

A Family-Based Approach to Prehypertension Prevention: Development of the WINDA Model from a Qualitative Study

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ABSTRACT:

Prehypertension is a transitional blood-pressure state associated with an increased risk of hypertension and cardiovascular disease. Lifestyle modification is the principal preventive strategy, but its implementation is strongly shaped by family support, household routines, and sociocultural context. This study explored family perceptions, roles, barriers, and educational needs related to lifestyle modification among individuals with prehypertension and used the findings to develop a family-based conceptual model. An exploratory qualitative design with a phenomenological orientation was used in three primary healthcare centers in Makassar, Indonesia. Eighteen participants representing individuals with prehypertension, family members, community health volunteers, and healthcare workers were recruited purposively. Data were generated through focus group discussions, in-depth interviews, and field observations, then analyzed using Braun and Clarke's six-phase thematic analysis. Four analytical themes were identified: fragmented family knowledge and culturally influenced understandings of prehypertension; the need for interactive, practical, and contextualized health education; the family's role as the primary driver of lifestyle modification; and multidimensional barriers to sustainable behavior change. These themes informed the WINDA model: Wellness-Oriented, Interactive, Needs-Based, Family-Driven, and Action-Oriented. The model positions family awareness,

tailored education, active support, and practical daily action as an integrated pathway toward sustainable prevention. Family-centered interventions should therefore move beyond information delivery and incorporate culturally responsive education, behavioral rehearsal, family role clarification, and continuous reinforcement.

Keywords: prehypertension; family empowerment; health behavior; qualitative research; health education; WINDA model

1. Introduction

Prehypertension describes a blood-pressure range above optimal levels but below the conventional threshold for hypertension. It is commonly characterized by systolic blood pressure of 120-139 mmHg and/or diastolic blood pressure of 80-89 mmHg, although terminology and thresholds differ across contemporary guidelines. (Lydia et al., 2021; Unger et al., 2020) Globally, the World Health Organization (WHO) estimates that non-communicable diseases are responsible for approximately 60% of deaths and 43% of illnesses globally for hypertension. (Wahyuni & Windasari, 2024). The condition is clinically important because it is associated with a higher probability of progressing to hypertension and with an increased risk of coronary heart disease and other cardiovascular outcomes (Huang et al., 2015).

Lifestyle modification remains the foundation of prevention. Regular physical activity, reduced sodium intake, healthy dietary patterns, weight management, smoking cessation, adequate sleep, and stress management can lower blood pressure and reduce cardiovascular risk (Unger et al., 2020; Windasari et al., 2025; Zhou et al., 2021) Nevertheless, knowledge of recommended behaviors does not automatically lead to sustained practice. Individuals must negotiate time, cost, work demands, household habits, motivation, and the availability of social support.

The family is a central social environment in which health behaviors are learned, reinforced, and maintained. Families influence food purchasing and preparation, daily routines, emotional coping, care-seeking, and the interpretation of symptoms. Family-centered empowerment interventions have been associated with improved self-efficacy, quality of life, and self-management among people

at risk of or living with hypertension (Hamedani et al., 2021; Hedayati, 2018; Kholifah et al., 2022) Broader reviews also indicate that family-based cardiovascular interventions can strengthen adherence when relatives participate as active agents rather than as passive observers (Kemp et al., 2021; Vedanthan et al., 2016)

However, three practical gaps remain. First, family knowledge is often fragmented and grounded in personal experience rather than systematic health literacy. Second, educational materials may be text-heavy, generic, or insufficiently adapted to family needs and literacy levels. Third, culturally embedded practices, including the use of herbal remedies, may coexist with biomedical advice and require respectful, evidence-informed communication (Murdiyanti et al., 2024; Widyaningtyas, 2024) These gaps can produce a persistent knowledge-practice divide in which people understand recommendations but struggle to integrate them into daily life (Carrillo-González, 2025; F. Alves, 2024)

This study therefore aimed to explore how families perceive prehypertension, how they support lifestyle modification, what barriers they encounter, and what forms of health education they consider useful. A second aim was to synthesize these empirical findings into a conceptual framework for family-based prevention. The resulting model was named WINDA, representing Wellness-Oriented, Interactive, Needs-Based, Family-Driven, and Action-Oriented intervention components.

