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Decision Support System for Early Detection of Depression Risk Based on Lifestyle Patterns Using the ROC-WASPAS Method

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Abstract- This study develops a decision-support model for prioritizing lifestyle-based depression risk indicators using Rank Order Centroid (ROC) weighting and Weighted Aggregated Sum Product Assessment (WASPAS). The model evaluates five respondents against five criteria: stress level, sleep duration, social interaction, dietary pattern, and physical activity. Criterion priorities were converted into ROC weights, after which the decision matrix was normalized according to cost and benefit orientation. WASPAS then combined the weighted sum and weighted product components using an equal aggregation coefficient. Stress received the largest weight (0.456), followed by sleep duration (0.256), social interaction (0.156), dietary pattern (0.090), and physical activity (0.040). The final preference scores placed A1 first (0.569), followed by A3 (0.557), A2 (0.519), A5 (0.502), and A4 (0.434). These scores represent relative lifestyle profiles within the small study sample; they do not constitute a clinical diagnosis of depression. The model demonstrates a transparent calculation workflow that may support preliminary risk prioritization when its criteria, scales, and weights have been validated by mental-health professionals. Future work should use a larger sample, a validated depression instrument, sensitivity analysis, and external validation before practical screening is considered.

Keyword : Decision Support System; Depression Risk; Lifestyle Indicators; Rank Order Centroid; WASPAS

1. INTRODUCTION

Depression is a major mental-health problem associated with persistent low mood, reduced interest, impaired functioning, and diminished quality of life. Its identification requires careful assessment because symptoms overlap with stress, fatigue, sleep disturbance, and other conditions. Evidence from screening research also shows that a positive screening result is not equivalent to a clinical diagnosis; diagnostic confirmation requires an appropriate interview conducted by a qualified professional [1], [2]. This distinction is essential for technology-assisted studies. A computational model may organize observable indicators and identify profiles that warrant attention, but it should not label an individual as depressed without validated clinical evidence. Accordingly, the present study uses the term depression-risk assessment to describe relative prioritization based on lifestyle data rather than medical diagnosis.

Lifestyle factors are relevant because mental health is related to patterns of sleep, physical activity, diet, stress exposure, and social connection. Recent clinical guidance considers lifestyle-based care a potentially useful component of mental-health management, while emphasizing that such care complements rather than replaces professional treatment [3]. Empirical and review evidence has reported associations between depressive symptoms and insufficient physical activity, disturbed sleep, unhealthy dietary behavior, and social isolation [4]-[6]. These relationships are complex and often bidirectional: depression may disrupt daily routines, while adverse routines may also intensify emotional difficulties. Lifestyle variables should therefore be interpreted as risk indicators, not as definitive causes. A transparent decision model can nevertheless help summarize several indicators consistently and show how each criterion contributes to an overall preference value.

Decision Support Systems (DSS) are designed to organize data, analytical rules, and alternative evaluations for structured or semi-structured decisions. In a mental-health context, a DSS can assist preliminary prioritization by converting questionnaire responses into comparable scores and documenting the reasoning behind a ranking. Such a system is useful only when the input definitions, criterion orientation, weights, and decision rules are explicit. It must also communicate uncertainty and provide referral guidance for high-risk responses. The present work does not replace a validated instrument such as the Patient Health Questionnaire-9; instead, it examines how a multi-criteria decision-making procedure can aggregate a limited set of lifestyle indicators [2], [7].

Multi-Criteria Decision Making (MCDM) offers techniques for evaluating alternatives when several criteria have different priorities and measurement directions. Rank Order Centroid (ROC) converts an ordinal criterion ranking into normalized weights, thereby offering a simple and reproducible approach when decision makers can state the priority order but cannot provide precise pairwise judgments [8], [9]. Weighted Aggregated Sum Product Assessment (WASPAS) combines the Weighted Sum Model and Weighted Product Model. The additive component reflects total weighted performance, whereas the multiplicative component reduces complete compensation among criteria. Their combination provides a single preference value for ranking alternatives [10], [11]. However, the numerical output remains conditional on the selected criteria, scoring scales, weights, normalization rules, and aggregation coefficient.

