspiration from Seligman's (2011) theory of flourishing of well-being, which focuses on positive emotion, engagement, relationships, meaning, and accomplishment (9). EPOCH measure adapts these constructs to suit adolescents as a unique assessment of the developmental and contextual needs of adolescents (10). Therefore, extending from the PERMA model of adults to the EPOCH measure of adolescent well-being, it is defined by five positive dimensions: engagement, perseverance, optimism, connectedness, and happiness, emphasizing that these traits are not only measurable but also malleable through intervention. It is also predictive of long-term success in adulthood (8).

The original validation study has tested EPOCH Measure on over 4,000 adolescents from ten different settings in Australia and the United States (8). Also, it has been culturally adapted and validated in several countries, including Sweden, Germany, China, Malaysia, Indonesia, and Thailand. In the absence of a culturally adapted and validated tool to measure the well-being of adolescents in Sri Lanka, this study aimed to validate the EPOCH Measure for the Sinhala-speaking Sri Lankan adolescents. This will

enable a more accurate and holistic assessment of adolescent well-being in the Sri Lankan population.

Methods

In the absence of a gold standard to assess criterion validity, the validity of S-EPOCH was assessed through a judgmental and construct validation process.

Initially, the original English version of EPOCH Measure of Adolescent Well-being (8) was forward translated into *Sinhala* (the primary local language in Sri Lanka) by two independent experts. It was back translated by another two independent experts. Its cultural appropriateness was assessed using a modified Delphi technique by a panel of experts, including a community consultant physician, a psychiatrist, a psychologist, an English teacher, and two adolescent counsellors. Cross-cultural adaptation was achieved following the standard guideline described by Beaton (11) to attain semantic, idiomatic, empirical, and conceptual equivalence. The finalised Sinhala version (S-EPOCH) was then pre-tested in 36 adolescents aged 10-18 years. Further, its judgmental validity was appraised by determining face, content, and consensual validity with the involvement of a multidisciplinary panel of experts, including three consultant community physicians, two psychiatrists, a psychologist, three teachers, and two senior paediatric medical officers. The difficulty, ambiguity, generality, consistency of style, clarity of language used, formatting, and readability of the items were assessed. No modifications were made.

Construct validity was assessed to determine the degree to which a specific variable in the S-EPOCH aligns with other predefined variables, by theoretically derived hypotheses related to adolescent well-being concepts or constructs (12). As no modification was made while adapting, the confirmatory factor analysis (CFA) was carried out

(13), with the assumption that the five-factor structure of the EPOCH measure would also yield an acceptable model fit for the Sinhala version (5). For this purpose, a cross-sectional validation study was conducted between August and September 2024 in the school setting of the Kekirawa Educational Zone in Anuradhapura District, which was selected purposively as it had the second-highest number of schools, students, and teachers in North Central Province. The calculated sample size was 223 for a 10:1 maximum subject-to-item ratio. Out of the four school categories, type 1AB, type 2 and type 3 were selected purposively to prevent selecting more than one school from the type 1 category. Out of 130 schools, one Sinhala medium school was selected randomly from each category. Within the selected three schools, eight classes were selected randomly (one class from grade five of type 3 school, three classes from grades six, eight and ten of type 2 school, and four classes from grades seven, nine, eleven, and thirteen of type 1AB school). All the students in a selected class were recruited for the study. All participants were requested to respond to the 20-item S-EPOCH measure. Each item was rated on a 5-point Likert scale ranging from 1 'Almost never' to 5 'Almost always' as in the original tool.

Data analysis

The SPSS AMOS 26 statistical software was used to test the factor structure of S-EPOCH using CFA with maximum likelihood estimation and 500 bootstraps. Following Kern et al. (2016), the five-factor model with interrelated latent variables corresponding to each EPOCH domain was determined (8) by loading the 20 items of S-EPOCH into five factors. Additionally, in line with Maurer et al. (2021), single-factor (one-factor) and second order (higher-order) models were tested (4). In the second-order model, the items were loaded into five factors, which in turn were loaded onto a single overarching latent construct of well-being. In the single-factor model, the items were loaded onto a single-factor, namely the overall well-being (4). Thereafter, the latter two models were compared with the five-factor model.

Several fit indices were used to assess the adequate fit between the hypothesized model and the observed data (13). Absolute model fit was assessed using chi-squared test (χ^2), Goodness-of-Fit Index (GFI) and Standardized Root Mean Square Residual (SRMR). Baseline model comparisons were conducted using Non-Normed Fit Index (NNFI), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI). Parsimony fit was evaluated using Root Mean Square Error of Approximation (RMSEA). Reliability was assessed

by using Cronbach's alpha. A cut-off value of 0.7 or higher was considered satisfactory for both multidimensional scales and the total scale.