2. Materials and Methods

2.1. Research design

The study used an exploratory qualitative design with a phenomenological orientation. This approach was selected to examine how

participants understood and experienced family empowerment in the prevention of prehypertension. The design focused on meaning, perceived roles, practical needs, and barriers rather than on estimating prevalence or testing causal effects. The qualitative material was analyzed thematically, allowing patterns to be identified across different participant groups while retaining the contextual detail of individual accounts.

2.2. Setting and participants

The study was conducted in three primary healthcare centers in Makassar, Indonesia. Participants included individuals with prehypertension, family members, community health volunteers, and healthcare workers. Purposive sampling was used to recruit people with direct experience of prehypertension prevention or family support. Recruitment continued until the research team judged that the data were sufficiently rich and repetitive to support thematic interpretation. The source dataset comprised 18 participants: 12 contributed through focus group discussions and 6 through in-depth interviews.

2.3. Data collection procedures

Coordination was undertaken with healthcare workers and community health volunteers to identify eligible participants. Data were collected through focus group discussions, in-depth interviews, and field observations. The principal researcher moderated the interviews, while an assistant took field notes and managed audio recording. Sessions lasted approximately one hour. A semi-structured guide was used, with follow-up probes to clarify meanings, obtain examples, and explore divergent experiences. Audio files were checked immediately after each session and cross-checked against field notes before transcription.

2.4. Interview domains

The guide covered five domains: (1) family knowledge of prehypertension, including definitions, risk factors, prevention, and beliefs about herbal remedies; (2) preferences for health education media and the need for simple, practical, repeated, and family-based information; (3) emotional, instrumental, informational, and

monitoring support provided by families; (4) structural, psychological, environmental, and habitual barriers to lifestyle change; and (5) daily health practices related to diet, physical activity, stress, sleep, and smoking.

2.5. Data management and analysis

Recordings were replayed to verify audio quality and completeness, checked against field notes, and transcribed. Data were analyzed using the six phases described by Braun and Clarke: familiarization, initial coding, searching for themes, reviewing themes, defining and naming themes, and producing the report. Codes were developed inductively from the interviews and focus group discussions. The analysis compared patterns across participant roles and data-collection methods and then synthesized the themes into the WINDA conceptual model.

2.6. Trustworthiness

Credibility was supported through triangulation of participant groups and methods, including focus group discussions, in-depth interviews, and observations. The repeated checking of recordings against field notes strengthened data accuracy. Interpretations were examined across cases to identify both convergence and variation. Because the source study did not report formal member checking or inter-coder agreement procedures, the findings should be interpreted as an analytically grounded account rather than as a claim of statistical representativeness.

2.7. Ethical considerations

Ethical approval was obtained from the Ethics Committee of the Faculty of Public Health, Hasanuddin University (Approval No. 3658/UN4.14.1/TP.01.02/2024; Protocol No. 121224093083; approved December 30, 2024). Administrative permission was obtained from the relevant authorities in Makassar. Participation was voluntary, informed consent was obtained, and participants were informed of their right to withdraw without consequence. Quotations were anonymized in the manuscript.

2.8. Data availability statement

The qualitative data supporting the findings contain potentially identifiable contextual

information and are available from the corresponding author upon reasonable request, subject to ethical and institutional restrictions.

Table 1. Characteristics of participants

ID	Sex	Age	Education	Participant role	Method
P01	Male	22	Senior high school	Family member	Focus group discussion
P02	Male	23	Senior high school	Family member	Focus group discussion
P03	Male	37	Senior high school	Individual with prehypertension	Focus group discussion
P04	Male	21	Senior high school	Family member	Focus group discussion
P05	Female	22	Senior high school	Family member	Focus group discussion
P06	Male	25	Senior high school	Individual with prehypertension	Focus group discussion
P07	Female	35	Senior high school	Community health volunteer	Focus group discussion
P08	Female	22	Senior high school	Family member	Focus group discussion
P09	Female	38	Senior high school	Community health volunteer	Focus group discussion
P10	Female	53	Diploma	Community health volunteer	Focus group discussion
P11	Female	50	Bachelor's degree	Family member	Focus group discussion
P12	Female	45	Bachelor's degree	Family member	Focus group discussion
P13	Male	35	Nursing qualification	Healthcare worker	In-depth interview
P14	Male	22	Nursing qualification	Healthcare worker	In-depth interview
P15	Female	38	Senior high school	Community health volunteer	In-depth interview
P16	Female	53	Diploma	Community health volunteer	In-depth interview
P17	Female	50	Bachelor's degree	Community health volunteer	In-depth interview

ID	Sex	Age	Education	Participant role	Method
P18	Male	45	Bachelor's degree	Family member	In-depth interview

3. Results and Discussion

3.1. Participant profile

The 18 participants ranged from 21 to 53 years of age. Ten were women and eight were men. Senior high school was the most common educational level (10 participants), followed by bachelor's degrees (four), diplomas (two), and nursing qualifications (two). The participant groups comprised eight family members, six community health volunteers, two healthcare workers, and two individuals with prehypertension. This composition provided perspectives from people receiving support, family members delivering support, and community or professional actors facilitating prevention.