Previous depression-detection studies have used expert systems, fuzzy inference, certainty factors, and machine-learning classifiers. These approaches demonstrate the potential of computational support, but many require larger labeled datasets, expert-derived rules, or clinically validated target classes. The current study addresses a narrower

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methodological gap: it presents an auditable ROC-WASPAS workflow for ranking lifestyle profiles when only ordinal criterion priorities and a small decision matrix are available. The contribution is therefore procedural transparency, not a claim of diagnostic accuracy. Each transformation from qualitative response to numerical score, criterion weight, normalized value, and final preference is reported so that the calculation can be examined and replicated.

The objective of this study is to design and demonstrate a lifestyle-based depression-risk prioritization model by (1) defining five lifestyle criteria and their cost or benefit orientation, (2) deriving criterion weights through ROC, (3) ranking respondent profiles through WASPAS, and (4) interpreting the results within appropriate clinical and methodological limits. The study asks how the selected criterion priorities affect ROC weights and how the combined WASPAS score orders the five respondent profiles. The expected benefit is a transparent prototype that can support future system development and validation. Before deployment, the model requires expert review of the criteria, ethically approved data collection, comparison with a validated depression measure, sensitivity testing, and evaluation using a substantially larger and more representative sample. These boundaries align the stated objective with the evidence actually produced by the study.

2. RESEARCH METHODOLOGY

2.1 Research Stages

This applied decision-model study followed a sequential procedure consisting of problem definition, data and requirement collection, criterion specification, ROC weighting, WASPAS calculation, result interpretation, and documentation. Figure 1 summarizes the workflow. Verification was performed after each calculation stage by checking the criterion type, scale direction, weight total, normalized range, and ranking order. Because the study contains only five respondent profiles, the design is a proof-of-calculation rather than a diagnostic-accuracy or population study.

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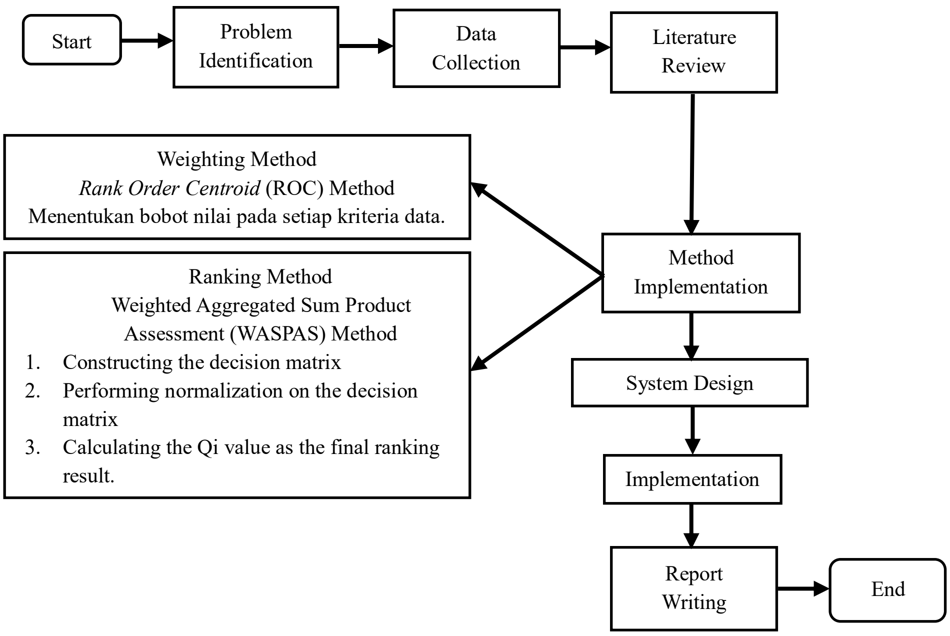

Fig 1. Research Framework

The following section explains each stage of the research process in detail based on the framework illustrated in Figure 1. These stages describe the systematic steps carried out in conducting the study, from problem identification and data collection to implementation and documentation of the research results:

1. Problem definition. The problem was formulated as the need to rank lifestyle profiles transparently using multiple criteria. The target output was a relative preference order, not a clinical depression label.
2. Data and requirements collection. Questionnaire responses were recorded for five respondents. The variables were stress level, sleep duration, social interaction, dietary pattern, and physical activity. The manuscript did not collect a clinical diagnosis as a reference standard.
3. Criterion specification. Each qualitative response was mapped to an ordinal score. Stress was treated as a cost criterion, while the remaining variables were treated as benefit criteria. These orientations were checked before normalization.
4. ROC weighting. The five criteria were ordered by assumed importance and converted into normalized centroid weights. The weights were verified to sum approximately to one, with rounding reported to three decimal places.

