

Mental Health Promotion Model: Mixed-Method Study of Adverse Childhood Experience and Neurovegetative in Early Adulthood

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KEYWORDS

Mental Health;
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ABSTRACT

Introduction: In this study, we aim to analyze the relationship between mental health, adverse childhood experiences, and neurovegetative factors in early adulthood. The findings created a mental health promotion model that considers aspects of digital media use and direct psychological approaches.

Methods: The study used a mixed-method approach with an explanatory sequential design. Quantitative participant data were collected using non-probability sampling from 460 individuals (male = 85; female = 375; mean age: 18–20 years), while qualitative data were collected from 20 informants (4 = HIMPSI, 9 = Academician, 7 = General). The instruments used were the MHI-38, ACE Scale, NCQ, interview guide, and FGD. Quantitative data analysis was conducted using path analysis with SmartPLS 4.0 software. In contrast, qualitative data analysis involves reduction, data display, and drawing conclusions. This data influenced the design of the mental health promotion model.

Results: The results of this study found that adverse childhood experiences (ACE) and neurovegetative factors influence mental health in early adulthood ($P = 0.001$), with ACE ($P = 0.009$) and neurovegetative factors ($P = 0.000$), with ACE also specifically acting as a predictor for neurovegetative factors ($P = 0.00$). These results prompted the development of a mental health model within the context of the three variables, considering key challenges, effective strategies, reaching vulnerable groups, and model recommendations by experts. The final model consists of a digital scheme and a direct approach model, incorporating interventions such as infographics, videos, psychoeducation, community development, and VR-CBT.

Conclusion: This study describes the urgency of mental health stability by considering ACE and neurovegetative as predictors. The data contribute to the development of a mental health promotion model in early adulthood. Implementation of the model in various settings is recommended.

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INTRODUCTION

The study was motivated by the high number of cases of mental disorders among young adults. It is estimated that around 450 million people suffer from mental disorders, contributing to 14% of the global disease burden (1). In Indonesia, based on data from the 2023 Indonesian Health Survey, around 2% of young people suffer from mental disorders, particularly depression (2). This health issue significantly impacts societal productivity in terms of activities and development. Mental health influences economic activities and societal well-being (3), national financial burden (4), education (5), family harmony (6), environmental stability (7), and the development of individual soft and hard skills (8).

Various natural and structural factors can influence mental health in the human body. Some studies link mental health issues to adverse childhood experiences (ACE) (9), although some individuals can cope well with such experiences (10). Adverse childhood experiences (ACE) refer to traumatic experiences during childhood that have the potential to cause adverse effects on health and well-being over the long term (11). These traumatic experiences also integrate into allostatic load, which can deplete the body's energy and increase vulnerability to physical health problems (12). These experiences may stem from child abuse and neglect, parental conflict and separation, and parental mental health issues (13). The impacts are diverse, including unstable emotions, marital relationships, promiscuity, alcohol, nicotine, and drug use, as well as causing neurovegetative issues in the body (14–16).

Neurovegetative symptoms are physical symptoms resulting from autonomic nervous system dysfunction associated with mental disorders in individuals (17). Neurovegetative symptoms such as sleep disturbances, decreased appetite, and chronic fatigue may arise due to prolonged stress (18). On the other hand, reactive/emotional symptoms, such as anxiety and depression, often occur due to emotional stress experienced when facing significant changes in the life of an individual in early adulthood (19). Unfortunately, there is currently insufficient specific identification of neurovegetative conditions in individuals suspected of or diagnosed with mental disorders in Indonesia. This provides a logical reason to initiate further analysis on the matter.

In our view, neurovegetative and ACE analyses of mental health conditions are insufficient. Holistically, preventive practices are needed to minimize curative efforts for these disorders. Therefore, mental health promotion is required to support sustainable development in the mastery of knowledge and the development of healthy behaviors, especially among young adults. The challenge is that no established model can be used as a standard for mental health promotion. Mental health promotion does not seem to be a primary focus in health services (20). This is because universities have not comprehensively implemented legal products and policies regarding education and psychological services. As a result, mental health promotion is still carried out haphazardly, unstructured, and through trial and error.

