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Predicting Women's Psychological Flourishing Using XGBoost: The Relative Importance of Self-Compassion, Resilience, Emotional Intelligence, and Social Support

Zuzana. Kováčová[1], Jacob. Sinclair[2*], Luca. Ferraro[3]

[1] Department of Experimental Psychology, Comenius University, Bratislava, Slovakia
[2] Department of Social Psychology, University of British Columbia, Vancouver, Canada
[3] Department of Cognitive Psychology, Sapienza University of Rome, Rome, Italy

*** Corresponding author email address**: jacob.sinclair@ubc.ca

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A B S T R A C T

Objective: The present study aimed to predict psychological flourishing among women using the Extreme Gradient Boosting (XGBoost) machine-learning algorithm and to determine the relative importance of self-compassion, resilience, emotional intelligence, and perceived social support as predictors of flourishing.

Methods and Materials: This cross-sectional predictive study was conducted among 642 adult women residing in Canada. Participants were recruited through online platforms and community networks and completed a battery of standardized self-report measures assessing psychological flourishing, self-compassion, resilience, emotional intelligence, and perceived social support. After data screening and preprocessing, descriptive statistics and Pearson correlations were calculated. The dataset was randomly divided into training (80%) and testing (20%) subsets. XGBoost was employed as the primary predictive model due to its ability to capture complex nonlinear relationships and interactions among predictors. Hyperparameter tuning was performed using five-fold cross-validation and grid-search optimization procedures. Model performance was evaluated using the coefficient of determination (R^2), root mean square error (RMSE), mean absolute error (MAE), and explained variance. Feature importance analysis and SHAP (Shapley Additive Explanations) values were used to determine the relative contribution and interpretability of each predictor.

Findings: All predictor variables demonstrated significant positive correlations with psychological flourishing. The XGBoost model exhibited strong predictive performance, explaining 82.1% of the variance in flourishing scores on the test dataset (R^2 = .821), with low prediction errors (RMSE = 3.18; MAE = 2.47). Feature importance analysis revealed that resilience was the most influential predictor (34.1%), followed by self-compassion (28.6%), emotional intelligence (22.3%), and social support (15.0%). SHAP analyses confirmed that all predictors exerted positive effects on flourishing, with resilience demonstrating the strongest impact on model predictions. The findings indicated that internal psychological

strengths contributed more substantially to flourishing than external support resources.

Conclusion: The findings suggest that women's psychological flourishing can be accurately predicted using machine-learning approaches and is primarily influenced by resilience, self-compassion, emotional intelligence, and social support. Resilience emerged as the strongest determinant of flourishing, highlighting the importance of adaptive coping capacities in promoting optimal psychological functioning. Interventions aimed at enhancing flourishing among women should prioritize the development of resilience and self-compassion while also strengthening emotional intelligence and supportive interpersonal relationships.

Keywords: *Psychological Flourishing; Women; XGBoost; Machine Learning; Resilience; Self-Compassion; Emotional Intelligence; Social Support*

1. Introduction

Psychological flourishing has emerged as one of the central constructs within contemporary positive psychology, reflecting an individual's optimal functioning across emotional, psychological, and social domains. Unlike traditional approaches that focus primarily on the absence of psychological distress, flourishing emphasizes the presence of positive functioning, meaningful engagement, purpose in life, personal growth, competence, and satisfying interpersonal relationships. Women's psychological flourishing has gained increasing attention due to the unique social, cultural, occupational, and familial challenges women encounter throughout the lifespan. Contemporary research indicates that flourishing is associated with improved mental health, physical well-being, adaptive coping, life satisfaction, and resilience against stressors. Consequently, identifying the psychological factors that contribute most strongly to flourishing among women represents an important objective for both researchers and practitioners seeking to promote well-being and prevent psychological difficulties (Gannamraju, 2025; Kolobaric et al., 2025; Mustabeen & Arshad, 2025).

Recent developments in positive psychology have shifted attention from pathology-oriented models toward strengths-based frameworks that emphasize protective psychological resources. Within this perspective, flourishing is understood as the result of complex interactions among emotional, cognitive, interpersonal, and motivational capacities. Rather than emerging from a single determinant, flourishing appears to be influenced by multiple internal and external resources that enable individuals to effectively navigate adversity while maintaining positive functioning. Among these resources, self-compassion, resilience, emotional intelligence, and social support have consistently emerged as important predictors of psychological well-being. However, despite extensive research examining these variables independently, relatively little is known about their relative importance when considered simultaneously within advanced predictive frameworks (Goodwin et al., 2025; Kumar et al., 2025; Liu, 2025).