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5. WASPAS calculation. The decision matrix was normalized, multiplied or exponentiated using the ROC weights, and aggregated using equal WSM and WPM contributions (lambda = 0.5).
6. Interpretation and documentation. Preference scores were ordered from highest to lowest and interpreted only within the observed sample. Limitations and requirements for future clinical validation were recorded with the findings.

2.2 Data, Criteria, and Scoring

The study used five anonymized alternatives (A1-A5). Responses were converted using the ordinal scales presented in Tables 4-8. The scales are operational rules for this demonstration and should not be interpreted as clinically validated cutoffs. In particular, sleep duration was coded monotonically as a benefit even though both insufficient and excessive sleep may be associated with adverse outcomes. This simplification is retained to reproduce the reported calculation but must be redesigned before practical use, for example by using an optimum-range or distance-from-target transformation. Ethical deployment would additionally require informed consent, secure storage, restricted access, referral procedures, and clear notices that the output is not a diagnosis.

2.3 ROC Criterion Weighting

ROC assigns weights from the ordinal priority of criteria. For n criteria, the weight at rank i is the average of reciprocal ranks from i through n [8], [9]. The method is transparent and requires limited elicitation effort, but it does not empirically estimate the relationship between each lifestyle factor and depression. Consequently, the priority order used here is an analytical assumption that requires validation by qualified mental-health experts.

2.3.1 ROC Formulation

For five ordered criteria, ROC calculates each weight from the average of reciprocal ranks [8], [9]. If C1 is ranked above C2, and the same ordering continues to C5, the resulting weights satisfy C1 > C2 > C3 > C4 > C5:

If

$$Cr_1 \geq Cr_2 \geq Cr_3 \geq \cdots \geq Cr_m \quad (1)$$

Then,

$$W_1 \geq W_2 \geq W_3 \geq \cdots \geq Wn \quad (2)$$

Furthermore, if k represents the number of criteria, then:

$$w_1 = \frac{1+\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{k}}{k} \quad (3)$$

$$w_2 = \frac{0+\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{k}}{k} \quad (4)$$

$$w_3 = \frac{0+0+\frac{1}{3}+\cdots+\frac{1}{k}}{k} \quad (5)$$

$$w_k = \frac{0+\ldots+0+\frac{1}{k}}{k} \quad (6)$$

In general, ROC weighting can be formulated as follows:

$$W_k = \frac{1}{k}\sum_{i=1}^{k}\left(\frac{1}{i}\right) \quad (7)$$

2.4 WASPAS Method

WASPAS combines additive and multiplicative preference components [10]-[12], [15]. Benefit criteria are normalized by dividing each value by the column maximum, whereas cost criteria are normalized by dividing the column minimum by each value. The WSM component sums weighted normalized values, and the WPM component multiplies normalized values raised to their corresponding weights. The final score uses lambda = 0.5, giving both components equal influence. The reproducible calculation procedure comprised the following steps:

1. Normalization

   The criterion values are converted into normalized values as follows:

   For benefit criteria:

   $$\bar{x}_{ij} = \frac{x_{ij}}{max_i\, x_{ij}} \quad (8)$$

   For cost criteria:

   $$\bar{x}_{ij} = \frac{min_i\, x_{ij}}{x_{ij}} \quad (9)$$

   Equation (8) is used for benefit criteria, while Equation (9) is used for cost criteria.

