

Developing a Health Education Checklist for Healthcare Professionals to Ensure Treatment Adherence of Newly Diagnosed Young People Living with HIV: A Delphi Study

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Background: Young people living with HIV (YLWH) are a key population in global HIV prevention and control. YLWH often shows poor adherence to antiretroviral therapy (ART), with poor medication adherence, delayed initiation and frequent treatment interruption. This study aimed to develop a theory-based health education checklist to support ART adherence among newly diagnosed YLWH.

Methods: An initial pool of 41 items was generated through a literature review and the Protection Motivation Theory (PMT) framework, covering ART knowledge, coping strategies, psychosocial support, and behavioral skills. A structured health education checklist was then designed and refined through expert panel discussions and the Delphi method. Between November 2024 and January 2025, 17 experts from seven provinces in China participated in a two-round Delphi consultation. Experts assessed and revised the scientific rigor, importance, and feasibility of the proposed checklist. The expert authority coefficient and Kendall's coefficient of concordance were calculated to evaluate the consistency of expert opinions, leading to the development of a standardized checklist.

Results: The final checklist comprises 5 primary indicators, 10 secondary indicators, and 32 tertiary indicators. The expert authority coefficients for the two Delphi rounds were 0.867 and 0.905, respectively, the Kendall's coefficients of concordance were 0.621 and 0.716 ($P < 0.001$). The expert participation rates were 100% in the first round and 94.12% in the second round.

Conclusion: The health education checklist developed in this study demonstrates high scientific rigor and feasibility. It provides healthcare professionals with a structured tool to guide health education, which may support both short-term and long-term ART adherence among YLWH.

Keywords: health education, newly diagnosed, young people with HIV, Delphi method

Introduction

HIV/AIDS remains a global public health issue, and young people are key target population for HIV/AIDS prevention and control.^{1,2} According to the UNAIDS 2024 Global AIDS Progress Report, approximately 360,000 young people aged 15–24 years were newly infected with HIV in 2023, of whom 140,000 were aged 15–19 years.³ In China, between 2010 and 2019, a total of 141,557 HIV cases were reported among individuals aged 15–24 years, with more than 3000 new young people cases diagnosed annually.^{4,5}

For individuals living with HIV, lifelong HIV treatment is crucial to maintaining immune function, so keeping long-term adherence is a key determinant of treatment success.⁶ The U.S.A. National Institutes of Health (NIH) defines HIV treatment adherence as initiating ART immediately upon HIV diagnosis, maintaining regular follow-ups during treatment, and consistently adhering to prescribed ART medication regimens.⁷ However, existing studies have shown that the treatment adherence among YLWH is relatively poor. The World Health Organization (WHO) explicitly recommends immediate ART initiation upon diagnosis,⁸ while young people often experience greater delays in ART initiation than adults.^{7,9} Research shows that only 57.0% of YLWH initiated ART within 30 days of diagnosis,¹⁰ and only 18.7% initiated ART within 7 days.¹¹ Furthermore, young people exhibit high rates of treatment disengagement, with a loss-to-follow-up rate of 20% to 40% within the first year, particularly during the transition from pediatric to adult HIV care.¹² Studies consistently reported that ART adherence among young people is lower than that of children and adults.^{13,14} Macdonell KE et al¹⁵ found that 67% of adults achieved $\geq 90\%$ medication adherence, only 21% of young people reached this threshold. Similarly, Boadu I et al¹⁶ reported that ART adherence of YLWH was approximately 66%, further emphasizing the need for targeted interventions. Therefore, it is imperative to conduct scientific, effective and comprehensive interventions to improve treatment adherence among YLWH.

The issue of treatment adherence among people living with HIV (PLHIV) persists throughout the entire treatment process, with long-term adherence remaining a major global challenge.^{17,18} Implementing early intervention at the time of diagnosis could not only increase ART initiation rates but also optimize ART-related cognition of PLHIV.¹⁹ What's more, PLHIV who received psychological intervention at diagnosis were more likely to accept antiretroviral treatment.²⁰ Campbell et al²¹ demonstrated that delivering targeted educational messages during the rapid ART initiation process, particularly at the time of diagnosis, could enhance the acceptance of ART, reduce internalized stigma, and foster long-term adherence. Similarly, Kumwenda et al²² found that healthcare workers emphasized the critical role of immediate counseling and education at the point of diagnosis ensured women's sustained ART adherence. These findings suggest that systematic health education and adherence interventions at the time of diagnosis may facilitate timely ART initiation, improve treatment awareness, and reduce the risk of treatment discontinuation.