Results

The judgmental validation process and pre-testing ensured simplicity, cultural appropriateness and understandability of the S-EPOCH. The tool was self-completed with, typically within 10-15 minutes.

Table 1: Sociodemographic characteristics of the study participants (N=262)

Characteristics	No.	%
Sex		
Male	138	51.9
Female	126	48.1
Age (years)		
11	36	13.7
12	30	11.5
13	30	11.5
15	16	6.1
16	22	8.4
17	34	13.0
18	31	11.8
Ethnicity		
Sinhala	244	93.1
Moor	15	5.7
Tamil	2	0.8
Other	1	0.4
Religion		
Buddhist	239	91.2
Catholic/ Catholic	7	2.7
Islam	15	5.7
Hindu	1	0.4

The cross-sectional study showed 96% response rate. Their mean age was 13.7 (SD=2.8) years. The majority were male, Sinhala in ethnicity and Buddhist (Table 1). Data normality were determined by using item histograms, Q-Q plots and normality tests. Both Kolmogorov-Smirnov and Shapiro-Wilk tests showed p-values less than 0.05, indicating non-normality of the data. Hence, CFA with maximum

likelihood estimation and 500 bootstraps was used to ensure normal distribution. Most of the items showed linear relationships in the scatter plot matrix. All the Variance Inflation Factor (VIF) values were less than five, which were below the cut-off value (14), indicating no multicollinearity. Hence, the data were proven to be compatible with the CFA.

Table 2: Comparison of the Sinhala EPOCH five-factor model with Harman's single-factor model and higher-order model

Fit index	Five-factor model	Second-order model	Single-order model
Absolute fit indices			
Chi-squared test (χ^2)	280.95; p<0.001	289.95; p<0.001	2668.31; p<0.001
Goodness-of-Fit Index (GFI)	0.906	0.903	0.442
Standardized Root Mean-squared Residual ((S)RMR)	0.031	0.042	0.17
Comparative fit indices			
Non-Normed Fit Index (NNFI)	0.919	0.916	NA
Tucker-Lewis Index (TLI)	0.956	0.956	0.149
Comparative Fit Index (CFI)	0.963	0.962	0.238
Parsimony fit indices			
Root Mean Squared Error of Approximation (RMSEA)	0.054	0.054	0.237

NA- Not applicable

The five-factor model of S-EPOCH showed a good model fit with absolute fit and Parsimony-adjusted measures (Figure 1). However, the chi-squared test value was significant ($p<0.001$) due to trivial differences detected in large sample sizes (15). Hence, adhering to Groskurth et al. (2024), the chi-squared test statistic was divided by the model degrees of freedom (280.9/160), yielding a relative chi-squared value of 1.75, which was less than two

and considered significant (10). The second-order model also reflected a good model fit but indices lower than the five-factor model (Figure 2; Table 2). After accommodating for the exclusion of common method bias, the single-factor model did not have an acceptable model fit (Figure 3; Table 2). Therefore, the fit indices of the five-factor model and the second-order model supported a good model fit for S-EPOCH (Table 2).

Table 3: Reliability assessment of the Sinhala version of the EPOCH Measure

EPOCH Factor	Cronbach's alpha (α) coefficient
Engagement	0.905
Perseverance	0.9
Optimism	0.883
Connectedness	0.882
Happiness	0.914
Total	0.839

The reliability of S-EPOCH was indicated by a high internal consistency (Cronbach's $\alpha=0.839$). The lowest reliability occurred for connectedness

($\alpha=0.882$), while subscales such as perseverance ($\alpha=0.9$), optimism ($\alpha=0.884$), and happiness ($\alpha=0.914$) had excellent reliability (Table 3).

Table 4: Comparability of the Sinhala version with other validation studies of the EPOCH measure in different countries

Fit index	EPOCH Sinhala	EPOCH Sweden (Maurer et al., 2021)	EPOCH Indonesia (Simanjuntak et al., 2023)
Absolute fit indices			
Chi-squared test (χ^2)	289.95; p<0.001	N/A	871.78; p<0.001
Goodness-of-Fit Index (GFI)	0.903	N/A	
Standardized Root Mean-squared Residual ((S)RMR)	0.042	N/A	
Comparative fit indices			
Non-Normed Fit Index (NNFI)	0.916	N/A	N/A
Tucker-Lewis Index (TLI)	0.956	0.939	0.898
Comparative Fit Index (CFI)	0.962	0.951	0.911
Parsimony fit indices			
Root Mean Squared Error of Approximation (RMSEA)	0.054	0.048	0.071

