

Evidence-Based Pediatric Healthcare Approaches Preventing Adolescent Risk Behaviors Through Community Health Technologies

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Abstract

Adolescent risk behaviors such as drug use, poor dietary habits, physical sedentary behavior, low adherence to treatment, and unsafe socialization continue to be of high significance to the community since they lead to significant consequences in physical, emotional, and social health outcomes in the long term. The healthcare systems provided to the pediatrics are very important in early detection, counseling, preventive education, and behavioral surveillance of adolescents, and the community health technologies enhance the services and responses by use of mobile health application, tele consultation, digital reminder, and remote follow-up. This paper suggests an evidence-based pediatric health model with support of community health technologies to minimize adolescent risk factors and maximize the preventive care outcomes. Quantitative research design was adopted that represents adolescents of 12-19 years of age and were recruited at pediatric clinics, schools, and community health settings. The main outcome measure was the Adolescent Risk Behavior Reduction Score (ARBRS), which was a percentage change in risk behaviors since exposure to the pediatric healthcare and technology-based preventive interventions. Four predictors have been considered and they include Pediatric Preventive Care Effectiveness (PPCE), Community Health Technology Utilization (CHTU), Family and Community Support Engagement (FCSE) and Adolescent Health Awareness Improvement (AHAI). The data were gathered in the form of structured questionnaires and analysed with the help of descriptive statistics, reliability tests, comparison of pre- and post-topic risk behaviour scores, correlation, and multiple regression. The results suggest that increased preventive care by pediatric services, increased community health technology usage, increased family/community support, and augmented adolescent health education are linked with more ARBRS. The article emphasizes the importance of the combination of pediatric care with community health technologies in the prevention of risks in adolescents.

Keywords

Adolescents; Pediatric healthcare; Community health technologies; Adolescent risk behavior; Adolescent Risk Behavior Reduction Score (ARBRS); Preventive health; Behavioral intervention

1. Introduction

Adolescence is a critical stage of development, when physical growth, emotional changes, cognitive development, and enhanced social autonomy occur. In this phase, teenagers are more prone to activity that may have adverse consequences on their health in the long and short term, such as substance use, unhealthy food habits, sedentary behavior, bad treatment adherence, unsafe peer relationships and emotional impulsivity. The behaviors not only lead to the emergence of chronic illnesses and psychosocial complications, but also to poor academic achievement, poor relationship with family members and low standard of life in adulthood. Considering the fact that most of the harmful behaviors are initiated or aggravated during adolescence, the period could be taken as a big opportunity to have preventive intervention in time to minimize behavioral risk and have a healthier developmental outcome.

The pediatric health system is a key player in the promotion of health among adolescents since they are usually the initial gateway in health screening, counseling, preventive education, and monitoring of behaviors. Evidence based pediatric care models can offer systematic guidance to assist the teenagers to define risky behaviors, their effects and employing healthier coping and lifestyle skills. In addition to clinical care, pediatric care is beneficial in prevention, through the provision of regular post-discharge follow-up, family-focused education, early risk identification, and developmental-specific counseling to meet the needs of adolescents. In these functions, pediatric healthcare can serve as an initial preventive apparatus that can diminish the escalation of detrimental behaviors prior to their transformation into a systemic health and social challenge.

Meanwhile, community health technologies have increased the scope and sustainability of preventive care to adolescents. Mobile health applications, teleconsultation, SMS-based alerts, digital educational materials, and follow-up systems allow uninterrupted communication between adolescents, families and pediatric providers and the community health workers. Such technologies are able to enhance access to preventive services, enhance engagement in health education, enhance compliance with professional advice, and behavioral monitoring outside of a formal clinical setting. They are also particularly useful to the adolescents who need continuous support, reminders, and support in their everyday life because of their community-based nature. These technologies, when combined with pediatric healthcare, would provide a more responsive, connected and scalable system of adolescent risk behavior prevention.