Contemporary mental health promotion can take advantage of the widespread use of technology, such as virtual reality, infographics, and online videos. This is in line with the behavior of young adults who rely heavily on the practical use of technology (21). Through a deep understanding of this background, this study aims to develop a mental health promotion model to reduce the negative impact of ACE and stabilize the neurovegetative condition of young adults. This study also explores the relationship between the two variables and the mental health conditions of the participants.

METHOD

Research Type

This research method uses a mixed-method approach with an explanatory sequential design. The first study began quantitatively to obtain exploratory data on the relationship between ACE, neurovegetative, and mental health. The second study was conducted using descriptive qualitative methods to find a mental health promotion model based on expert considerations.

Population and Sample/Informants

Based on the study design, the research sample was divided into two groups of participants. In the first study, the participants were young adults in Makassar. The sampling technique used was non-probability with accidental sampling. This technique considers high accessibility with an age limit of 18-40 years based on Santrok's developmental categorization (22). Accessibility considerations are adjusted to the number of measurement

instruments that are usually considered by subjects when completing the scale. The sample size was determined using the Isaac and Michael table, with an infinite population size, a 5% margin of error, and a 95% confidence level. The standard sample size based on the table is at least 349 people. However, in this study, a sample size exceeding the standard was used, namely 460 people (male = 85; female = 375) with a median age of 18–20 years.

The second study involved 20 strategic participants designing a mental health promotion model. Purposive sampling was used and consisted of administrators from the Indonesian Psychological Association (HIMPSI) (n = 5), academics (n = 10), and the private sector/general public (n = 5). HIMPSI executives can produce appropriate psychological products based on psychological ethics codes. The academics are psychology lecturers from UGM, UNM, UNIBOS, and Exeter University. Meanwhile, the private sector/general public participants are members of the general public with a special focus on mental health issues based on their educational backgrounds.

Table 1. Description of The Second Study Participants

Participants	Size	Method	Purpose
HIMPSI	4	In-depth interview	1. Key Challenges 2. Public understanding of mental health 3. Effective Strategies
Academician	9	In-depth interview Focus Group Discussion (FGD)	4. Ways to reach vulnerable groups 5. Recommendations for mental health promotion models
Private Sector/General	7	In-depth interview	6. Opinions on the mental health promotion model developed

Instrumentation or Tools

Data were collected using several instruments in the first study, such as the Adverse Childhood Experience Scale (ACE Scale), Neurovegetative Checklist Questionnaire (NCQ), and Mental Health Inventory-38 (MHI-38). The ACE Scale measures the prevalence of violence, neglect, and family dysfunction (23). The psychometric properties of the ACE Scale include an RMSEA value of 0.055 (RMSEA < 0.60); Comparative Fit Index (CFI) = 0.958; Tucker-Lewis Index (TLI) = 0.939; Std. Est is positive, P-value < 0.05, and Z-value > 1.96. The NCQ examines: neurovegetative somatic and reactive emotional (24). The questionnaire is considered a good fit with several indicators, namely RMSEA = 0.097 (RMSEA < 0.60); Comparative Fit Index (CFI) = 0.936; Tucker-Lewis Index (TLI) = 0.928; Standardized estimates are positive, p-value < 0.05, and Z-value > 1.96. The MHI-38 measures two aspects of health: psychological well-being and psychological distress. The scale has a model fit with an RMSEA value of 0.048 (RMSEA < 0.60); Comparative Fit Index (CFI) = 0.945; Tucker-Lewis Index (TLI) = 0.929; Standardized estimates are positive, p-values < 0.05, and Z-values > 1.96 (25).

Table 2. Reliability of Instruments

	Variables	Cronbach Alpha	N of Items
1	Adverse childhood experience	0.784	10
2	Neurovegetative	0.903	19
3	Mental health	0.893	38

The data for developing the model were obtained from in-depth interviews and focus group discussions (FGDs). The interview guide and discussion topics were compiled based on several themes, such as the main challenges in developing a mental health promotion model, public understanding of mental health, effective strategies, ways to reach vulnerable groups, recommendations for mental health promotion models, and opinions related to the mental health promotion model that was created. Observations were conducted during the interview and discussion process and supported by documentation in the form of initial model design documents accompanied by implementation diagrams.