Therefore, it is necessary to advance the time of treatment adherence health education forward to the point of diagnosis, to reduce the time of starting treatment, improve follow-up and medication adherence, thereby helping YLWH maintain immune function and prolong survival. A structured checklist can serve as a standardized tool for healthcare professionals to deliver consistent and comprehensive health education, which may improve both the quality and effectiveness of adherence interventions. Grounded in the Protection Motivation Theory (PMT), this study developed an education checklist on treatment adherence for newly diagnosed YLWH through literature review and Delphi method, with the goal of providing scientific evidence and practical guidance for healthcare professionals in delivering adherence-focused health education to newly diagnosed YLWH.

Materials and Methods

Study Design

Firstly, this study included experts from the fields of HIV/AIDS clinical treatment, infectious disease prevention, infectious disease nursing and management, patient adherence education, epidemiology, and symptom management. Experts were invited based on their relevant professional background, practical experience, and familiarity with the subject matter. Subsequently, the preliminary draft of the expert questionnaire was developed through a literature review and an expert group discussion and then sent them to experts. Based on the results of the first round of responses from the expert panel, we revised the objectives and contents of the health education checklist and modified it to form the second round of expert questionnaires, which were sent out.²³ After that, we reached consensus and finalized the health education checklist.

Expert Selection

Purposive sampling augmented by snowball recruitment was employed to deliberately select Delphi panel members from different regions and organizations in China.²⁴ This study followed the principle of informed consent, and experts were

selected from November to December 2024 based on the following inclusion and exclusion criteria: (a) bachelor's degree or above; (b) professional title qualification of intermediate or above; (c) extensive experience in HIV/AIDS prevention and control, or HIV/AIDS research or health education; (d) work experience over 5 years. Exclusion criteria: (a) experts meeting the inclusion criteria but unable to continue participation due to limited availability, health conditions, or other personal reasons were excluded. Experts who meet the inclusion criteria were subsequently contacted via email, telephone, or text message and were provided with detailed information regarding the research objectives, content, and significance. Finally, a total of 17 experts with a high level of academic expertise in the field of HIV/AIDS agreed to participate in this Delphi study and a follow-up questionnaire was sent to them and then sent back by e-mail.

The experts came from seven provinces in China and represented different professions, including infectious disease clinicians, adherence educators, epidemiologists, nursing managers, and front-line nurses. The wide range of regions helped to show differences in health resources and access to ART, while the mix of professions brought views on clinical practice, health education, and patient support. These views were combined to revise the items and make the checklist completer and more practical for use in different settings.

Theoretical Framework

The development of the health education checklist was based on PMT, which is a behavior change theory based on individual motivation. It employs two mechanisms—threat appraisal and coping appraisal to stimulate protective motivation, ultimately promoting health behaviors.²⁵ In the context of treatment adherence among YLWH, threat appraisal includes severity, vulnerability, internal rewards, and external rewards, while coping appraisal encompasses response efficacy, self-efficacy, and response costs.²⁶ By strengthening these key elements of PMT, treatment adherence among young people can be effectively improved, fostering long-term health behavior adoption and maintenance. The theoretical framework based on PMT was presented as [Figure 1](#).

Preliminary Development of the Health Education Checklist

A systematic literature review was conducted by using databases such as Web of Science, PubMed, CINAHL, Cochrane Library, and Elsevier, China National Knowledge Infrastructure (CNKI), VIP Database, Wanfang Database. Relevant literature on HIV treatment adherence health education for YLWH was reviewed and analyzed. Based on PMT and practical experience, an initial item pool of health education checklist for the YLWH was developed. Through expert panel discussions, a preliminary face-to-face health education checklist for newly diagnosed YLWH was drafted, consisting of 5 first-level items, 12 second-level items, and 41 third-level items ([Supplementary Table 1](#)). The first-level indicators represented the core dimensions of the health education framework based on the PMT and served as the foundational structure for promoting treatment adherence among newly diagnosed YLWH. The second-level indicators were categorized and defined according to the motivational constructs embedded within each theoretical dimension. The third-level indicators are the concrete and operational items under each second-level indicator, designed to guide the development and implementation of practical health education content in clinical settings.