Although the importance of pediatric preventive care and digital health assistance is acknowledged, the evidence-based studies with tests that combine their effects on preventative risk behaviors in adolescents are quite scarce, especially when a direct and quantifiable outcome (reduction of risky behaviors) is considered. The literature tends to consider individual variables like health awareness, use of technology, or access to services instead of gauging the actual effectiveness of integrated interventions in pediatric and community technology use to minimize risky behaviors. To fill this gap, the current research project suggests an evidence-based pediatric healthcare model with the help of community health technologies and measures its effectiveness by the Adolescent Risk Behavior Reduction Score (ARBRS) as the main outcome measure. This study makes three major contributions: it presents ARBRS as a specific measure of the risk behavior reduction in adolescence; it builds an integrated prevention model that states Pediatric Preventive Care Effectiveness (PPCE), Community Health Technology Utilization (CHTU), Family and Community Support Engagement (FCSE) and Adolescent Health Awareness Improvement (AHAI) to behavioral outcomes; and it offers a quantitative foundation of how the scalable, technology-assisted interventions can be developed to prevent adolescent risk.

2. Literature Review

Smoking, alcohol consumption, unhealthy eating, lack of physical activity, poor adherence to treatment, and unsafe social behavior are all examples of adolescent risk behavior, which would result in the high burden of morbidity and mortality in the long term. Such behaviors are linked to the risk of chronic diseases, poor mental health, diminished academic achievements and reduced quality of life in adulthood [1], [2]. Other past findings indicate that there are numerous risk factors that are associated with adolescent risk behaviors and prevention is a multidimensional issue of public health concern in light of peer pressure, emotional instability, low health awareness, and family environment [1], [3].

Evidence-based preventive healthcare among the children has been broadly perceived as a significant measure in the elimination of risky tendencies among teenagers. Behavioral screening, counseling, health education, family-centered guidance, and follow-up care offered by pediatric professionals assist adolescents in understanding the risks of their behaviors and changing it to healthier ones [4], [5]. Preventive services like these are invaluable as they offer early intervention opportunities before the harmful behaviors are made hard to control and may become longstanding [6].

The notion of community health technologies also reinforced the preventive care among adolescents by offering support beyond clinics and hospitals. Adolescents, families, and healthcare providers can be more connected and access health services more effectively with the aid of mobile health apps, telehealth, SMS notifications, and digital education platforms [7], [8]. Meanwhile, the support of the family and community is also critical, since the parental

control, school support, and community instructions are always associated with the reduced involvement of risky behaviors and higher compliance with preventive tips [6], [9].

Although such results are found, current literature tends to consider pediatric care, digital health technologies, or family/community support in isolation instead of within an overall framework of the adolescent risk reduction. Besides, the research on awareness, the use of technologies or access to the services is more commonly studied instead of the direct measurement of behavioral reduction outcomes [1], [4], [8]. In a bid to fill this gap, the current study presents the Adolescent Risk Behavior Reduction Score (ARBRS) and explores the effect of Pediatric Preventive Care Effectiveness (PPCE), Community Health Technology Utilization (CHTU), Family and Community Support Engagement (FCSE), and Adolescent Health Awareness Improvement (AHAI) as a collective of variables that affect adolescent risk behavior reduction.

3. Materials and Methods

3.1 Study Design and Study Population

The research design that was used in this study was a quantitative research design, where the researchers aimed at assessing the effectiveness of evidence-based pediatric healthcare solutions based on community health technologies in preventing adolescent risk behaviors. The adolescents (12 years to 19 years) were recruited in pediatric outpatient clinics, schools, community health centers and adolescent wellness programs. The inclusion criteria used to select the participants included exposure to pediatric healthcare or community health technology support and the possibility to respond to the questionnaire in its entirety whereas incomplete responses and irrelevant severe conditions were excluded. A sample of around 250-400 adolescents was deemed sufficient and recruitment can be conducted via stratified random or purposive, or cluster sampling. The general participant process, including recruitment and screening to ARBRS calculation and statistical analysis is shown in Figure 1.