Data Collection Procedures

Data collection was conducted offline and online over two months from June to July 2025. Participants in the first study accessed the research form by filling out an informed consent form and a scale. All researchers and experienced research assistants facilitated data collection. No coercion was used against any of the participants. They were provided with an explanation of the research objectives, potential risks, and data confidentiality. Participants could take a break during the completion process or stop if they could not continue. To maintain data integrity and prevent duplicate responses, we perform data cleaning. On the other hand, qualitative data collection was conducted based on the consent of the informants, aligning the location, time, and context of the interviews. Interviews and focus group discussions (FGDs) were conducted for 15–40 minutes and followed a structured format.

Data Analysis

Data analysis was performed using path analysis with SmartPLS 4 software. The study aimed to measure the strength of the relationship between mental health, ACE, and neurovegetative symptoms in the path model image. The analysis process began with evaluating construct validity and reliability. Convergent validity was assessed using two criteria: external load values (threshold ≥ 0.70) and Average Variance Extracted (AVE) (threshold ≥ 0.50). Two indicators did not meet the loading factor requirements (MHI-1 & MHI-3), so they were removed from the model.

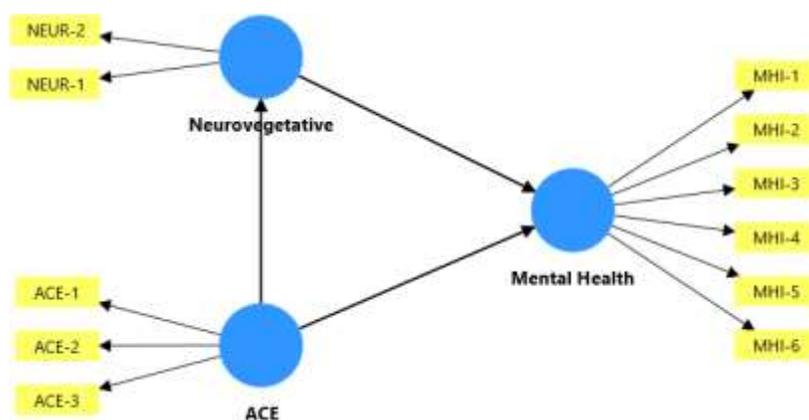


Figure 1. The First Study Path Model (Early Outer Model)

After deletion, all indicators met the threshold requirement (≥ 0.70), ranging from 0.704 to 0.955. All remaining indicators exceeded the required value and confirmed strong convergent validity across all constructs. The AVE values ranged from 0.690 to 0.912. These values indicate that each construct explains more than 50% of the variance in its respective indicators. The removal of MHI-1 and MHI-3 indicators reinforces the decision to refine the mental health variable construct. On the other hand, the consistency of this variable is still complemented by aspects of psychological well-being and psychological distress. These results reinforce the use of the research instrument in the first study.

Table 3. Factor Loading

	ACE	Mental Health	Neurovegetatif
ACE-1	0.846		
ACE-2	0.912		
ACE-3	0.724		
MHI-2		0.704	
MHI-4		0.930	
MHI-5		0.909	
MHI-6		0.929	
NEUR-1			0.954
NEUR-2			0.955

The research hypothesis based on the model seeks to identify four interrelationships: 1) ACE and neurovegetative, 2) ACE and mental health, 3) neurovegetative and mental health, and 4) ACE and neurovegetative and mental health. The results of the data analysis show the urgency of designing a promotion model for mental health.

Furthermore, qualitative data analysis techniques use three stages: 1) data reduction, aimed at summarizing, selecting key points, focusing on essential aspects, identifying themes and patterns, and eliminating unnecessary elements, 2) data display, which involves presenting brief descriptions, charts, relationships between categories, and similar elements, or most commonly using narrative text, and 3) conclusion drawing, which can be a description or depiction of a previously mentioned object. The collected data was analyzed using a thematic derivation method that focused on identifying and understanding patterns of meaning in the data and grouping them into interrelated themes. The credibility of the data obtained is also based on data triangulation through methodology.