Discussion

The current study aimed to assess the psychometric properties of the Sinhala EPOCH (S-EPOCH) measure. No modifications were made to the original EPOCH measure following the cultural adaptation. Construct validity was assessed as in the Chinese study (16). The good model fit of the five-factor model was guaranteed with absolute and comparative fit indices. Furthermore, the parsimony fit index ensured the model fit. The study findings were consistent with Kern's original model CFA findings from the sample of Australian Catholic girls' school, where the RMSEA was 0.058, the (S)RMR was 0.037 and the CFI was 0.964. Moreover, the sample of US hospitalized youth showed a very close Tucker-Lewis Index (TLI=0.907), which aligns with our findings.

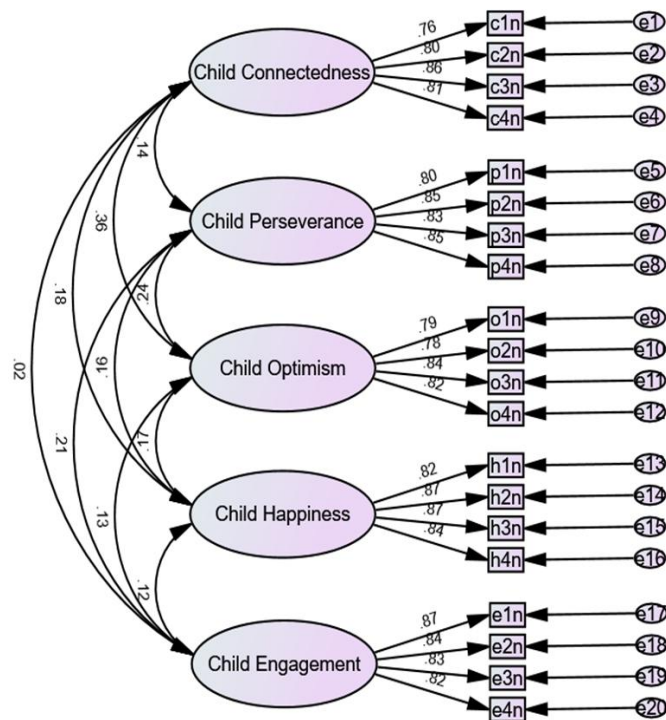
The fit indices of the five-factor model for the Sinhala EPOCH measure were consistent with the CFA findings of translated versions of the EPOCH measure in Sweden (4), Germany (5), China (16), Malaysia (10) and Indonesia (17). The GFI was 0.906 in our study, indicating a strong fitness and consistent with findings from a Malaysian study (GFI=0.9).

Additionally, a GFI value above 0.9 suggests that the model effectively explains the variance and covariance in the data (13). In this study, the SRMR was 0.031, indicating a strong model fit and aligning with findings from similar validation studies in Sweden (SRMR=0.044), Germany (SRMR=0.042) and China (SRMR=0.041) (4-5, 16). It measures the standardized difference between observed and predicted correlations and was considered acceptable when it is below 0.08 (13).

Chi-squared goodness-of-fit statistic of CFA of the study demonstrated the magnitude of discrepancy between the observed and predicted covariance matrices, which it used to assess the overall fit. Though a non-significant chi-squared value ($p>0.05$) indicates a good model fit, the chi-squared test value of the study was significant ($\chi^2(160)=280.95$; $p<0.001$) aligning with Swedish ($\chi^2(160)=818.72$; $p<0.001$) and Chinese ($\chi^2(160)=893.4$; $p<0.001$) studies (4, 16). However, as the chi-squared value is sensitive to sample size, it often leads to the rejection of good models in large samples of more than 200 (18). However, as mentioned by Groskurth (2024), the relative chi-squared value (19), which was used in

this study to determine whether the received chi-squared value demonstrated an acceptable fit. Since it

was 1.75, which was less than two and considered significant (10), it was deemed to reveal a good fit.



- c1- When something good happens to me, I have people who I like to share the good news with.
- c2 - When I have a problem, I have someone who will be there for me.
- c3- There are people in my life who really care about me.
- c4- I have friends that I really care about.
- p1- I finish whatever I begin.
- p2-I keep at my schoolwork until I am done with it.
- p3-Once I make a plan to get something done, I stick to it.
- p4-I am a hard worker.
- o1-I am optimistic about my future
- o2-In uncertain times, I expect the best.
- o3-I think good things are going to happen to me.
- o4-I believe that things will work out, no matter how difficult they seem
- h1-I feel happy.
- h2-I have a lot of fun.
- h3-I love life.
- h4-I am a cheerful person.
- e1- When I do an activity, I enjoy it so much that I lose track of time.
- e2-I get completely absorbed in what I am doing.
- e3-I, get so involved in activities that I forget about everything else.
- e4-When I am learning something new, I lose track of how much time has passed.