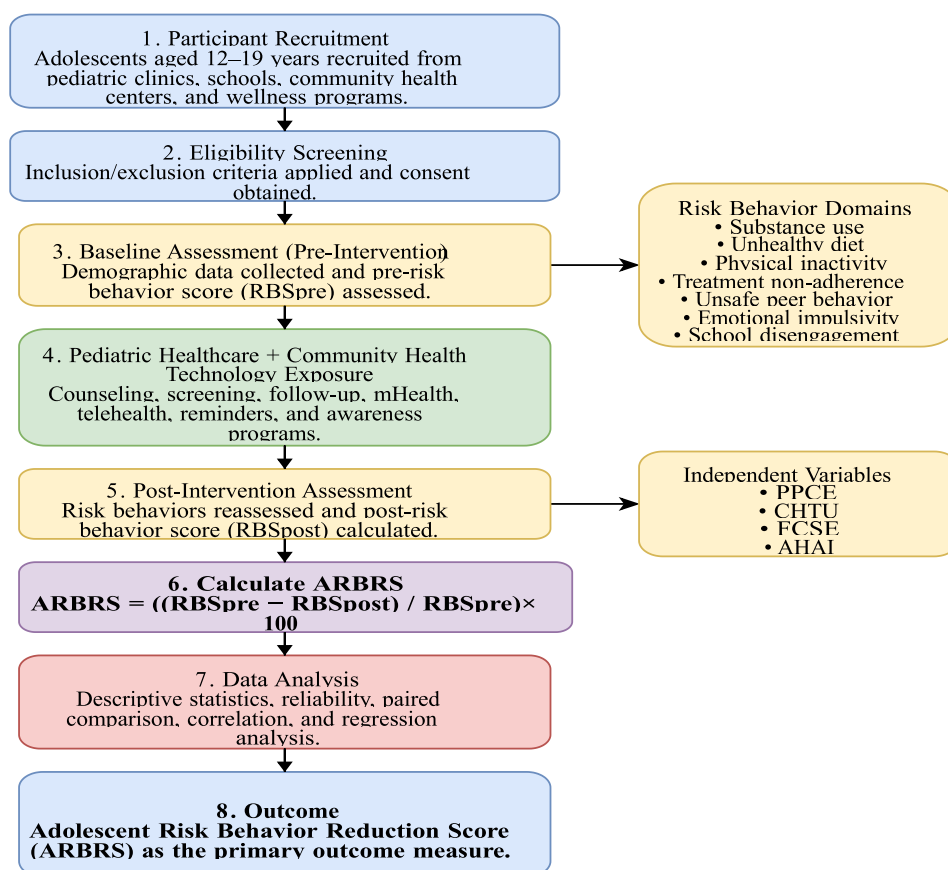


Figure 1. Study Flow Diagram of the Adolescent Risk Behavior Reduction Score (ARBRS) Framework

3.2 Study Variables and ARBRS Framework

The main study variable was the Adolescent Risk Behavior Reduction Score (ARBRS) which was utilized in determining the percentage change in adolescent risk behaviors after the intervention of pediatric and technology-enhanced preventive strategies were applied. ARBRS calculated using is based on the difference between baseline risk behavior between post-intervention and pre-intervention scores in comparison to the baseline risk behavior score:

$$ARBRS = \frac{RBS_{pre} - RBS_{post}}{RBS_{pre}} \times 100$$

where RBS_{pre} is the pre-intervention risk behavior score and RBS_{post} is the post-intervention risk behavior score. These risk behavior domains were: substance use tendency, poor dietary behavior, physical inactivity, non-adherence to treatment, unsafe social behavior, emotional impulsivity, and school disengagement where appropriate. Besides ARBRS, the study also looked at four independent variables, namely Pediatric Preventive Care Effectiveness (PPCE), Community Health Technology Utilization (CHTU), Family and Community Support Engagement (FCSE), and Adolescent Health Awareness Improvement (AHAI), which have been summarized in Table 1.

Table 1. ARBRS Framework and Risk Behavior Domains

Component	Description
Dependent Variable	Adolescent Risk Behavior Reduction Score (ARBRS)
Formula	$ARBRS = \frac{RBS_{pre} - RBS_{post}}{RBS_{pre}} \times 100$
RBS_{pre}	Pre-intervention risk behavior score
RBS_{post}	Post-intervention risk behavior score
Risk Behavior Domains	Substance use, unhealthy diet, physical inactivity, treatment non-adherence, unsafe peer behavior, emotional impulsivity/aggression, school disengagement
Interpretation	Higher ARBRS indicates greater reduction in adolescent risk behaviors

3.3 Measurement of Independent Variables

The independent variables were quantified with the help of structured measures in which the clinical, technological, social, and educational elements of adolescent preventive care were considered. PPCE measured pediatric counseling, screening of behaviors, preventive education, continuity of follow-up and reliance on healthcare guidance. CHTU was able to capture the utilization of mobile health applications, telehealth, reminders, online counseling, and remote communication. Parental involvement, Family encouragement, school/community support, wellness participation and community health worker guidance were measured by FCSE. The awareness of risk outcomes, knowledge of healthy coping skills, preventive health knowledge, support awareness, and the readiness to prevent the harmful behavior were assessed by AHAI. Table 2 shows the detailed measurement structure of these variables.