Ethical Approval

This study fully implemented survey methods without conducting clinical interventions on participants and was non-invasive. The research procedures followed the applicable national psychological and research ethics codes. Each participant voluntarily participated, as evidenced by completing an informed consent form. Other considerations include data anonymization, respect for autonomy, privacy, the right to withdraw from the study, and data confidentiality. Therefore, formal ethical approval was waived. However, this research still obtained formal legal approval from the Directorate of Innovation, Research, and Community Service at Bosowa University with the number: PG 657/-026/DRIPM-UNIBOS/VI/2025.

RESULTS

The results of this study describe the first study, which consists of mental health categorization, ACE, and neurovegetative symptoms accompanied by path coefficients between variables, and the second study, which relates to mental health promotion models. The findings are explained as follows:

First quantitative study

The participants in this study tended to be dominated by moderate mental health (66.52%), low mental health (17.39%), and high mental health (around 16.09%). Similarly, neurovegetative conditions were predominantly moderate (44.78%), high (approximately 16.30%), and low (38.91%). Interestingly, participants showed a higher prevalence of ACE in the low category (85.43%) and a lower prevalence in other categories (14.57%).

Table 4. Variable Categorization

Variable	Mean	StDev	Categorization	n (%)
Mental Health	121,13	23,80	Low	80 (17.39)
			Moderate	306 (66.52)
			Good	74 (16.09)
Adverse childhood experience (ACE)	25,5	2,83	Low	393 (85.43)
			Moderate	51 (11.09)
			High	16 (3.48)
Neurovegetative	47,5	9,5	Low	179 (38.91)
			Moderate	206 (44.78)
			High	75 (16.30)

The path coefficients between variables show significance in each hypothesis designed. ACE and neurovegetative have a negative relationship with mental health ($P < 0.05$) with an effect size of 9.1% and 70.9% and have a multivariate effect on mental health ($P = 0.001$) with an effect size of 79.8%. It was also found that ACE affects neurovegetative ($P = 0.000$) with an effect size of 49.5%.

Table 5. Path Coefficients

	R	Stdev	T statistics (O/STDEV)	P values
ACE -> Mental Health	-0.091	0.035	2.596	0.009
ACE -> Neurovegetative	0.495	0.044	11.282	0.000
Neurovegetative -> Mental Health	-0.709	0.027	26.312	0.000
ACE & Neurovegetative -> Mental Health	0.798	23.795	109.176	0.001

These quantitative findings provide necessary evidence of the importance of mental health stability. The factors causing these health changes require follow-up, both preventive and curative. One effort that can support this is creating a mental health promotion model (26). The model design was developed based on the results of interviews and discussions.

The analysis of qualitative data yielded several emergent and superordinate themes. These themes highlight two key points: 1) the urgency of developing a mental health promotion model and 2) the model itself. The superordinate themes from the data are 1) key challenges, 2) public understanding of mental health, 3) effective strategies, 4) ways to reach vulnerable groups, 5) recommendations for mental health promotion models, and 6) opinions on the developed mental health promotion model.

The urgency of developing a mental health promotion model is evident from the respondents' responses regarding 1) the main challenges in creating mental health and 2) public understanding of mental health. The main challenges include social and cultural stigma, lack of knowledge and literacy, access to services and professional staff, behavioral and attitudinal issues in society, family environment and childcare, and communication and alignment of perceptions. Several quotations from the interviewees and their themes:

“There is usually a stigma attached to people with mental disorders. Especially if their families don't know how to deal with it” (HIMPSI 2, female, 48).

“...There are also parents who have minimal literacy about mental health” (Academic 5, female, 33).



Figure 2. Key Challenges

According to the sources, the level of public understanding of mental health varies considerably. Some consider it low, but on the other hand, there are communities that are already aware. Regarding model planning, the sources highlighted effective strategic concepts for optimizing the model. Emerging themes include conducting education and psychoeducation, utilizing digital and social media, collaborating with professionals and institutions, and strengthening the environment and communication. Some opinions from the interviewees and their themes:

“Actually, the use of social media is good now. However, education is also needed for small groups” (HIMPSI 1, female, 40).

“Strengthening mental health promotion at every level of education and in the surrounding environment” (Academic 3, female, 35).

“First aid by those around the person is needed, but for further effectiveness, action by professionals is required” (General 7, female, 30).