Questionnaire Design

The expert consultation questionnaire consisted of the following three sections: 1. Expert Information Form. 2. Health Education Checklist Consultation Form: this part was the main body of assessment in the expert questionnaire, the contents of the preliminary draft of health education checklist were shown in this section. Experts were required to evaluate the importance of each item by using a 5-point Likert scale, ranging from 1 to 5 point as “very unimportant” to “very important”. They were also required to evaluate the relevance of each item by using a 4-point Likert scale, ranging from 1 to 4 points as “not relevant at all” to “highly relevant”. In addition, this section provided suggestions and recommendations for revisions. The comment and revision section were included for each item. 3. Expert Authority Form: this section assessed the level of authority of experts, which included familiarity and judgment basis. Familiarity was assessed on a 5-point Likert scale, and the judgment basis included work experience, theoretical analysis, literature review, and direct observation. These factors were also used to calculate the authority coefficient of each expert. The checklist was designed to apply across the 15–24 years age range. Experts were instructed to consider the full

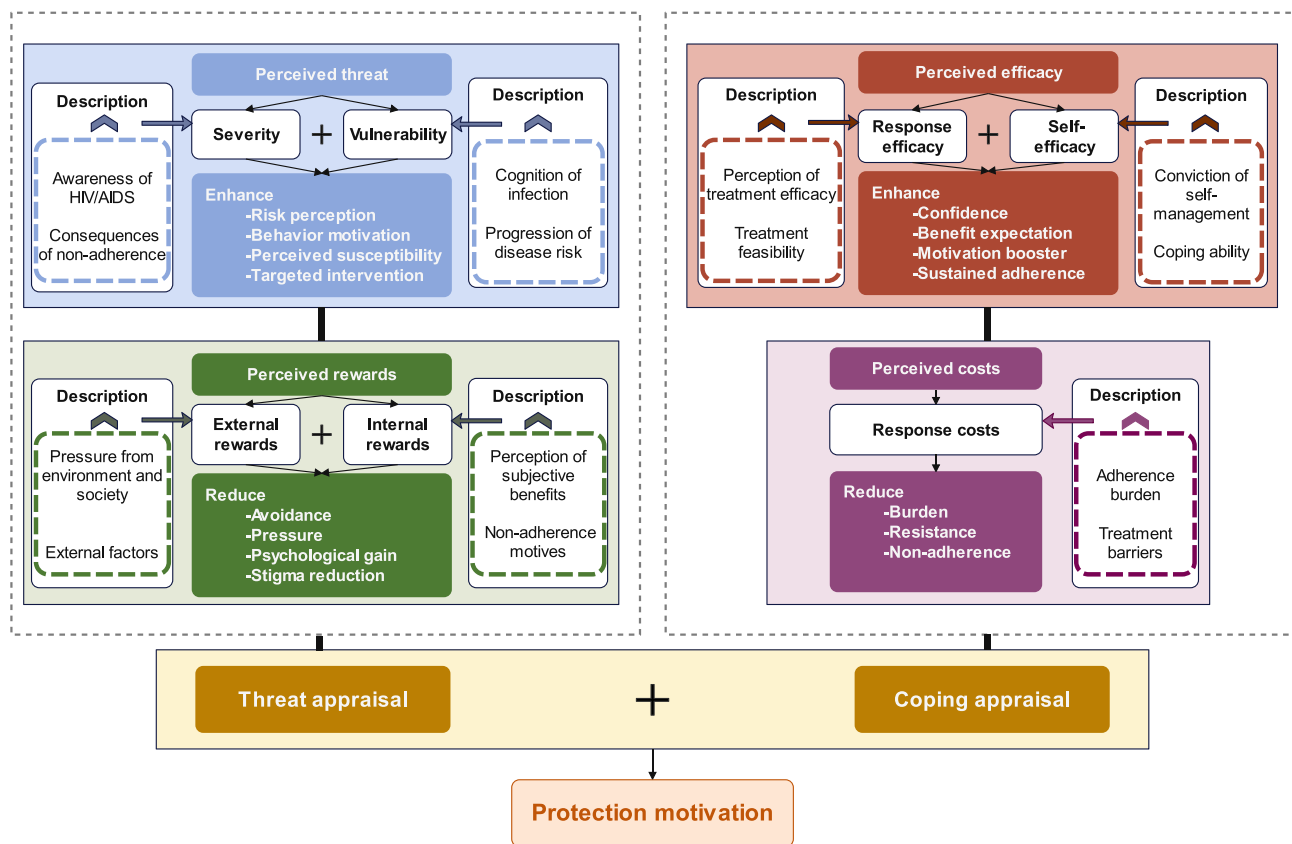


Figure 1 The theoretical framework based on Protection Motivation Theory (PMT). This model illustrates how treatment adherence among young people living with HIV (YLWH) can be understood through two key cognitive processes: threat appraisal and coping appraisal. Threat appraisal includes severity, vulnerability, and perceived rewards (both external and internal), which influence the perception of risk. Coping appraisal includes response efficacy, self-efficacy, and response costs, which influence the individual's confidence and perceived ability to manage HIV treatment. Arrows indicate the direction of influence, and annotated elements highlight motivational factors targeted in intervention design.

developmental span during item evaluation. Items with potential age-specific implications were retained only if experts judged them appropriate for flexible application, depending on the patient's age and cognitive ability.