Figure 1: Five-factor model (Confirmatory factor analysis of the EPOCH item loadings onto their subcomponents, showing the standardized factor loadings and latent correlations)

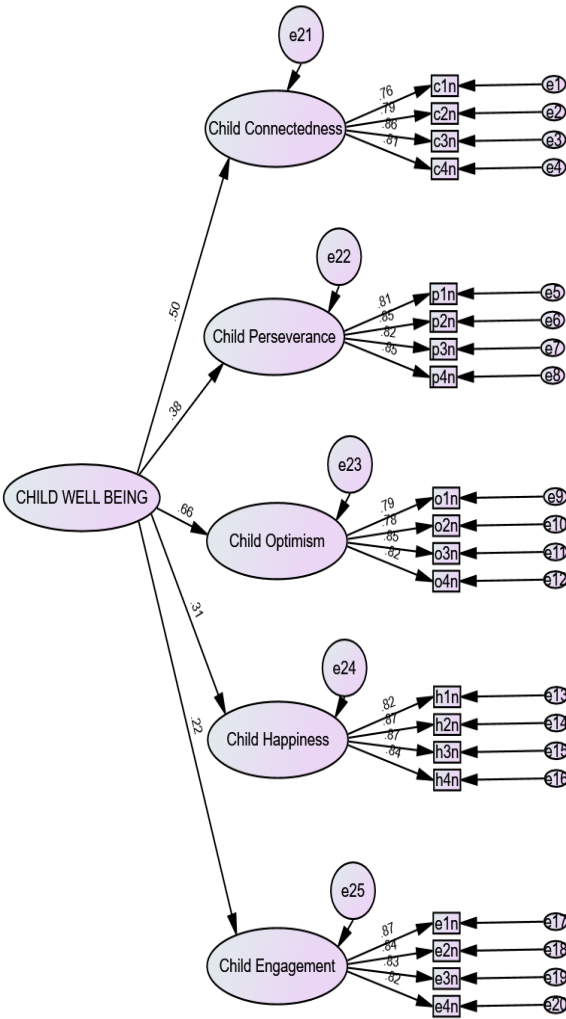


Figure 2: Second-order factor model (Confirmatory factor analysis of the EPOCH latent factor loadings onto their construct (Second order factor), standardized construct loading)

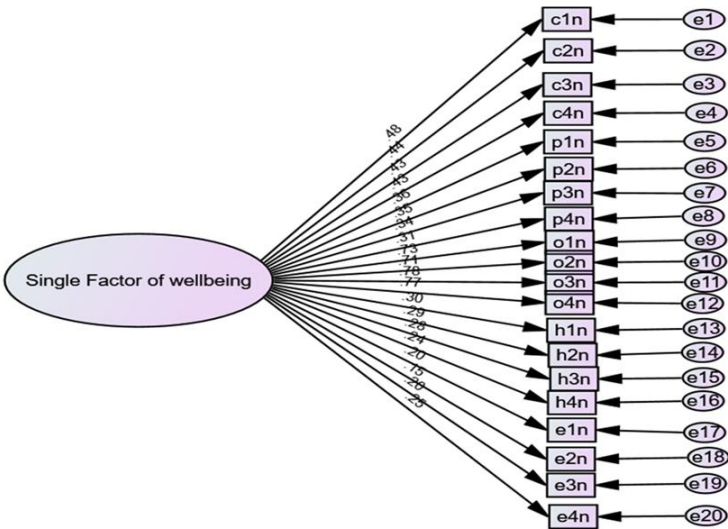


Figure 3: Single factor model (Confirmatory factor analysis of the EPOCH item loadings onto their one factor, showing the standardized factor loadings)

The comparative fit indices provide relative fit information, rather than absolute measures, and assess how well a theoretical model aligns with the observed data. Therefore, the comparative fit indices of our study determined excellent model fit by presenting CFI and TLI values of more than 0.95. Moreover, they resembled the translated German version of the EPOCH measure (TLI=0.95; CFI=0.96), though their sample size ($n=1651$) was much higher (5). In addition to the five-factor model, a second-order model of CFA was employed to evaluate a multidimensional account of five different dimensions of well-being (engagement, perseverance, optimism, connectedness and happiness), rather than just one. The second-order model analysis also showed a good model fit, similar to that in the Swedish and Thai studies (Table 4).