   Description:

   x = criterion value before normalization
   $\bar{x}$ = normalized criterion value
   i = i-th alternative
   j = j-th criterion
2. Calculation Using WSM (Weighted Sum Model)

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$$WSM_i = \sum_{j=1}^{n} \bar{x}_{ij}.w_j \quad (10)$$

Description:
$\bar{x}$ = normalized criterion value
w = criterion weight
i = i-th alternative
j = j-th criterion

3. Calculation Using WPM (Weighted Product Model)

$$WPM_i = \prod_{j=1}^{n} (\bar{x}_{ij}) w^j \quad (11)$$

4. Calculation of WASPAS Value by Combining WSM and WPM Results

$$Q_i = \lambda.WSM_i + ((1-\lambda)WPM_i) \quad (12)$$

Description:
Q = WASPAS value
WSM_i = result of WSM calculation
WPM_i = result of WSM calculation
λ = a real number between 0 and 1

3. RESULT AND DISCUSSION

3.1 Alternatives and Criterion Specification

The alternatives in this study consist of several individuals (respondents) whose levels of depression risk are analyzed based on their lifestyle pattern data. Each respondent is considered an alternative in the decision-making process and is evaluated using predetermined criteria related to mental health and daily lifestyle habits. These criteria include stress level, sleep duration, social interaction, dietary pattern, and physical activity. The purpose of analyzing these alternatives is to determine which respondents have lower or higher risks of depression based on the calculation results obtained through the ROC and WASPAS methods. The list of alternatives used in this study is presented in the following table::

Table 1. Respondent Alternative Data

Code	Alternative Name
A1	Respondent 1
A2	Respondent 2
A3	Respondent 3
A4	Respondent 4
A5	Respondent 5

3.2 Criteria and Measurement Scales

The selection of criteria was based on respondents' responses by considering lifestyle pattern indicators that theoretically and empirically are closely related to depression risk. These criteria were chosen because they represent important factors influencing mental health conditions and can support a more objective and accurate assessment process.

Table 2. Criteria Data

Code	Criteria	Type
C1	Stress Level (score 1–5)	Cost
C2	Sleep Duration (score 1–4)	Benefit
C3	Social Interaction (score 1–4)	Benefit
C4	Dietary Pattern (score 1–3)	Benefit
C5	Physical Activity (score 1–3)	Benefit

Description:
Stress Level : High stress levels negatively affect physical and mental health.
Sleep Duration : Adequate sleep (approximately 7–9 hours) is correlated with better emotional and cognitive balance.
Social Interaction : Good social relationships help reduce anxiety, improve mood, and lower stress.
Dietary Pattern : A balanced diet supports energy stability, brain function, and stress reduction.
Physical Activity : Exercise increases endorphins and reduces stress hormones (cortisol).

Table 3. Respondent Alternatives

Alternative	C1	C2	C3	C4	C5
Respondent 1	Very Low	<4 hours	Very Low	Very Poor	Active

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Respondent 2	Low	4–5 hours	Low	Fair	Moderate
Respondent 3	Moderate	6–7 hours	High	Fair	Moderate
Respondent 4	High	4–5 hours	Adequate	Good	Low
Respondent 5	Very High	>8 hours	Adequate	Good	Low

To determine the Suitability Rating Data, each criterion is assigned a specific value or weight based on its assessment category. The weighting process is carried out systematically to support objective calculations and produce accurate evaluation results in the decision-making process:

Table 4. Stress Level Data

Description	Value
Very Low	1
Low	2
Medium	3
High	4
Very High	5

Table 5. Sleep Duration Data

Description	Value
<4 Hours	1
4-5 Hours	2
6-7 Hours	3
>8 Hours	4

Table 6. Social Interaction Data

Description	Value
Very Low	1
Low	2
Adequate	3
High	4

Table 7. Dietary Pattern Data

Description	Value
Very Poor	1
Fair	2
Good	3

Table 8. Physical Activity Data

Description	Value
Low	1
Medium	2
Active	3

Based on the weighting tables above, the suitability rating data for each respondent can be identified and converted into numerical values according to the predefined criteria scales. These numerical values are used as the basis for further calculations and evaluations in the decision-making process. The data are processed using the ROC method to determine criterion weights and the WASPAS method to rank the alternatives objectively. Through this process, the system can analyze and determine the level of depression risk for each respondent more accurately and systematically:

Table 9. Suitability Rating Data

Alternative	Criteria and Assessment					Total Score
	C1	C2	C3	C4	C5	
A1	1	1	1	1	3	7
A2	2	2	2	2	2	10
A3	3	3	4	2	2	14
A4	4	2	3	3	1	13
A5	5	4	3	3	1	16

3.3 ROC Weighting Results

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In the ROC method, the initial step involves determining the ranking order of each criterion based on its level of importance in the decision-making process. The criterion placed in Rank 1 is considered the highest priority and receives the largest weight value, followed by the remaining criteria according to their priority levels. After the ranking order has been established, the weight of each criterion is calculated using the ROC formula presented in Equation (7). This calculation process produces proportional weights that represent the relative importance of each criterion objectively and systematically:

$$C_1 = \frac{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5}=0{,}456$$

$$C_2 = \frac{0+\frac{1}{2}+\frac{1}{3}+\frac{1}{3}+\frac{1}{5}}{5}=0{,}256$$

$$C_3 = \frac{0+0+\frac{1}{3}+\frac{1}{3}+\frac{1}{5}}{5}=0{,}156$$

$$C_4 = \frac{0+0+0+\frac{1}{3}+\frac{1}{5}}{5}=0{,}09$$

$$C_5 = \frac{0+0+0+0+\frac{1}{5}}{5}=0{,}04$$

The results of the ROC weighting calculation are presented in Table 10.

Tabel 10. Criteria Weights

Code	Criteria	Weight	Type
C1	Stress Level (score 1–5)	0.456	Cost
C2	Sleep Duration (score 1–4)	0.256	Benefit
C3	Social Interaction (score 1–4)	0.156	Benefit
C4	Dietary Pattern (score 1–3)	0.09	Benefit
C5	Physical Activity (score 1–3)	0.04	Benefit

3.4 WASPAS Calculation and Ranking

The following section describes the calculation procedures used in the WASPAS method to determine the ranking results objectively and accurately. The process begins with the normalization of decision matrix values based on benefit and cost criteria, followed by calculations using the Weighted Sum Model (WSM) and Weighted Product Model (WPM). Finally, the results of both methods are combined to obtain the final WASPAS value, which is then used to determine the ranking of each alternative according to the specified criteria and weights.

1. Normalization

   C_1 = Stress Level (Cost)

   $$X_{11} = \frac{1}{1} = 1$$

   $$X_{21} = \frac{1}{2} = 0.50$$

   $$X_{31} = \frac{1}{3} = 0.33$$

   $$X_{41} = \frac{1}{4} = 0.25$$

   $$X_{51} = \frac{1}{5} = 0.20$$

   C_2 = Sleep Duration

   $$X_{12} = \frac{1}{4} = 0.25$$

   $$X_{22} = \frac{2}{4} = 0.50$$

   $$X_{32} = \frac{3}{4} = 0.75$$

   $$X_{42} = \frac{2}{4} = 0.50$$

   $$X_{52} = \frac{4}{4} = 1$$

   C_3 = Social Interaction

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$X_{13} = \frac{1}{4} = 0.25$

$X_{23} = \frac{2}{4} = 0.50$

$X_{33} = \frac{4}{4} = 1$

$X_{43} = \frac{3}{4} = 0.75$

$X_{53} = \frac{3}{4} = 0.75$

C_4 = Dietary Pattern

$X_{14} = \frac{1}{3} = 0.33$

$X_{24} = \frac{2}{3} = 0.67$

$X_{34} = \frac{2}{3} = 0.67$

$X_{44} = \frac{3}{3} = 1$

$X_{54} = \frac{3}{3} = 1$

C_5 = Physical Activity

$X_{15} = \frac{3}{3} = 1$

$X_{25} = \frac{2}{3} = 0.67$

$X_{35} = \frac{2}{3} = 0.67$

$X_{45} = \frac{1}{3} = 0.33$

$X_{55} = \frac{1}{3} = 0.33$

2. Calculation Using WSM (Weighted Sum Model)

$$WSM_1 = \sum_1^5 (1{,}00 \times 0{,}456) + (0{,}25 \times 0{,}256) + (0{,}25 \times 0{,}156) + (0{,}33 \times 0{,}09) + (1{,}00 \times 0{,}04)$$
$$= (0{,}456) + (0{,}064) + (0{,}039) + (0{,}0297) + (0{,}04) = 0{,}6287$$