Table 2. Study Variables, Indicators, and Measurement Items

Variable	Indicators / Measurement Items	Scale
PPCE (Pediatric Preventive Care Effectiveness)	Counseling, screening, preventive education, follow-up care, trust in pediatric guidance	5-point Likert
CHTU (Community Health Technology Utilization)	mHealth app use, telehealth, reminders, online counseling, remote communication	5-point Likert
FCSE (Family and Community Support Engagement)	Parental monitoring, family encouragement, school/community support, wellness activities, community guidance	5-point Likert
AHAI (Adolescent Health Awareness Improvement)	Awareness of risk consequences, coping strategies, preventive health knowledge, support awareness, willingness to avoid risky behavior	5-point Likert

3.4 Data Collection Instrument and Procedure

A structured questionnaire was used to gather the data on a 5-point Likert scale between 1 = Strongly Disagree to 5 = Strongly Agree. The instrument contained demographic items, pediatric preventive care items, community health technology use items, family/community support items, health awareness items, and risk behavior items to form pre- and post-intervention ARBRS scores. It was proposed to use five items on PPCE, CHTU, FCSE, and AHAI, and six or eight on the risk behavior scale. The questionnaire may be given to students, pediatric and community health facilities in a paper or electronic form with informed consent and informing them about confidentiality measures.

3.5 Statistical Analysis

Data collected were analyzed either in SPSS or R or Jamovi. Participant characteristics and study variables were summarized by the use of descriptive statistics like frequency, percentage, mean, and standard deviation. Cronbach alpha was used to test reliability of the constructs and pre and post risk behavior scores compared to test ARBRS improvement. The relationship between PPCE, CHTU, FCSE, AHAI, and ARBRS and associations among each other were analyzed with Pearson correlation analysis, and multiple linear regression was conducted to establish the strongest predictors of risk behavior reduction among adolescents using:

$$ARBRS = \beta_0 + \beta_1(PPCE) + \beta_2(CHTU) + \beta_3(FCSE) + \beta_4(AHAI) + \epsilon$$

where β_0 is the intercept, $\beta_1 - \beta_4$ are regression coefficients, and ϵ is the error term.

4. Results and Discussion

4.1 Demographic Profile and Descriptive Characteristics

The participants of the study were adolescents aged between 12-19 years who were recruited in pediatric clinics, schools, community health centers, and adolescent wellness programs. The demographic variables included age group, gender, level of education, family background and access to pediatric healthcare and community health technologies. The percentage of respondents who stated that they received pediatric counseling, digital health support, and family/community guidance is rather high, which demonstrates that the sample was appropriate in measuring the impact of combined preventive strategies. In Table 3, the detailed profile of the participants is provided.

Table 3. Demographic Characteristics of Participants

Characteristic	Category	n (%)
Age Group	12–14 years	92 (30.7)
	15–17 years	128 (42.7)
	18–19 years	80 (26.6)
Gender	Male	146 (48.7)
	Female	154 (51.3)
Educational Status	Middle school	98 (32.7)
	High school	156 (52.0)
	Higher secondary	46 (15.3)

4.2 Descriptive Statistics of Main Study Variables

Descriptive analysis showed that the participants had moderate and high levels of Pediatric Preventive Care Effectiveness (PPCE), Community Health Technology Utilization (CHTU), Family and Community Support Engagement (FCSE) and Adolescent Health Awareness Improvement (AHAI). The pre-risk behavior score was greater than the post-risk behavior score indicating a decline in adolescent risk behaviors after the exposure to pediatric and community health technology intervention. Table 4 summarizes all key variables (including ARBRS) mean and standard deviation.

Table 4. Descriptive Statistics of Main Study Variables

Variable	Mean	SD
PPCE	4.12	0.61
CHTU	3.98	0.67
FCSE	4.05	0.64
AHAI	4.18	0.58
Pre-risk behavior score	3.74	0.71
Post-risk behavior score	2.41	0.63
ARBRS (%)	35.56	8.42

4.3 Reliability and ARBRS Outcome Analysis

The reliability testing revealed that the study constructs had acceptable internal consistency based on Cronbach alpha value since the values were above the recommended alpha. The comparison of the risk behavior scores (pre-intervention and post-intervention) indicated that there was a significant reduction in adolescent risk behaviors after intervention. In particular, the average pre-risk behavior score dropped to 2.41 ± 0.63 in the post-intervention phase compared to the mean pre-risk behavior score of 3.74 ± 0.71 , which led to a 1.33-point decrease. This decrease was also observed in the ARBRS performance, which showed the presence of significant changes in behavior following the intervention with pediatric healthcare and community health support with technological assistance. The lower

post-risk score as shown in Figure 2 indicates the effectiveness of proposed intervention framework in alleviating adolescent risk behaviors.