Self-compassion has become one of the most widely studied constructs in contemporary psychological science. Conceptually, self-compassion involves treating oneself with kindness during times of failure or suffering, recognizing personal experiences as part of the shared human condition, and maintaining balanced awareness of emotions rather than engaging in excessive self-criticism or avoidance. Research suggests that self-compassion functions as an adaptive emotional regulation strategy that enhances psychological resilience, reduces stress, and promotes positive self-evaluation. Individuals with higher levels of self-compassion tend to demonstrate greater emotional stability, lower levels of anxiety and depression, and enhanced psychological well-being. Recent evidence further indicates that self-compassion serves as a protective factor against the negative consequences of stigma, trauma, and chronic health challenges. For example, self-compassion has been shown to mitigate the psychological impact of long-COVID-related stigma and contribute to healthier coping processes in vulnerable populations (Hovnanyan et al., 2024; Shani & Wübbelt, 2025; Tsironis et al., 2024).

The importance of self-compassion for flourishing is supported by intervention studies demonstrating that compassion-focused training programs can significantly enhance emotional regulation, well-being, and adaptive functioning. Online compassion training programs have been found to improve mental health outcomes among university students, while compassion-based interventions

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have also demonstrated effectiveness in reducing stress and strengthening psychological resources among professionals. Furthermore, evidence suggests that self-compassion is positively associated with flourishing through its ability to reduce self-judgment and increase acceptance during challenging circumstances. These findings imply that self-compassion may constitute a foundational psychological resource that supports flourishing by promoting adaptive emotional responses and psychological flexibility (Bock et al., 2025; Rofiqah, 2023; Tendhar et al., 2024).

Another construct that has received substantial empirical attention is resilience. Resilience refers to the capacity to adapt successfully to adversity, recover from setbacks, and maintain psychological functioning despite exposure to stressors. Traditionally viewed as a stable personality characteristic, resilience is now widely recognized as a dynamic process involving cognitive, emotional, behavioral, and social resources. Research conducted across diverse populations consistently demonstrates that resilience is strongly associated with psychological well-being, life satisfaction, and positive adaptation. Individuals with greater resilience are better equipped to manage stress, regulate emotions, and maintain optimism during difficult life events. Consequently, resilience is increasingly regarded as a critical determinant of flourishing and long-term mental health (Kumar et al., 2025; Liu, 2025; Schimmels et al., 2024).

The significance of resilience has become particularly evident in healthcare and educational settings, where individuals are frequently exposed to demanding circumstances. Recent meta-analytic evidence indicates that resilience-focused interventions produce meaningful improvements in psychological functioning among nurses and other healthcare professionals. Furthermore, resilience has been identified as a key mechanism through which individuals transform adverse experiences into opportunities for personal growth and enhanced well-being. Studies examining trauma survivors have demonstrated that resilience contributes to posttraumatic growth, psychological recovery, and the preservation of positive functioning despite significant adversity. These findings suggest that resilience may play a central role in predicting flourishing among women, particularly in contexts characterized by increasing social, occupational, and personal demands (Kolobaric et al., 2025; Kumar et al., 2025; Liu, 2025).

Emotional intelligence represents another important psychological resource with substantial implications for well-being and flourishing. Emotional intelligence generally refers to the ability to perceive, understand, regulate, and effectively utilize emotions in oneself and others. The construct has received considerable attention due to its associations with interpersonal competence, leadership effectiveness, stress management, and psychological adjustment. Theoretical perspectives suggest that emotionally intelligent individuals possess superior abilities to identify emotional information, regulate emotional responses, and engage in adaptive coping strategies, thereby facilitating positive psychological outcomes (Ding et al., 2024; Lu et al., 2024; Nayak & Satpathy, 2023).

Accumulating evidence demonstrates that emotional intelligence contributes positively to mental health and psychological well-being across a wide range of populations. Studies have shown that emotional intelligence predicts professional quality of life, academic adaptation, leadership effectiveness, ethical sensitivity, and stress regulation. Furthermore, emotional intelligence appears to enhance individuals' capacity to navigate interpersonal relationships and maintain positive functioning during stressful situations. Research conducted among healthcare workers, students, and organizational leaders consistently indicates that higher emotional intelligence is associated with greater well-being and improved psychological adjustment. These findings suggest that emotional intelligence may contribute substantially to flourishing through its influence on emotional regulation, interpersonal effectiveness, and adaptive coping processes (Goodwin et al., 2025; Mosallanezhad et al., 2023; Z. et al., 2023).