Figure 3. Effective Strategies

There are several ways to reach vulnerable subjects and mental health promotion targets, such as direct contact with individuals, identifying and analyzing target data, education and socialization, and collaboration and partnership. The target audience is focused on vulnerable groups and the general public to create a stable support system. Several quotations from the interviewees and their themes:

“Education is divided; for teenagers, it is faster to use the media. However, individually or in groups, a direct approach is more appropriate” (HIMPSI 3, female, 42).

“Mental health promotion can collaborate with communities, such as religious communities” (General 1, female, 27).

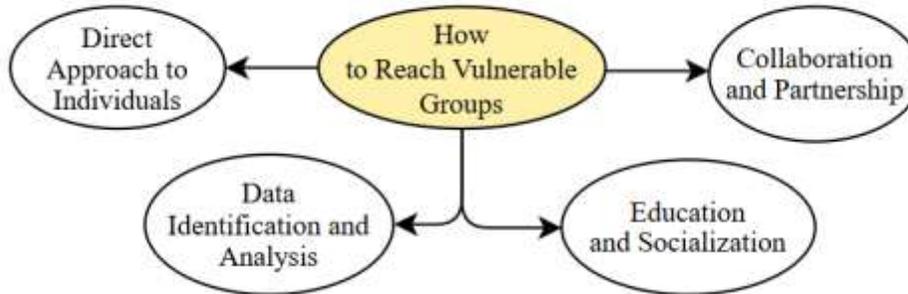


Figure 4. Reaching Vulnerable Groups

The speakers provided recommendations for developing promotional models. The use of media, digital technology, and education remained key points. To ensure the program's sustainability, it was deemed necessary to provide direct approaches and counseling, community-based and participatory promotion, and adjustments to specific segments of society. Quotes and themes can be seen below:

“It is necessary to create community events with a direct approach. In these events, simple counseling is carried out and cathartic media is provided.” (HIMPSI 4, male, 31).

“Psychoeducation should continue to be carried out by developing new things in accordance with the context of society.” (Academic 6, male, 33).

“We can use digital media; platforms such as AI will help provide education to the community.” (General 6, male, 26).

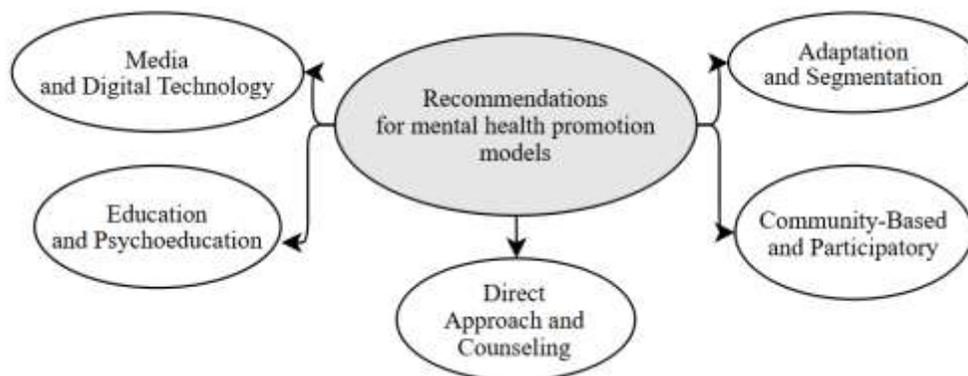


Figure 5. Recommendations For Mental Health Promotion Models

Technology can be utilized to treat mental disorders and physiological conditions in humans, such as ACE and neurovegetative disorders. Virtual reality is one solution, but it is recommended that it be adapted to the user's cultural context. The results of mental health promotion model are shown in Figure 7. Most sources mentioned that the model could be helpful and easy to implement.

DISCUSSION

Unlike physical health, mental health is highly dynamic for each individual. Sometimes a person can quickly experience emotional distress, even suddenly (27). Mental health in this study uses the basic concept of Veit and Ware (25) by looking at the mental condition of participants over the past month. The instruments used have completed a process of cultural adaptation. The participants' conditions were predominantly in the moderate category (66.52%). This may indicate the participants' struggle, where they attempt to create positive meaning from problems but remain in intense anxiety. The good category describes stable psychological well-being, while the low category indicates dominant psychological distress.