$$WSM_2 = \sum_2^5 (0{,}50 \times 0{,}456) + (0{,}50 \times 0{,}256) + (0{,}50 \times 0{,}156) + (0{,}67 \times 0{,}09) + (0{,}67 \times 0{,}04)$$
$$= (0{,}228) + (0{,}128) + (0{,}078) + (0{,}0603) + (0{,}0268) = 0{,}5211$$

$$WSM_3 = \sum_3^5 (0{,}33 \times 0{,}456) + (0{,}75 \times 0{,}256) + (1{,}00 \times 0{,}156) + (0{,}67 \times 0{,}09) + (0{,}67 \times 0{,}04)$$
$$= (0{,}150) + (0{,}192) + (0{,}156) + (0{,}0603) + (0{,}0268) = 0{,}5851$$

$$WSM_4 = \sum_4^5 (0{,}25 \times 0{,}456) + (0{,}50 \times 0{,}256) + (0{,}75 \times 0{,}156) + (1{,}00 \times 0{,}09) + (0{,}33 \times 0{,}04)$$
$$= (0{,}114) + (0{,}128) + (0{,}117) + (0{,}09) + (0{,}0132) = 0{,}4622$$

$$WSM_5 = \sum_5^5 (0{,}20 \times 0{,}456) + (1{,}00 \times 0{,}256) + (0{,}75 \times 0{,}156) + (1{,}00 \times 0{,}09) + (0{,}33 \times 0{,}04)$$
$$= (0{,}0912) + (0{,}256) + (0{,}117) + (0{,}09) + (0{,}0132) = 0{,}5674$$

3. Calculation Using WPM (Weighted Product Model)

$$WPM_1 = \prod_1^5 (1{,}00^{0{,}456}) \times (0{,}25^{0{,}256}) \times (0{,}25^{0{,}156}) \times (0{,}33^{0{,}09}) \times (1{,}00^{0{,}04})$$
$$= (1) \times (0{,}701) \times (0{,}805) \times (0{,}905) \times (1) = 0{,}510$$

$$WPM_2 = \prod_2^5 (0{,}50^{0{,}456}) \times (0{,}50^{0{,}256}) \times (0{,}50^{0{,}156}) \times (0{,}67^{0{,}09}) \times (0{,}67^{0{,}04})$$
$$= (0{,}729) \times (0{,}837) \times (0{,}897) \times (0{,}964) \times (0{,}984) = 0{,}519$$

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$$WPM_3 = \prod\nolimits_3^5 (0{,}33^{0{,}456}) \times (0{,}75^{0{,}256}) \times (1{,}00^{0{,}156}) \times (0{,}67^{0{,}09}) \times (0{,}67^{0{,}04})$$
$$= (0{,}603) \times (0{,}928) \times (1) \times (0{,}964) \times (0{,}984) = 0{,}530$$
$$WPM_4 = \prod\nolimits_4^5 (0{,}25^{0{,}456}) \times (0{,}50^{0{,}256}) \times (0{,}75^{0{,}156}) \times (1{,}00^{0{,}09}) \times (0{,}33^{0{,}04})$$
$$= (0{,}531) \times (0{,}837) \times (0{,}956) \times (1) \times (0{,}956) = 0{,}406$$
$$WPM_5 = \prod\nolimits_5^5 (0{,}20^{0{,}456}) \times (1{,}00^{0{,}256}) \times (0{,}75^{0{,}156}) \times (1{,}00^{0{,}09}) \times (0{,}33^{0{,}04})$$
$$= (0{,}480) \times (1) \times (0{,}956) \times (1) \times (0{,}956) = 0{,}438$$