3.2. Overview of thematic findings

Five initial coding domains were identified: family knowledge, educational-media needs, family support, barriers and challenges, and healthy lifestyle practices. During thematic refinement, healthy lifestyle practices were treated as the intended behavioral outcome rather than as an independent interpretive theme. The final analysis therefore produced four major themes and 13 subthemes. The themes describe a progression from what families know, to how education should be delivered, to how support is mobilized, and finally to the constraints that determine whether knowledge becomes sustained action.

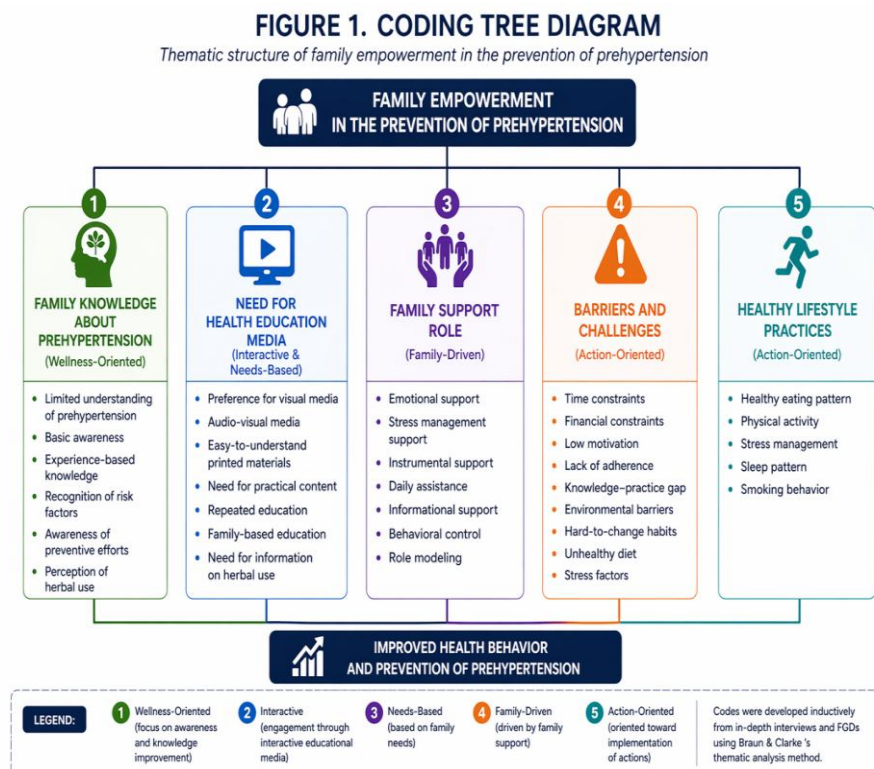


Figure 1. Coding tree for family empowerment in prehypertension prevention. Five coding domains informed four final analytical themes; healthy lifestyle practices represent the target outcome.

Table 2. Themes and subthemes of family empowerment in prehypertension prevention

Theme	Subthemes
Fragmented family knowledge and cultural understanding of prehypertension	Limited understanding of prehypertension; recognition of risk factors; beliefs about herbal remedies
Need for interactive and contextualized health education	Visual learning preferences; family-based education; practical and repetitive learning
Family as the primary driver of lifestyle modification	Emotional support; instrumental support; informational support; behavioral monitoring
Barriers to sustainable lifestyle change	Structural barriers; psychological barriers; knowledge-practice gap

3.3. Theme 1: Fragmented family knowledge and cultural understanding

Participants' knowledge of prehypertension was partial and uneven. Several families understood it only as "blood pressure beginning to rise" and could not describe its clinical range or long-term implications. One participant stated, "I did not know what prehypertension was; I only heard the term recently." Knowledge was commonly acquired through everyday experience, neighbors, relatives, or prior contact with health services rather than through structured education.