Traumatic past experiences influence mental health. Often, someone may appear physically and mentally healthy, but when confronted with past adverse events, negative responses emerge (28). The data show a high prevalence of low ACE scores among the subjects (85.43%), which contrasts sharply with the moderate category, which tends to be still able to accommodate adverse experiences (11.09%). We report that only about 3.48% have high ACE levels. High ACE levels can be influenced by various factors, including childhood abuse and sexual abuse (29), neglect or indifference (30), and family role dysfunction at home (31). The higher the ACE, the lower the mental health. Memories can serve as triggers in undermining one of these life goals. This aligns with the research by William, Ford, and Kensinger (32). The low ACE rate is undoubtedly good news for the population, and the findings guide us to strive to create positive memories for children again.

On the other hand, neurovegetative scores were dominated by moderate levels (44.78%) and only slightly differed from low neurovegetative levels (38.91%). Some of them (16.30%) reported conditions such as headaches, difficulty sleeping, easy despair, lack of concentration, and high feelings of being unappreciated. The data indicates that these neurovegetative factors significantly impact mental health, with an influence of approximately 70.9%. Neurovegetative factors are influenced by somatic factors and reactive emotions (33). Somatic factors create physical discomfort in the body, while reactive emotions lead to mood instability, reduced motivation, and altered perspectives. In conclusion, the lower a person's neurovegetative levels, the better their mental health.

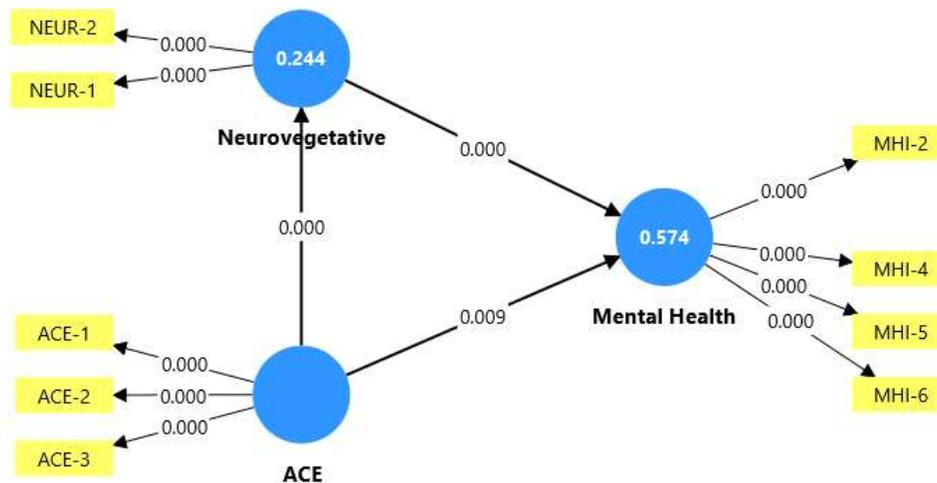


Figure 6. Path Coefficient Graphic

An interesting finding in this study is that neurovegetative function can be influenced by the extent of ACE experienced by an individual. The consequences of traumatic experiences include anxiety, rapid heartbeat, dizziness, and irritability (34). Furthermore, emotionally, it leads to a lack of initiative, low energy, and even despair (35). If participants have a history of ACE and neurovegetative symptoms simultaneously, the impact on mental health is significant. In this study, the magnitude of this impact was reported to be 79.8%. Based on this empirical data, mental health deserves a more appropriate focus on maintaining its stability.

The dynamic nature of early adulthood health conditions requires a flexible intervention model. Meanwhile, the likelihood of negative experiences and neurovegetative instability necessitates sustainable educational and personal strengthening elements. Our interviews found that the psychological dynamics of early adulthood can include anxiety, depression, stress, overthinking, violence, and trauma. Accommodating all of these issues is certainly not easy. The main challenges (Figure 2) in addressing these issues are also diverse. For example, the stigma of being labeled “crazy” can arise simply from seeking counselling from a psychologist, insufficient family support during the healing process, limited access to professional mental health services, and low levels of literacy and understanding.