4. Calculation of WASPAS Values by Combining WSM and WPM Results

$$Q_1 = 0{,}5(0{,}6287) + \big((1 - 0{,}5)0{,}510\big) = (0{,}314) + (0{,}255) = 0{,}569$$
$$Q_2 = 0{,}5(0{,}5211) + \big((1 - 0{,}5)0{,}519\big) = (0{,}260) + (0{,}259) = 0{,}519$$
$$Q_3 = 0{,}5(0{,}5851) + \big((1 - 0{,}5)0{,}530\big) = (0{,}292) + (0{,}265) = 0{,}557$$
$$Q_4 = 0{,}5(0{,}4622) + \big((1 - 0{,}5)0{,}406\big) = (0{,}231) + (0{,}203) = 0{,}434$$
$$Q_5 = 0{,}5(0{,}5674) + \big((1 - 0{,}5)0{,}438\big) = (0{,}283) + (0{,}219) = 0{,}502$$

Based on the calculation results above, the ranking table obtained is presented as follows.

Table 11. Ranking Results

Alternative	Total Score	Rank
A1	0.569	1
A2	0.519	3
A3	0.557	2
A4	0.434	5
A5	0.502	4

Table 11 shows that A1 obtained the highest preference score (0.569), followed by A3 (0.557), A2 (0.519), A5 (0.502), and A4 (0.434). The small difference between A1 and A3 (0.012) indicates that their order may be sensitive to changes in weights, scoring rules, or rounding. The result is primarily influenced by the dominant stress weight (0.456), which accounts for almost half of the total importance. A1 benefits from the lowest stress score and high physical-activity score, whereas A4 and A5 receive less favorable results under the specified cost and benefit transformations. These findings demonstrate the mechanics of the integrated method, but they do not establish predictive accuracy, causal influence, or clinical validity. No diagnostic reference standard, confusion matrix, sensitivity, specificity, or external test sample was available. Moreover, the monotonic sleep scale rewards values above eight hours even though the relationship between sleep and mental health may be non-linear. The model should therefore be described as a relative lifestyle-profile ranking. A publishable validation study should recruit an adequate sample, use a validated depression measure and professional assessment where appropriate, predefine cutoffs, evaluate reliability and discrimination, and perform sensitivity analysis across alternative weights and lambda values.

Several verification checks can be derived from the reported calculations. The rounded ROC weights total 0.998 rather than exactly 1.000 because each value is displayed with limited decimal precision; implementation code should retain full precision and round only for presentation. Every normalized value should lie between zero and one, and the cost transformation should decrease as the original stress score increases. The final table should contain every alternative exactly once and assign unique rank numbers after sorting the preference scores in descending order. Recalculation should also reproduce A1 = 0.569, A3 = 0.557, A2 = 0.519, A5 = 0.502, and A4 = 0.434 within a stated rounding tolerance. These checks improve computational correctness, but they are distinct from validation of the underlying construct. Correct arithmetic does not demonstrate that the criteria measure depression risk accurately. Construct validity requires evidence that the selected indicators and scale transformations represent the intended concept, while criterion validity requires comparison with an accepted reference measure. Separating software verification, model validation, and clinical evaluation prevents a successful calculation test from being misreported as proof of diagnostic effectiveness. This distinction is fundamental to responsible interpretation and future deployment.

Practical implementation also introduces ethical and safety requirements. The interface should display the factors that contributed to a score, avoid stigmatizing labels, and explain that results are preliminary. A high-risk response or any

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indication of self-harm should activate an approved escalation pathway rather than merely produce a numerical rank. Personal mental-health information should be minimized, encrypted in transit and at rest, protected through role-based access, and retained only for a defined period. System logs should support accountability without exposing sensitive questionnaire content. Model monitoring should examine missing data, unusual response patterns, and systematic differences across demographic groups. These safeguards were not evaluated in the current study and are therefore requirements for future development, not demonstrated features of the prototype.

Compared with machine-learning classifiers, the ROC-WASPAS model can operate without a large labeled training set and exposes every computational step. This transparency is useful for a prototype and for settings where explanation is important. However, it does not learn predictive relationships from data, estimate classification probabilities, or provide diagnostic-performance measures. Compared with expert systems based on fuzzy rules or certainty factors, the present model requires fewer rule definitions but depends strongly on ordinal scoring and criterion priority. Published student-depression prototypes based on Support Vector Machines and fuzzy inference illustrate these alternative computational designs [13], [14]. These are complementary approaches rather than evidence that one method is universally superior. A future comparative study should apply ROC-WASPAS, a clinically grounded scoring rule, and selected baseline models to the same dataset. Performance should be evaluated against an appropriate reference standard using predefined metrics, confidence intervals, and validation partitions. Such a design would permit a scientifically meaningful statement about utility that the present five-profile demonstration cannot support.