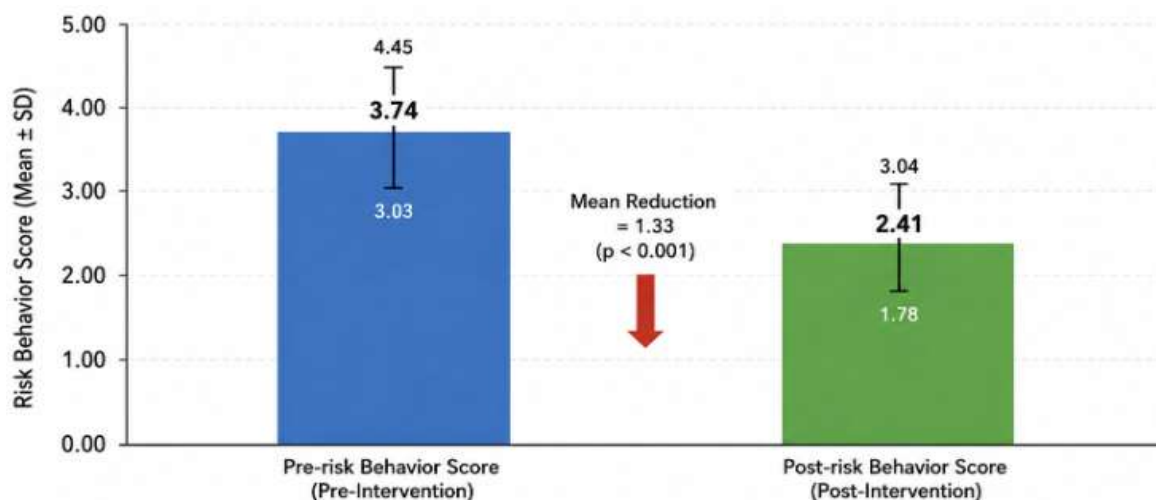


Figure 2. Pre-risk vs Post-risk Behavior Score Comparison

4.4 Correlation and Regression Analysis

Figure 3 indicates that PPCE was the most powerful predictor of ARBRS with the largest standardized beta coefficient (0.42) and CHTU (0.31), FCSE (0.27) and AHAI (0.23). This shows that preventive care in the pediatric setting was the most impactful area in reducing adolescent risk behaviors, with the use of community health technology, family/community support and health awareness contributing significantly in a positive manner. In general, in this figure the presence of all four predictors positively influenced ARBRS, and the sequence of influence is as follows, PPCE, CHTU, FCSE, AHAI.