Expert Consulting

The expert consultation was conducted through Email distribution and in-person delivery from December 2024 to February 2025, with a predetermined deadline for questionnaire retrieval. After the first round of consultation, items were modified or removed based on expert opinions, then leading to the development of a second-round questionnaire. Items were deleted if the mean of the importance of the item is less than 3.5 and the coefficient of variation is greater than 0.2.²⁷ The consultation ends when experts reach a consensus.

Data Analysis

Excel 2010 and SPSS 24.0 software were used for data analysis. Frequency and percentage were used to describe the personal information of experts. Experts' concern for this study was reflected in the positive coefficient of the expert panel, ie, the rate of the return of a questionnaire.²⁸ It is generally believed that the positive coefficient above 85% indicates good feedback of the survey. The authority coefficient (Cr) of the expert was the mean value of the expert's judgment basis (Ca) and degree of familiarity (Cs) with the research content, based on the formula $Cr = (Ca + Cs) / 2$.²⁹ The degree of expert's opinion dispersion was represented by the Kendall coefficient of concordance (Kendall's W) and coefficient of variation (CV). The importance and relevance of each index was described by mean±standard deviation. $P < 0.05$ was considered to indicate statistical significance for the differences.

Quality Control

To ensure the results were representative and reliable, the criteria for selecting experts were strictly formulated. Zhao et al³⁰ noted that evaluations conducted by a homogeneous group of experts may be subject to bias. Therefore, this study purposefully involved experts from various research domains. Returned questionnaires were checked for completeness and clarity. Experts were contacted to confirm unclear or missing parts. Questionnaires with more than 10% of unanswered questions were excluded. All data were entered by two researchers using Excel 2010 software.

Ethical Consideration

The Delphi panel members were informed in the invitation Email and accompanying material that they were free to withdraw at any point. Consent to participate was implied by response to the expression of interest and subsequent return of questionnaires. This study was approved by the Ethics Committee of the Affiliated Hospital of Southwest Medical University (Approval No. KY2024067).

Results

Expert Sociodemographic Information

The present research enrolled panel of 17 experts from 7 provinces and cities including Beijing, Shanghai, Sichuan, Shandong, Jilin, Hebei, Hunan in China. The experts specialized in HIV/AIDS clinical treatment, infectious disease prevention, infectious disease nursing and management, patient adherence education, epidemiology, and symptom management. The average age of the experts was 41.76 (*SD* 6.12) years old, and their average working experience was 15.29 (*SD* 7.83) years. Seven experts (41.18%) hold a doctoral degree, five experts (29.41%) were with master's degree, and five experts (29.41%) have bachelor's degree (Table 1).

Table 1 The Socio-Demographic Information of the Experts

Project	Round 1 (n = 17)		Round 2 (n = 16)	
	Number	Percentage (%)	Number	Percentage (%)
Age (years)				
30~34	2	11.77	2	12.50
35~44	10	58.82	9	56.25
45~54	5	29.41	5	31.25
Work experience				
<10 years	4	23.53	3	18.75
10~19 years	8	47.06	8	50.00
≥20 years	5	29.41	5	31.25
Highest education				
Bachelor	5	29.41	4	25.00
Master	5	29.41	5	31.25
Doctor	7	41.18	7	43.75
Professional positions				
Intermediate certificate	6	35.29	5	31.25
Associate senior position	7	41.18	7	43.75
Senior position	4	23.53	4	25.00
Specialist Fields				
Adherence education for PLHIV	2	11.77	1	6.25
HIV nursing education	4	23.53	4	25.00
Clinical medicine for infectious diseases	4	23.53	4	25.00
Clinical nursing for infectious diseases	4	23.53	4	25.00
Nursing management	2	11.77	2	12.50
Psychological nursing	1	5.87	1	6.25

Table 2 Positive Coefficient of Experts

	Round 1	Round 2
Questionnaire recovery		
Total distribution (n)	17	17
Total response (n)	17	16
Response rate (%)	100	94.12
Effective proportion (%)	100	100
Proposed ratio		
Number of experts (n)	9	3
Constituent ratio (%)	52.94	18.75