Recent investigations have further expanded understanding of emotional intelligence by highlighting its interaction with other psychological strengths. Emotional intelligence has been linked to academic buoyancy, resilience, empathy, and psychological adaptation in diverse contexts. Moreover, emotional intelligence appears to function as a protective factor following traumatic experiences and may enhance individuals' ability to derive meaning and growth from adversity. Research among students, healthcare providers, and community populations suggests that emotional intelligence facilitates positive adaptation through both direct and indirect pathways, underscoring its relevance as a predictor of flourishing (Hovnanyan et al., 2024; Kuzmić et al., 2025; Liu et al., 2025).

In addition to individual psychological resources, social support has long been recognized as a critical determinant of mental health and well-being. Social support encompasses

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the emotional, informational, and instrumental assistance individuals receive from family members, friends, colleagues, and broader social networks. According to social support theories, supportive interpersonal relationships provide individuals with resources that buffer the negative effects of stress and promote positive psychological outcomes. Social support contributes to feelings of belongingness, security, validation, and connectedness, all of which are essential components of flourishing. Research consistently demonstrates that individuals with stronger support systems experience higher levels of well-being, resilience, and life satisfaction (Goodwin et al., 2025; Kolobaric et al., 2025; Rofiqah, 2023).

Although substantial evidence supports the individual contributions of self-compassion, resilience, emotional intelligence, and social support to psychological well-being, the relationships among these variables are complex and likely nonlinear. Traditional statistical approaches such as correlation and regression analyses have provided valuable insights but may be limited in their ability to capture intricate interactions among multiple predictors. As psychological phenomena become increasingly understood as multidimensional and dynamic, researchers have begun adopting advanced analytical approaches capable of modeling nonlinear relationships and identifying complex predictive patterns (Bhattacharjee, 2024; Ding et al., 2024; S. & K., 2024).

Machine learning methodologies have emerged as powerful tools for advancing psychological research by enabling more accurate prediction and deeper understanding of complex psychological processes. Unlike conventional statistical models, machine learning algorithms can identify nonlinear associations, interactions among variables, and subtle patterns that may otherwise remain undetected. Among these approaches, Extreme Gradient Boosting (XGBoost) has gained particular popularity due to its high predictive performance, robustness, and interpretability. XGBoost integrates multiple decision trees through gradient boosting procedures, allowing researchers to develop highly accurate predictive models while simultaneously examining the relative importance of individual predictors. Recent applications of machine learning in psychological and health sciences have demonstrated its utility for predicting well-being, resilience, emotional functioning, and related outcomes (Bhattacharjee, 2024; Ding et al., 2024; Goodwin et al., 2025).

Despite growing interest in flourishing and psychological strengths, several gaps remain in the existing literature. First, most studies have examined self-compassion, resilience, emotional intelligence, and social support independently rather than evaluating their relative contributions within a unified predictive framework. Second, the majority of previous investigations have relied on traditional statistical techniques that may not fully capture the complexity of psychological flourishing. Third, limited research has specifically focused on women, despite evidence suggesting that women experience unique psychosocial stressors and may benefit differently from various psychological resources. Finally, few studies have employed machine learning approaches to identify which strengths exert the greatest influence on flourishing when considered simultaneously (Amartyavanda et al., 2024; Mustabeen & Arshad, 2025; Saoji et al., 2024).

Addressing these limitations may provide important theoretical and practical insights. Understanding the relative importance of self-compassion, resilience, emotional intelligence, and social support could inform the development of targeted interventions designed to enhance flourishing among women. Furthermore, the application of machine learning techniques may contribute to a more nuanced understanding of how psychological strengths interact to promote optimal functioning and well-being across diverse populations (Emslie, 2025; Gannamraju, 2025; Kuzmić et al., 2025).

Therefore, the present study aimed to predict women's psychological flourishing using XGBoost and to determine the relative importance of self-compassion, resilience, emotional intelligence, and social support as predictors of flourishing.

2. Methods and Materials

2.1. Study design and Participant

This study employed a cross-sectional predictive research design to examine the relative contributions of self-compassion, resilience, emotional intelligence, and perceived social support in predicting psychological flourishing among adult women. The study was conducted in Canada between January and April 2026. The target population consisted of women residing in different provinces of Canada, including Ontario, British Columbia, Alberta, Quebec, and Nova Scotia. Participants were recruited through online advertisements distributed via social media platforms, community organizations, women's health networks, and university mailing lists. Eligibility criteria included being female, at least 18 years of age,

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residing in Canada, and possessing sufficient English language proficiency to complete the study questionnaires independently. Individuals with incomplete responses exceeding 10% of survey items were excluded from the final analysis.