In facing these challenges, the speakers provided strategic advice on designing a mental health promotion model (Figure 3), consisting of education and psychoeducation, digital and social media use, collaboration with professionals and institutions, and strengthening the environment and communication. Mental health education is provided directly, considering psychological aspects in its delivery (36). These activities can involve young adults, parents, and even children. Digital media is also quite effective for campaigns, outreach, or online seminars. The content shared can be designed based on collaboration with professionals or educational institutions. Influencers and expert training are also included. A joint agenda with the community will support these activities to strengthen the surrounding environment.

Communities can be divided into vulnerable and non-vulnerable groups. Mental health promotion will reach both. The approach that can be taken for vulnerable groups is a direct approach to individuals. Personal identification and analysis are conducted through surveys and mapping. Education remains quite effective in this regard (37). On the other hand, relying on the community can be more empowering. Many vulnerable groups require community support to share experiences, strengthen bonds, and receive therapy (38).

Several mental health promotion models have been developed to accommodate differences in group types and needs. Each model has its advantages and disadvantages. Kusmawaty's research focuses on creating a mental health promotion model for pregnant women to prevent maternal depression (39). She-hong et al.'s research on constructing a postgraduate mental health promotion model from the perspective of positive psychology (40). Additionally, Dong et al.'s research on developing a physical and mental health promotion model for adolescents in different social contexts (41). In this study, a mental health promotion model was developed that focuses on childhood trauma experiences and early adult neurovegetative conditions.

The development of this model is based on resource persons' recommendations, considering the use of media and digital technology, psychoeducation, direct approach and counseling, community-based, and segmentation (Figure 5). The promotion model is divided into digital and direct approach models. Digital media is developed into two platforms: infographics and videos. Infographics are intended to improve mental health literacy among the target audience by incorporating content such as awareness of mental health promotion activities, beliefs about mental disorders, normalization of psychological problems and mental disorders, the belief that mental health is part of overall well-being, and the causes of mental health issues. Several digital media tools can assist in creating infographics, such as Canva, CorelDraw, Adobe Photoshop, and others (42). Video creation can utilize applications like Capcut, Filmora, Canva, and others (43). Video content may include psychological well-being and distress, ACE, and neurovegetative themes. Videos can then be uploaded to YouTube for greater sustainability.

The direct approach model includes psychoeducation, community development, and virtual reality-cognitive behavior therapy (VR-CBT). This model is preventive and curative for disorders such as ACE and neurovegetative. Preventive psychoeducation helps explain the things needed to improve mental health. Interventions related to parenting understanding are highly significant in this context (44). Community-based development and VR-CBT are curative program implementations. This is crucial because program participants need positive experiences to share with others to support the effectiveness of health promotion. Community-based mental health development can support successful recovery (45), create a stable inner environment (46), and lead to significantly improved physical condition (47). These outcomes will also be effective if supported by psychological therapy interventions. CBT has demonstrated its effectiveness in addressing psychological disorders such as ACE (48). The innovation in this model is a unique scheme utilizing VR as a therapeutic tool. Several studies have also used this technology to enhance therapeutic effectiveness, including Ko et al.'s research on subjects' experiences with VR (49) and Bonnetterre et al.'s study on immersive virtual reality for health promotion and primary prevention in psychology (50). The purpose of using VR in this model is to help the counselling or cognitive behavior therapy process run more effectively. The mechanism is carried out by providing visualizations in the form of videos and stimulating images. The therapeutic scope focuses on childhood experience therapy and the importance of maintaining mental health. Specifically, the informants expressed satisfaction with the developed model.