Enthusiasm and Authority Coefficient of Experts

Expert enthusiasm is reflected in the questionnaire response rate, which is generally considered high when it exceeds 70%.³¹ In the first round, all 17 distributed questionnaires were returned with valid responses, yielding a 100% response rate, and 9 experts (52.94%) provided suggestions for revision. In the second round, 17 questionnaires were distributed, and 16 valid responses were received, yielding a 94.12% response rate, and 3 experts (18.75%) provided suggestions for revision (Table 2). An authority coefficient (Cr) >0.70 is commonly regarded as a threshold for expert reliability.³² In this study, the authority coefficient (Cr) of two rounds were 0.867 and 0.905, indicating a high level of expert authority in this study.

Degree of Concentration and Coordination of Experts' Opinions

In the first round of consultation, the importance scores of all items ranged from 3.59 to 5.00, while the relevance scores of all items ranged from 3.00 to 3.94, with a full mark rate of 34.08% to 100%. The coefficient of variation (CV) was less than 0.25, except for three indexes were 0.255, 0.297 and 0.318. The Kendall's W was 0.621 ($\chi^2= 854.749$, $P < 0.001$). In the second round of consultation, the importance scores of all items ranged from 4.56 to 5.00, while the relevance scores of all items ranged from 3.56 to 3.94, with a full mark rate of 39.84% to 100%. The coefficient of variation (CV) was less than 0.25. The Kendall's W was 0.716 ($\chi^2= 721.970$, $P < 0.001$) (Table 3).

The Formation Process of the Health Education Checklist

In this study, two rounds of consultation were conducted. According to the indicator screening criteria, expert opinions, and discussion of the research team, the indicators were adjusted until a consensus is reached.

In the first round of consultation, the experts did not make any comments on the first-level and second-level indicators, so they were all retained. However, a total of 61 expert comments on the third-level indicators were collected in this round, which were consolidated into 31 revision suggestions, 10 supplementary recommendations, and 6 deletion suggestions after merging identical feedback. The revision suggestions primarily focused on content enhancement, including refining HIV-related knowledge, detailing treatment adherence management, supplementing information on the side effects of ART and corresponding coping strategies, elaborating on the consequences of poor adherence, adding auxiliary examinations related to treatment, and optimizing safe sexual behavior management and adherence skills training. The supplementary recommendations included reinforcing treatment adherence education, incorporating high-risk behaviors assessments and successful adherence case studies. In the mental health management section, experts suggested adding emotion regulation strategies and psychological crisis interventions. In the social support section, experts proposed introducing guardian supervision mechanisms and optimizing guidance strategies for HIV disclosure. In the daily management section, experts recommended improving access to medications, adjusting lifestyle habits, and identifying barriers to treatment adherence. Based on the suggestions of the experts, the contents of health education checklist were supplemented considering the characteristics of YLWH, and the second round of questionnaire was developed.

In the second round of consultation, experts had relatively unified opinions on each indicator, so only a total of 11 expert comments were received in this round, which were consolidated into 2 revision suggestions and 6 supplementary

Table 3 The Health Education Checklist for YLWH Based on the PMT (Second-Round)