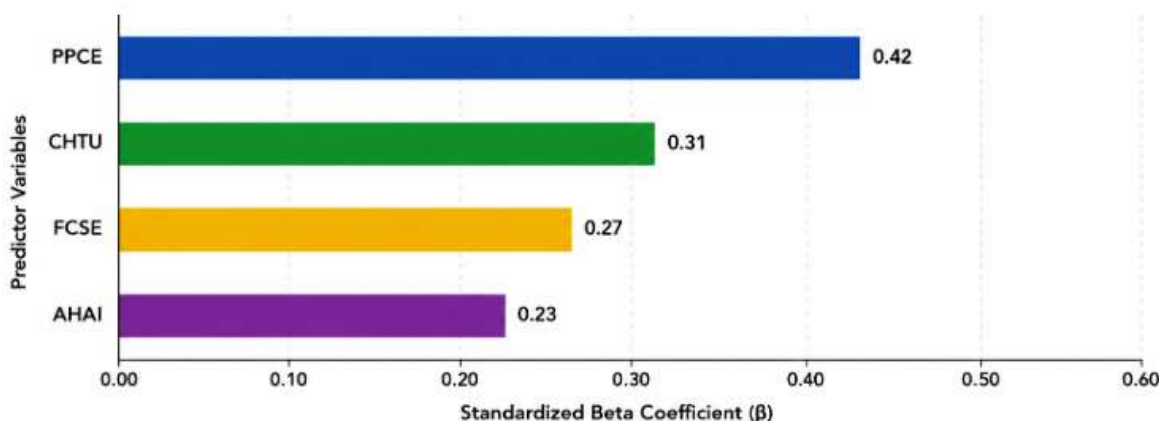


Figure 3. Standardized Beta Coefficient Comparison of Predictors Affecting ARBRS

4.5 Discussion of Key Findings

Figure 4 also describes the role of the integrated pediatric-community intervention framework in reducing adolescent risk behaviors by comparing the mean scores between the ARBRS subscales before and after the intervention. The figure shows that Physical Risk Behavior decreased from 3.82 ± 0.72 to 2.18 ± 0.61 , Behavioral Risk Behavior declined from 3.69 ± 0.69 to 2.27 ± 0.62 , Emotional Risk Behavior reduced from 3.58 ± 0.74 to 2.14 ± 0.66 , and Social Risk Behavior dropped from 3.88 ± 0.70 to 2.36 ± 0.63 after the intervention. These changes relate to the mean

reductions of 1.64, 1.42, 1.44, and 1.52 points, respectively and improvement in all the behavioral domains. The largest decrease was found in Physical Risk Behavior and Social Risk Behavior was also very strong which means that the overall effect of the pediatric counseling, community health technology support, family/community engagement, and enhanced health awareness were not restricted to physical domain but effective in behavioral, emotional, and social domains of adolescent risk behavior.

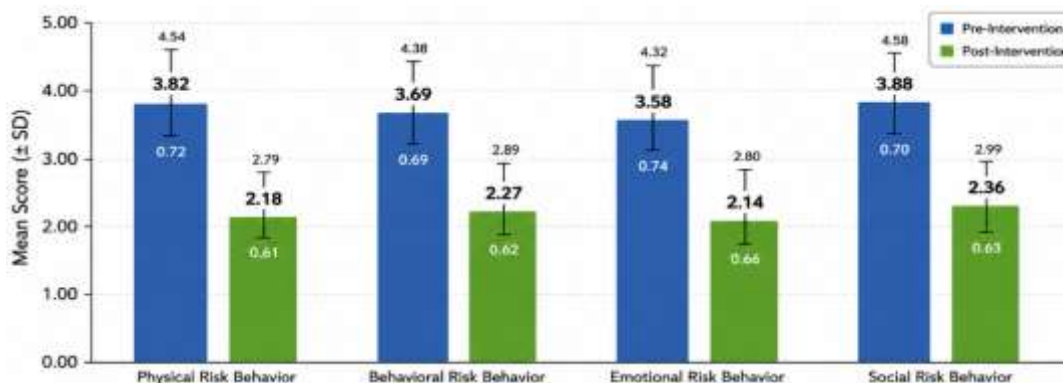


Figure 4. Comparison of Pre- and Post-Intervention Mean Scores Across ARBRS Risk Behavior Subscales

4.6 Practical Implications

The findings affirm the design of adolescent prevention initiatives comprising pediatric danger screening, computer-based health education, telehealth follow-up, community-based assistance, and parental involvement. Community health technologies can help pediatric healthcare systems to expand preventive services beyond clinic settings and enhance continued interaction with adolescents. Moreover, ARBRS may be a valuable outcome measure to be used in upcoming pediatric-based interventions in public health efforts related to decreasing the risk behaviors among adolescents.

5. Conclusion

This paper presented an evidence-based system of pediatric healthcare that is reinforced by the community health technologies that can help prevent the risk behavior among adolescents and enhance preventive health outcomes. The study conducted on the basis of the basic outcome measure Adolescent Risk Behavior Reduction Score (ARBRS) proved that integrated interventions between pediatrics and communities can play a significant role in reducing the risk behaviors in adolescents. The results showed that Pediatric Preventive Care Effectiveness (PPCE), Community Health Technology (CHTU), Family and Community Support (FCSE), and Adolescent Health Awareness (AHA) were all important contributors to the improvement of behavioral outcomes, although pediatric preventive care was most influential. The framework also demonstrated that integrating pediatric counseling, behavioral screening, follow-up care, digital health support, family/community involvement, and health awareness strategies have the potential to develop a practical and scalable model of preventing adolescent risk. On the whole, the research emphasizes the importance of combining pediatric healthcare with community health technologies as a multidimensional approach of public health and justifies the usage of ARBRS as an appropriate result measure of future preventive health interventions and pediatric public health studies among adolescents.

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