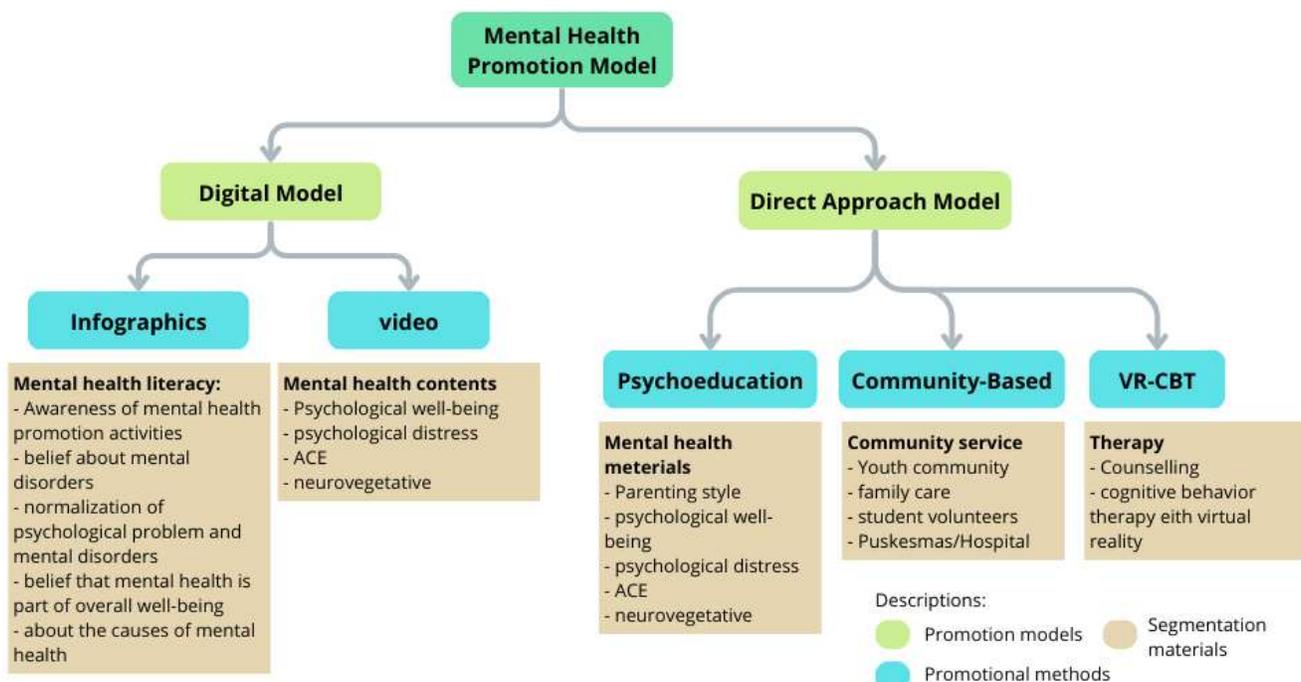


Figure 7. Mental Health Promotion Model

This model is supported by the Health Belief Model paradigm, which considers demographic aspects (e.g., early adulthood, gender) and psychological characteristics of the subject (e.g., mental health level, past experiences, neurovegetative history). Other components, such as Perceived Susceptibility and Perceived Severity, have been described quantitatively, while the Cues to Action component has become the basis for intervention and other psychological treatments. From a model development perspective, the above model has fulfilled the HEPRO planning circle model scheme: attention, insight/knowledge, basic, and structure (51). Although this is a fundamental advantage, the model requires implementation, documentation, and evaluation. To support further research, we recommend conducting implementation research. This scheme can be implemented by a special department in the Faculty of Psychology or Health.

CONCLUSION

This study examined the relationship between mental health, adverse childhood experiences (ACE), neurovegetative, and produced a health promotion model. The results found that ACE and neurovegetative influences affect mental health. Adverse childhood experiences also contributed positively to increased neurovegetative in early adulthood and simultaneously had a significant impact on mental health. These findings have led to the development of a mental health promotion model. The model consists of a digital and direct approach model, designed using infographics, videos, psychoeducation, community-based development, and therapy in mind. Although this study provides valuable insights into health, we recommend continuing its implementation in the context of adolescents using a research and development (R&D) approach and implementation research.

AUTHOR'S CONTRIBUTION STATEMENT

The authors' contributions were as follows: TT: research chair, research design, measurement tool development, data collection, path analysis, and article writing. SSG: data collection, data analysis, and article writing. MA: data collection and quantitative data analysis. Tr: data collection and qualitative data analysis. NSI: data collection and qualitative data diagram creation.

CONFLICTS OF INTEREST

This study has no conflicts of interest. The researchers have no financial or personal relationships with entities that could unduly influence the objectivity of the results.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

Grammarly and DeepL assisted the author in writing this article to refine and clarify the language. Finally, this article was reviewed for perfection by the Eastern Society for Education, Research, and Development (Eserde) Translation Agency, with registration number 003 001/lp.eserde/VII/2025.

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