Primary Indicators	Secondary Indicators	Indicators	Importance Score			Relevance Score		
			Mean ± SD	CV	AR (%)	Mean ± SD	CV	AR (%)
1.Enhance perceived severity and susceptibility of non-adherence to treatment	1.1 Basic knowledge of HIV/AIDS	1.1.1 Definition and Transmission of HIV/AIDS	5	0	100	3.94±0.25	0.063	93.75
		1.1.2 HIV latency and window period, clinical manifestations, and disease progression	4.75±0.45	0.094	75.00	3.88±0.34	0.088	82.35
		1.1.3 Authoritative sources for acquiring HIV-related knowledge, such as the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), health departments and hospitals, academic journals, and research papers	4.56±0.63	0.138	62.50	3.56±0.51	0.144	56.25
		1.1.4 HIV susceptibility behaviors and factors among young people in high-risk groups	4.69±0.60	0.128	75.00	3.75±0.45	0.119	75.00
	1.2 Knowledge of ART	1.2.1 Policies and auxiliary examinations related to ART treatment	4.75±0.45	0.094	75.00	3.75±0.45	0.119	75.00
		1.2.2 Common side effects of ART and medical management measures	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.25
		1.2.3 The importance, requirements, and measurements of treatment adherence	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.25
		1.2.4 Common behaviors and causes leading to non-adherence to ART, as well as the adverse consequences of non-adherence	4.88±0.34	0.070	87.50	3.94±0.25	0.063	93.75
		1.2.5 Definition, manifestations, and consequences of HIV drug resistance	4.75±0.45	0.094	75.00	3.75±0.45	0.119	75.00
		2.1 Strengthen the belief in the benefits of adherence	2.1.1 Reinforce the belief that adhering to treatment effectively maintains immune function, reduces the threat of opportunistic infections, and sustains physical health	4.88±0.50	0.103	93.80	3.81±0.40	0.106
2.Enhance the perceived response efficacy of adherence to treatment	2.1 Strengthen the belief in the benefits of adherence	2.1.2 Demonstrating case studies on the benefits of adherence and the adverse consequences of non-adherence	4.81±0.40	0.084	81.30	3.88±0.34	0.088	87.50
		2.1.3 Reinforce the mental health gains associated with ART adherence, such as reduced psychological distress and enhanced self-efficacy	4.75±0.45	0.094	75.00	3.69±0.48	0.130	75.00
		2.1.4 Inform PLHIV about the importance of adherence to treatment for society, family, and personal well-being	4.88±0.34	0.070	87.50	3.81±0.40	0.106	81.25
		2.2 Benefits of adherence to treatment	2.2.1 Visualize the impact of ART on HIV viral suppression and CD4+T lymphocyte function	4.88±0.34	0.070	87.50	3.81±0.40	0.106
	3.1 Strengthen self-management	2.2.2 Definition, importance, and implementation of U=U (Undetectable = Untransmittable)	4.75±0.45	0.094	75.00	3.69±0.48	0.130	68.75
		3.1.1 Guide PLHIV to undergo regular testing, record disease progression, self-monitor and manage their health status, thereby improving their self-care capabilities	4.88±0.34	0.070	87.50	3.88±0.34	0.088	87.50
		3.1.2 Management of safe sexual behaviors and health guidance on reproductive knowledge for YLWH	4.94±0.25	0.051	93.80	3.81±0.40	0.106	81.25
		3.1.3 Inform PLHIV about online and offline ways for obtaining ART medications	4.81±0.40	0.084	81.30	3.88±0.34	0.088	87.50
		3.1.4 Teach PLHIV about the strategies and methods to maintain adherence, such as setting medication reminders, creating medication schedules, and using visualized pill organizers	4.75±0.45	0.094	75.00	3.88±0.34	0.088	87.50
		3.2 Strengthen the confidence in the ability to adhere to treatment	3.2.1 Recognize and encourage the adherence behaviors of PLHIV	4.88±0.34	0.070	87.50	3.94±0.25	0.063

(Continued)

Table 3 (Continued).

Primary Indicators	Secondary Indicators	Indicators	Importance Score			Relevance Score			
			Mean ± SD	CV	AR (%)	Mean ± SD	CV	AR (%)	
4.Reduce internal and external rewards of non-adherence	4.1 Weaken the feeling of benefiting and external gains from non-adherence	4.1.1 Encourage PLHIV to articulate behaviors that may negatively impact their treatment adherence, assist them in analyzing the internal factors contributing to these behaviors, and provide targeted health education	4.88±0.34	0.070	87.50	3.88±0.34	0.088	87.50	
		4.1.2 Emphasize the long-term harm of negative behaviors and correct the subjective perception of benefits gained from non-adherence, such as the pleasure of skipping medication	4.63±0.62	0.134	68.80	3.81±0.40	0.106	81.25	
	4.2 Enhance social support	4.2.1 Skills for disclosing HIV infection to family members, partners, and friends	4.63±0.72	0.155	75.00	3.63±0.50	0.138	62.50	
		4.2.2 Specific channels for obtaining social support, such as community services, medical assistance, and HIV peer support organizations	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.25	
		4.2.3 Guardian supervision mechanism for minors living with HIV	4.75±0.45	0.094	75.00	3.75±0.45	0.119	75.00	
	4.3 Improve mental health	4.3.1 Assess the psychological trauma of PLHIV, help them accept their HIV infection, and promote post-traumatic growth	4.3.1.1	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.25
			4.3.1.2	4.69±0.60	0.128	75.00	3.81±0.40	0.106	81.75
		4.3.3 Provide crisis mental health support channels, such as national psychological consultation hotlines, online counseling platforms, and psychological counseling and treatment services in medical institutions	4.3.3.1	4.75±0.45	0.094	75.00	3.75±0.45	0.119	75.00
			4.3.3.2	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.75
			4.3.3.3	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.75
5. Reduce the response cost of treatment adherence	5.1 Lower the barriers and costs associated with adherence to treatment	5.1.1 Help PLHIV identify barriers to treatment and develop targeted solutions for different factors	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.75	
		5.1.2 Reduce internal stigma and discrimination among PLHIV, such as intervening in disease cognition, increasing social participation, and personal psychological adjustments	4.81±0.40	0.084	81.30	3.81±0.40	0.106	81.75	
		5.1.3 Daily life management, including diet, exercise, sleep patterns, smoking cessation, and alcohol consumption control	4.56±0.63	0.138	62.50	3.56±0.51	0.144	56.25	
		5.1.4 Policies on the rights and privacy protection of PLHIV	4.69±0.48	0.102	68.80	3.69±0.48	0.130	68.75	