Despite limited conceptual understanding, participants readily recognized familiar risk factors such as unhealthy food, stress, inadequate sleep, and inactivity. This pattern indicates basic awareness without a fully developed explanatory model. Similar gaps have been reported in Indonesian communities, where knowledge of hypertension may be adequate at a general level but less consistent when translated into risk appraisal and preventive practice (Ari Mashuri et al., 2024; Ramadhani et al., 2023). Health literacy is therefore not only the possession of information but also the capacity to interpret and use it in decision-making (Li et al., 2023).

Cultural understandings were particularly visible in the use of herbal remedies. Breadfruit leaves and cinnamon were described as "natural" approaches to lowering blood pressure. Such practices should not be dismissed, because they are embedded in

family experience and may increase acceptability of prevention messages. At the same time, participants lacked clear information about indications, dosage, interactions, and the limits of herbal therapy. Evidence suggests that cinnamon may influence blood pressure, but its clinical use requires careful interpretation and should not replace appropriate assessment or treatment (Hadi et al., 2020). Breadfruit leaf preparations have also been investigated locally, underscoring the need for evidence-based counseling rather than uncritical endorsement (Jariah et al., 2024).

The first theme therefore establishes the "Wellness-Oriented" foundation of the WINDA model: families need a clear understanding of prehypertension, risk, prevention, and safe health practices before they can consistently support behavior change.

3.4. Theme 2: Need for interactive and contextualized health education

Families strongly preferred educational materials that were visual, practical, easy to understand, and reusable at home. Participants described posters, illustrated booklets, and videos as more accessible than dense written materials. One participant explained that materials "with pictures are easier to understand," while another emphasized the value of something that could be "taken home and read again." These preferences reflect the need for education that supports both initial comprehension and repeated family discussion.

Participants also wanted practical demonstrations, including examples of healthy meals, physical activity, stress management, and safe preparation of commonly used herbal products. The request was not simply for more information, but for information organized around real household decisions. This finding supports person- and needs-based intervention planning, in which content, format, literacy demands, and delivery methods are tailored to the target group (Band et al., 2017; Hashemian et al., 2019; Ndosi et al., 2016)

Digital and audiovisual approaches can strengthen engagement when they are accessible and linked to behavior-support strategies. Mobile health interventions have improved self-management and blood-pressure control in hypertension populations, (Chun-Yun Kang, 2022) although effectiveness depends on usability, continued engagement, and integration with clinical or family support (Liu et al., 2023; Zhou et al., 2021). The study findings therefore informed two connected WINDA components: “Interactive,” referring to engaging and participatory media, and “Needs-Based,” referring to content adapted to family literacy, culture, preferences, and daily circumstances.

3.5. Theme 3: Family as the primary driver of lifestyle modification

The family was described as the most immediate source of motivation, assistance, information, and behavioral control. (Arnason et al., 2021; Isnaini et al., 2025; Shaafi et al., 2020) Emotional support included encouragement, reassurance, and efforts to create a calm household atmosphere. As one participant stated, families can “give encouragement and motivation and create a comfortable atmosphere at home.” Instrumental support included preparing healthier food, accompanying relatives to health services, sharing household tasks, and facilitating physical activity.

Informational support occurred when family members reminded one another about health advice, discussed symptoms, or shared information received from health workers. Behavioral monitoring was also prominent. Families regulated food availability, reminded

members to exercise or rest, discouraged smoking, and modeled healthier routines. These actions show that the family is not merely a background influence; it is an active system capable of shaping opportunities, expectations, and reinforcement.

The finding is consistent with Social Cognitive Theory, which explains behavior through reciprocal interaction among personal factors, social environments, and action (Luszczynska & Schwarzer, 2015). It also aligns with family-centered empowerment research showing that relatives can improve self-efficacy and adherence when their roles are explicitly defined (Hedayati, 2018; Kadek Ayu Erika et al., 2016). Recent evidence indicates that family-based hypertension interventions can improve self-management and blood-pressure outcomes, particularly when support is structured and sustained (Kebebew et al., 2026). These findings underpin the “Family-Driven” component of the WINDA model.

3.6. Theme 4: Barriers to sustainable lifestyle change

Participants encountered interconnected structural, psychological, environmental, and habitual barriers. Time constraints and financial limitations restricted attendance at health activities and the ability to purchase preferred foods. Work and caregiving responsibilities reduced opportunities for exercise and rest. Low motivation and fatigue weakened adherence, while longstanding habits such as irregular meals, late sleeping, smoking, and sedentary routines were difficult to change.