The Sinhala EPOCH measure is a self-reported well-being measure, where shared methods of similar wording, response styles, or social desirability may influence the responses. Hence, this may lead to common method bias, which inflates or distorts the observed relationships between variables, leading to biased results. Therefore, the common method bias (CMB) was one of the main limitations of this study, which may present as a systematic measurement error. To exclude it, the one-factor model analysis was performed. The results indicated poor model fit excluding CMB, as in the Malaysian study (TLI=0.872; CFI=0.899; RMSEA=0.069) (10) and could exclude the CMB.

Supporting the multidimensional approach to well-being, the internal reliability of the Sinhala version of EPOCH measure elicited good consistency for all five subscales. Moreover, it revealed high consistency for the overall scale (Cronbach's $\alpha=0.839$). The connectedness ($\alpha=0.882$) showed the lowest reliability, but it also indicated high internal consistency. Moreover, the happiness subscale showed the strongest internal consistency ($\alpha=0.914$). These reliability estimates were closely compatible with the internal consistency of Swedish and

Indonesian versions (4, 17). The assessment of concurrent validity posed a challenge due to time constraints and the lack of a validated Sinhala version of adolescent well-being tools in Sri Lanka. As a result, the psychometric evaluation was limited to the CFA of construct validity. However, in addition to the five different dimensions of well-being, the Sinhala EPOCH measure accommodates both the hedonic and eudemonic views of well-being. Hence, it gives a more comprehensive picture of adolescents' well-being. Moreover, though this validation study was carried out in the Kekirawa Educational Zone, a similar characteristic distribution is seen in youth in urban and rural settings in Sri Lanka (20). As such, the validated Sinhala EPOCH measure will help assess and predict the well-being of Sinhala-speaking adolescents in Sri Lanka. However, the main limitation was that this validation study was conducted exclusively in Sinhala-medium schools, with minimal representation from adolescents belonging to ethnic and racial minority groups. Moreover, the cultural adaptation of the tool may not adequately reflect the diversity of all adolescent contexts in Sri Lanka and primarily targets school-going Sinhala-speaking adolescents. Additionally, this validation was conducted in the Kekirawa educational zone, which was under the jurisdiction of *Pradishiyasaba*. Additionally, a significant proportion of adolescents, particularly in rural areas, discontinue formal education after completing their Ordinary Level (O/L) examinations, but their age is around 17 years when doing O/Ls. As this validation study was limited to the school setting, it created difficulty in ensuring broader applicability. Hence, this tool further has to be evaluated among out-of-school adolescents in different contexts.

Conclusions & Recommendations

The 20-item S-EPOCH is a valid and reliable instrument to measure the well-being of Sinhala-speaking adolescents aged 10-18 years in Sri Lanka. The five-factor model demonstrated an acceptable

construct with good psychometric properties, indicated by good model fit. The internal consistency revealed high reliability. It also has the advantage of being relatively easy to administer as a self-administered questionnaire. This study supports the

use of S-EPOCH to measure positive psychological functioning among Sinhala-speaking adolescents and recommends its use in observational studies and intervention programmes in Sri Lanka.

Public Health Implications

- The study findings of the S-EPOCH ensure its cultural appropriateness and validity. It is therefore recommended for future studies and preventive campaigns to assess the well-being of adolescents and to encourage policymakers and administrators to adopt initiatives for adolescents.
- The S-EPOCH is recommended for future observational studies focusing on schooling adolescent populations, so that researchers could gain deeper insights into the well-being of schooling adolescents.

Author Declarations

Competing interests: The authors declare that they have no competing interests.

Ethics approval and consent to participate: Ethics clearance was granted by the Ethics Review Committee of the Faculty of Medicine, University of Kelaniya (Reference number P/17/02/2024). Informed written consent was obtained from each parent and assent from the participant. Administrative clearance was obtained from the Zonal Director of Education, Kekirawa, and the respective principals of the selected schools.

Funding: Self-funded

Acknowledgments: Our sincere thanks and gratitude go to all study participants. Furthermore, we are grateful to the Postgraduate Institute of Medicine at the University of Colombo.

Author contributions: PI as a principal investigator in the literature review, study design, data collection, performing the statistical analysis, interpreting data, and drafting the manuscript; PK as the supervisor, participated in the design of the study, performing the statistical analysis, interpreting data, and drafting the manuscript; KJ as the supervisor provided inputs for the study proposal.

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