Abbreviations: SD, standard Deviation; CV, Coefficient of variation; AR, Approval rat.

recommendations. The revision suggestions included relocating the section on techniques and methods for maintaining treatment adherence among PLHIV to Section 3.1: *Strengthening Self-Management*; and moving the policies on the rights and privacy protection of PLHIV to Section 5.1: *Lower the barriers and costs associated with adherence to treatment*.³² Following group discussions, the research team incorporated expert feedback and an expert consensus on health education checklist for newly diagnosed YLWH was finally reached. The content system included 5 first-level items, 10 second-level items, and 32 third-level items as shown in Table 3.

After the first Delphi round, 26 items were retained, 6 items were modified through merging or refinement based on expert suggestions, and 9 items were deleted because of low scores, redundancy, or lack of consensus. In the second round, no further changes were made, and the process mainly served to confirm expert agreement on the final 32-item checklist.

Discussion

Content Analysis of the Health Education Checklist

HIV treatment adherence is not a simple concept and was influenced by a range of cognitive, behavioral and age-related determinants. This study developed a structured and context-specific checklist comprising 32 items across five domains—perceived threat, response efficacy, self-efficacy, perceived rewards, and response cost grounded in PMT—to guide healthcare professionals in promoting adherence among newly diagnosed YLWH.

Enhance YLWH's Initiative and Active Engagement

Health education is one of the effective approaches to promoting patient health recovery through multidimensional interventions such as systematic knowledge dissemination, health behavior shaping, and collaborative patient-provider management, serves to prevent disease onset and progression.^{33–35} PMT is founded on the Health Belief Model³⁶ and emphasizes cognitive regulatory processes, offering a more effective framework than traditional health education for explaining, predicting, and intervening in various health behaviors.³⁷ Interventions based on PMT focus on enhancing patients' initiative and self-motivation, encouraging them to actively adopt and sustain positive health behaviors. The health education checklist developed in this study was closely aligned with the core variables of PMT. Through threat appraisal and coping appraisal, the checklist provides in-person, face-to-face health education for YLWH, reinforcing their awareness of susceptibility to and severity of HIV and ART-related knowledge while improving their self-efficacy and coping abilities.³⁸ Additionally, by leveraging internal and external regulatory factors alongside continuous support, the checklist stimulates patients' self-motivation, enhances their protective motivation, and encourages proactive engagement in health management, ultimately fostering long-term health behaviors.³⁹ The health education checklist for YLWH employs structured and goal-oriented educational activities to cultivate health beliefs, enhance adherence to ART, and ultimately improve the quality of healthcare services. Furthermore, it plays a positive role in safeguarding public health security. Therefore, this study's PMT-based health education checklist could provide a valuable reference for healthcare providers in conducting health guidance, thereby optimizing health education outcomes and enhancing treatment effectiveness.

Emphasize Specialization and Target Precision

Health education for YLWH is becoming increasingly diverse. However, a common issue is the failure to adequately address both internal and external factors influencing YLWH, leading to a disconnect between acquired knowledge and actual behaviors among this key population,⁴⁰ ultimately reducing the effectiveness of health education interventions. Similarly, international studies have highlighted that existing health education programs for YLWH often lack personalization and fail to adequately cater to the diverse needs of young people in different socio-cultural backgrounds.⁴⁰ Furthermore, most current health education programs prioritize short-term knowledge dissemination while neglecting long-term behavioral monitoring, which affects the sustainability of ART adherence improvements.⁴¹ To address these issues, this study conducted a comprehensive analysis of how YLWH interacts with the core variables of PMT and developed a tailored health education checklist with strong target specificity and applicability. This study explicitly