The social environment could either support or obstruct change. Inconsistent communication within families, limited encouragement, and unhealthy routines shared by other household members reduced the likelihood that an individual could maintain new behaviors. These findings echo research showing that lifestyle change is constrained by social determinants and practical conditions, not only by personal intention (Nielsen et al., 2017; Sharma et al., 2023). Support from family and health workers is associated with better adherence, but support must be specific, feasible, and responsive to daily realities (Maytasari & Sartika, 2020)

A persistent knowledge-practice gap was evident. Participants sometimes knew what should be done but continued to eat unhealthy foods or postpone physical activity. (Alobaidi & Saleh, 2024; Primadani et al., 2025) One participant summarized the problem: “Sometimes we already know, but we still eat unhealthy food.” Knowledge is therefore necessary but insufficient. Behavioral change requires rehearsal, goal setting, environmental modification, feedback, and reinforcement. This insight informed the “Action-Oriented” component of WINDA, which shifts

emphasis from information exposure to concrete and repeated implementation.

3.7. Development of the WINDA model

The four themes were integrated into a five-component conceptual model. The components are sequential in logic but not strictly linear in practice. Families may move forward, return to earlier stages, or require additional reinforcement when circumstances change. Contextual factors - social and cultural beliefs, economic constraints, health-system support, and the physical and social environment - influence every component.

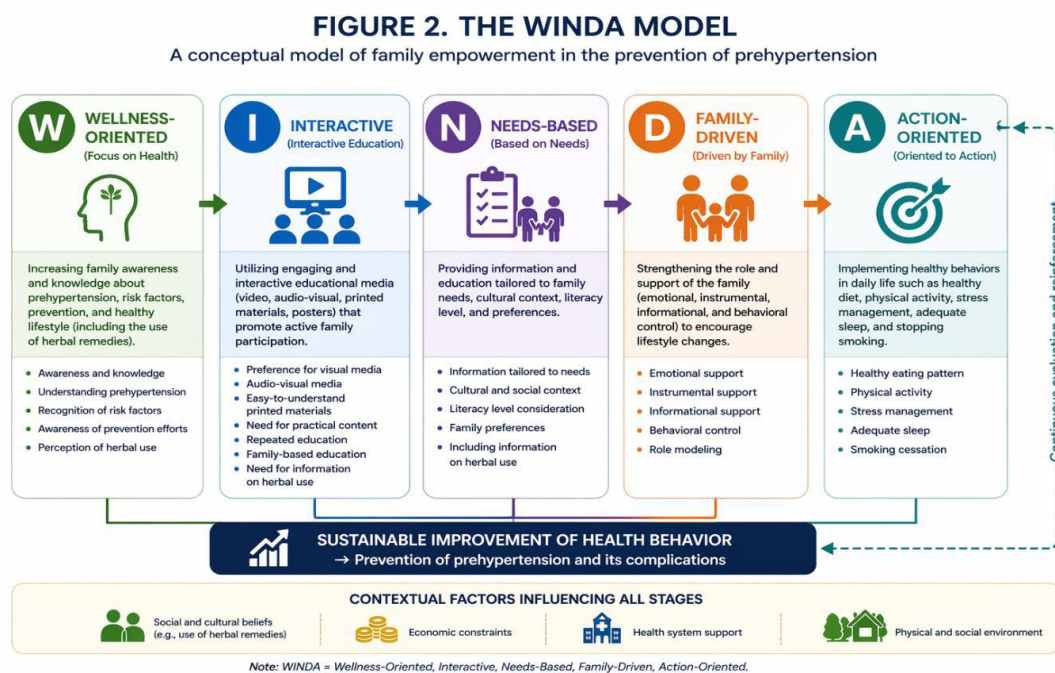


Figure 2. The WINDA model: a conceptual model of family empowerment in prehypertension prevention.

Table 3. Empirical basis and intervention implications of the WINDA model

Component	Empirical basis	Intervention implication
W - Wellness-Oriented	Limited and experience-based knowledge; partial understanding of risk factors and prevention; culturally influenced herbal beliefs.	Build accurate family awareness of prehypertension, risk, prevention, and safe complementary practices.
I - Interactive	Preference for visual, audiovisual, demonstrative, and reusable learning materials.	Use participatory sessions, illustrated booklets, short videos, demonstrations, and family discussion.