The measurement scales require particular caution. Stress is consistently oriented as a cost criterion, meaning that lower values are preferred. Social interaction, diet, and physical activity are oriented as benefits. Sleep duration is also treated as a monotonically increasing benefit from less than four hours to more than eight hours. That transformation is convenient for linear normalization but may not reflect an optimum interval. A more defensible implementation could score distance from an expert-defined healthy range, use a piecewise utility function, or distinguish insufficient and excessive sleep. Similarly, qualitative labels such as good diet or active physical activity require operational definitions describing frequency, duration, and recall period. Without these details, two users may interpret the same response category differently. Content validity should be assessed by relevant experts, and reliability should be tested through repeated or internally consistent measurement before the resulting scores are used for individual decisions.

The WASPAS aggregation provides a second interpretive layer. The WSM component permits compensation: a weak value on one criterion can be offset by stronger values on other criteria. The WPM component is multiplicative and is more sensitive to low normalized values. Combining them with lambda = 0.5 balances these behaviors, but the equal coefficient is an assumption rather than an empirically optimized value. Reporting the two component scores separately would make the calculation more auditable and reveal whether an alternative ranks highly because of broadly balanced performance or because strong values compensate for a weakness. Future evaluation should vary lambda from 0 to 1 and report rank correlations across settings. This is especially important for A1 and A3, whose final scores differ by only 0.012. A minor change in the weight vector, scale mapping, or aggregation coefficient could reverse their positions. In contrast, the gap between A1 and A4 is 0.135, indicating greater separation under the current assumptions. These numerical distances describe model sensitivity within this matrix; they do not represent differences in clinical symptom severity.

The ROC results clarify the structure of the decision model. The first-ranked criterion receives 0.456, whereas the fifth-ranked criterion receives only 0.040. Thus, the highest-priority criterion has more than eleven times the weight of the lowest-priority criterion. This steep distribution is an inherent consequence of applying ROC to five ordered criteria rather than an effect estimated from the five respondents. It makes the assumed priority order highly influential. Stress contributes 45.6% of the additive component, and stress-related differences can therefore outweigh several smaller advantages in diet or physical activity. The second criterion, sleep duration, contributes another 25.6%, so the first two criteria jointly account for 71.2% of total weight. This concentration makes the model easy to explain, but it also means that an unsupported ordering of criteria can materially change the outcome. Expert elicitation should therefore be documented, and agreement among experts should be measured before the weights are used operationally. A sensitivity analysis should then exchange adjacent criterion ranks and compare alternative weighting schemes to determine whether the preference order remains stable.

4. CONCLUSION

This study presented an integrated ROC-WASPAS model for ranking five lifestyle profiles using stress level, sleep duration, social interaction, dietary pattern, and physical activity. ROC translated the assumed priority order into weights

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of 0.456, 0.256, 0.156, 0.090, and 0.040, respectively. WASPAS then combined the normalized weighted-sum and weighted-product components to produce preference scores. A1 ranked first with 0.569, followed by A3 with 0.557, A2 with 0.519, A5 with 0.502, and A4 with 0.434. The calculation is transparent and reproducible for the reported decision matrix, but the ranking represents relative lifestyle profiles only. It must not be interpreted as a diagnosis or as evidence that the model accurately detects depression. The study is limited by the five-person sample, ordinal scales that have not been clinically validated, assumed criterion priorities, the monotonic treatment of sleep duration, and the absence of a diagnostic reference standard, sensitivity analysis, and external validation. Future research should involve mental-health experts in criterion design, employ validated screening and diagnostic measures, recruit a larger and representative sample, test alternative normalization and weighting scenarios, and report reliability, sensitivity, specificity, and fairness across relevant groups. Subject to these steps, the proposed workflow may serve as the basis for a responsible decision-support prototype that assists preliminary prioritization and referral without replacing professional assessment.

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