defined the dissemination of fundamental HIV/AIDS knowledge, emphasized the importance of ART adherence, and included policies related to treatment, management of medication side effects, adherence strategies, and drug resistance prevention. It also strengthened patients' belief in ART adherence by demonstrating the benefits of treatment, the consequences of non-adherence, and promoting the U=U concept. Moreover, the checklist enhances patients' self-management skills, such as regular viral load monitoring, medication reminders, and access to treatment resources. It further mitigated the reinforcement effects of non-adherence by highlighting the long-term consequences of poor treatment adherence and providing psychological and social support strategies. Additionally, it reduces the perceived costs of adherence by helping patients overcome treatment barriers, alleviating HIV-related stigma, and optimizing daily life management. These components underscore the checklist's comprehensiveness and high degree of targeting, making it a specialized and effective intervention reference for improving ART adherence among YLWH.

Reliability and Credibility of the Health Education Checklist

The health education checklist for healthcare professionals to ensure treatment adherence of newly diagnosed YLWH constructed in this study was scientific, comprehensive and diversified with the following characteristics. Firstly, the development of this health education checklist was theory-driven based on PMT—a well-established and widely used theory. In addition, the initial content of the checklist was informed by an extensive review of literature focusing on treatment adherence among YLWH, which ensured a strong theoretical and empirical foundation for the index system. Secondly, the checklist was reliable and authoritative due to the participation of qualified experts in the field. A total of 17 experts were invited from tertiary-level hospitals and universities across seven provinces and municipalities in China. Among them, five experts had over 20 years of experience, and eight had over 15 years of professional experience. This ensured a high level of expertise and reduced regional bias. Thirdly, the expert group had a high academic and professional profile. Seven experts held doctoral degrees, five held master's degrees, and eleven held intermediate certificate or associate senior position titles. Their areas of specialization covered infectious disease research, HIV medical care, HIV nursing, psychological care, and public health, allowing for diverse and targeted feedback across multiple relevant domains. This helped enhance the relevance, comprehensiveness, and applicability of the checklist. Fourthly, the consultation process demonstrated a high level of engagement and consistency. The two rounds of Delphi consultation achieved effective response rates of 100% and 94.12%, respectively. In the first and second rounds, 52.94% and 18.75% of the experts provided constructive textual suggestions, reflecting their strong engagement with the research. Fifthly, the reliability of the checklist was supported by quantitative indicators. The authority coefficients of the two consultation rounds were 0.867 and 0.905, indicating high reliability and credibility of the expert input.²² The Kendall's concordance coefficient of two rounds of consultation were 0.621 and 0.716, both statistically significant ($P < 0.001$), suggesting strong consistency and agreement among experts.⁴² Therefore, this health education checklist was well-founded, reliable, and scientifically robust, provided practical guidance for improving ART adherence in clinical settings.

Limitations

This study has some limitations. First, our panel did not include pediatricians or specialists in child psychology and psychiatry, though the clinicians and public health experts involved had long experience with young people living with HIV. Similar Delphi studies also showed that missing some specialists did not prevent key items from being judged appropriate. Second, the study focused on young people aged 15–24 years, a group often treated as one in HIV research. We recognize differences within this range, so the checklist allows flexible use for different ages. Third, although we reduced bias by selecting experts from various fields and calculating authority coefficients, some subjectivity may remain. Future studies should involve more experts and further validation.

Conclusion

Based on the Protection Motivation Theory, this study constructed a scientific and operational health education checklist for newly diagnosed YLWH through literature review, expert group discussion and Delphi method. This checklist provided healthcare providers with a clear and concise practical guidance to help improve adherence to antiretroviral

treatment among newly diagnosed YLWH. Further empirical studies could be conducted to evaluate its practical effectiveness, applicability, and feasibility in real-world healthcare settings.

Abbreviations

HIV, Human Immunodeficiency Virus; AIDS, Acquired Immune Deficiency Syndrome; ART, Antiretroviral therapy; PMT, Protection Motivation Theory; YLWH, Young people living with HIV; PLHIV, People living with HIV; Kendall's W, Kendall's coefficient of concordance; CV, Coefficient of variation; SD, Standard deviation; AR, Approval rate.

Data Sharing Statement

The datasets generated and analyzed in this study are not publicly available due to the principle of confidentiality. They are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

The study obtained the consent of the ethics committee of affiliated hospital of southwest medical university (Number: ky2024067), and verbal consent was obtained from each participant.

Funding

This research was supported by the National Natural Science Foundation of China (82304256).

Disclosure

The authors declare that they have no competing interests in this work.

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