Component	Empirical basis	Intervention implication
N - Needs-Based	Variation in literacy, family preferences, cultural context, daily routines, and information needs.	Tailor content, language, intensity, and examples to the household's actual needs and resources.
D - Family-Driven	Emotional, instrumental, informational, and monitoring support; role modeling and household control.	Assign concrete family roles and strengthen supportive routines, communication, and shared decision-making.
A - Action-Oriented	Knowledge-practice gap; difficulties sustaining diet, activity, stress management, sleep, and smoking cessation.	Use action plans, skills practice, goal setting, environmental restructuring, monitoring, feedback, and reinforcement.

3.8. Theoretical and practical interpretation

The WINDA model complements established health-behavior theories by positioning the family as the operational bridge between risk perception and daily action. The Health Belief Model emphasizes perceived susceptibility, severity, benefits, barriers, and cues to action (Karen Glanz et al., 2008). WINDA retains these cognitive elements within the Wellness-Oriented component but extends them through interactive education, tailoring, family involvement, and behavioral implementation.

The model also reflects the reciprocal mechanisms described in Social Cognitive Theory. Family members shape the environment, model behavior, provide reinforcement, and influence self-efficacy. In turn, visible changes in health practices can strengthen collective confidence and normalize healthier routines. This systemic interpretation is consistent with evidence that family-based interventions are more likely to succeed when they modify relationships and environments rather than simply transferring information (Enright et al., 2020; Vedanthan et al., 2016)

In primary care, WINDA can guide the design of family counseling, community education, and follow-up. The first contact should assess family understanding, beliefs, literacy, and household constraints. Education should then use visual and participatory methods, define concrete support roles, and produce a small number of measurable actions. Follow-up should review progress,

identify barriers, and reinforce feasible adaptations. Information on herbal products should be culturally respectful, evidence-informed, and clearly framed as complementary rather than as a substitute for indicated medical care.

The model is conceptual and requires empirical testing. Future studies should operationalize each component, develop fidelity indicators, and evaluate effects on family support, dietary behavior, physical activity, stress management, medication or care adherence when relevant, and objectively measured blood pressure. A sequential mixed-methods design would be particularly useful: qualitative adaptation could precede a pilot intervention, followed by a controlled quantitative evaluation and process analysis.

4. Final Considerations

This study shows that families occupy a central position in prehypertension prevention, but their contribution depends on more than goodwill. Family knowledge was incomplete, education was not always accessible, and practical barriers frequently prevented information from becoming action. At the same time, participants described substantial emotional, instrumental, informational, and monitoring support within households. These findings justify a model that treats family members as active partners in prevention.

The WINDA model integrates five intervention requirements: wellness-oriented understanding, interactive education, needs-based adaptation, family-driven support, and action-oriented

implementation. Its main contribution is the connection of health literacy, family dynamics, cultural context, and behavioral practice within a single framework. For primary healthcare services, the model provides a structured basis for designing counseling, educational media, family action plans, and reinforcement strategies.

The study has several limitations. The sample was relatively small and drawn from three primary healthcare centers in one city, which limits transferability to communities with different cultural, geographic, or socioeconomic characteristics. The findings depend on subjective accounts and may be affected by recall or social-desirability bias. The source study did not report formal member checking or an independent coding audit. In addition, the model was derived qualitatively and has not yet been tested for feasibility, acceptability, fidelity, or effectiveness.

Future research should refine the intervention package with families and healthcare workers, test the model in diverse settings, and evaluate both behavioral and clinical outcomes. Particular attention should be paid to low-literacy communication, affordability, work and caregiving constraints, the safe discussion of herbal remedies, and the sustainability of family support over time. The present findings support WINDA as a contextually grounded framework for developing family-based strategies to prevent the progression of prehypertension and its cardiovascular complications.

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experiences, as well as to the healthcare workers and community health volunteers in Makassar who supported recruitment and data collection. The authors also acknowledge the academic and administrative support of the Faculty of Public Health, Hasanuddin University.

6. Declarations

6.1. Ethical considerations

The study was approved by the Ethics Committee of the Faculty of Public Health, Hasanuddin University (Approval No. 3658/UN4.14.1/TP.01.02/2024; Protocol No. 121224093083). Informed consent was obtained from all participants, participation was voluntary, and data were anonymized in reporting.

6.2. Use of artificial intelligence

Generative artificial intelligence was used for language editing, structural reorganization, and document formatting. It was not used to generate participant data or alter the underlying findings. The authors remain responsible for verifying the scientific content, references, interpretations, and final wording before submission.

6.3. Conflict of interest

The authors declare no conflict of interest.

6.4. Funding

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