A total of 684 women initially accessed the online survey platform. After data screening and removal of incomplete questionnaires and cases with excessive missing data, 642 participants were retained for the final analysis. The participants ranged in age from 18 to 65 years, with a mean age of 36.84 years (SD = 11.27). The sample represented diverse educational, occupational, and socioeconomic backgrounds, thereby enhancing the generalizability of the findings. Before participation, all respondents received detailed information regarding the study objectives, confidentiality procedures, voluntary participation, and the right to withdraw at any stage without penalty. Electronic informed consent was obtained from all participants prior to data collection. The study protocol adhered to the ethical principles outlined in the Declaration of Helsinki and received approval from a university research ethics committee in Canada.

2.2. Measures

Psychological flourishing was assessed using the Flourishing Scale developed by Diener and colleagues in 2010. The scale consists of eight items designed to evaluate individuals' perceptions of purpose, competence, positive relationships, self-esteem, engagement, and optimism. Participants respond using a seven-point Likert scale ranging from strongly disagree to strongly agree. Total scores range from 8 to 56, with higher scores indicating greater psychological flourishing and overall psychosocial well-being. Previous research has consistently demonstrated strong psychometric properties for the scale across diverse cultural contexts, with evidence supporting its construct validity, convergent validity, and internal consistency reliability.

Self-compassion was measured using the Self-Compassion Scale developed by Kristin Neff in 2003. The instrument contains 26 items distributed across six dimensions, including self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification. Responses are provided on a five-point Likert scale ranging from almost never to almost always. Higher scores indicate greater levels of self-compassion and a more accepting and supportive attitude toward oneself during difficult experiences. Numerous studies have reported satisfactory reliability coefficients and substantial evidence of factorial and construct validity for the instrument in both clinical and non-clinical populations.

Resilience was assessed using the Connor–Davidson Resilience Scale developed by Kathryn M. Connor and Jonathan R. T. Davidson in 2003. The scale comprises 25 items measuring adaptive coping, persistence, personal competence, tolerance of negative emotions, and the ability to recover from adversity. Participants rate each item on a five-point scale ranging from not true at all to true nearly all the time. Higher scores reflect greater psychological resilience and adaptability when confronted with stress and life challenges. Previous investigations have established excellent internal consistency, test–retest reliability, and convergent validity across different age groups and cultural settings.

Emotional intelligence was measured using the Schutte Self-Report Emotional Intelligence Test developed by Nicola Schutte and colleagues in 1998. This instrument consists of 33 items evaluating emotional perception, emotional regulation, emotional utilization, and interpersonal emotional functioning. Responses are recorded on a five-point Likert scale ranging from strongly disagree to strongly agree. Higher scores indicate greater emotional intelligence and more effective emotional functioning. The scale has demonstrated satisfactory psychometric characteristics in previous research, including acceptable internal consistency, factorial validity, and predictive validity in psychological and educational studies.

Perceived social support was evaluated using the Multidimensional Scale of Perceived Social Support developed by Gregory D. Zimet and colleagues in 1988. The instrument contains 12 items assessing perceived support from family, friends, and significant others. Participants respond on a seven-point Likert scale ranging from very strongly disagree to very strongly agree. Higher scores indicate stronger perceptions of available social support. Extensive empirical evidence has confirmed the scale's reliability and validity across different populations, making it one of the most frequently used measures of perceived social support in psychological research.

All questionnaires were administered electronically using a secure online survey platform. Prior to the main analyses, the reliability of each instrument was evaluated using Cronbach's alpha and composite reliability coefficients. The results indicated satisfactory internal consistency for all

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measures, with reliability coefficients exceeding the recommended threshold of 0.70.

2.3. *Data Analysis*

Data analysis was performed using Python version 3.12 and IBM SPSS Statistics version 29. Initially, descriptive statistics, including means, standard deviations, skewness, and kurtosis values, were calculated to summarize participant characteristics and study variables. Missing data patterns, outliers, and distributional assumptions were examined before conducting predictive analyses. Pearson correlation coefficients were computed to explore the bivariate relationships among psychological flourishing, self-compassion, resilience, emotional intelligence, and perceived social support.

The primary analytical approach involved the implementation of the Extreme Gradient Boosting (XGBoost) algorithm, a powerful ensemble machine-learning method based on gradient-boosted decision trees. XGBoost was selected because of its ability to model complex nonlinear relationships, handle feature interactions, reduce overfitting through regularization, and provide robust predictive performance. Psychological flourishing served as the target variable, while self-compassion, resilience, emotional intelligence, and perceived social support were entered as predictor variables.

The dataset was randomly divided into training (80%) and testing (20%) subsets. Hyperparameter optimization was conducted using five-fold cross-validation and grid-search procedures to identify the optimal combination of model parameters, including learning rate, maximum tree depth, number of estimators, subsample ratio, and regularization coefficients. Model performance was evaluated using multiple metrics, including the coefficient of determination (R^2), root mean square error (RMSE), mean absolute error (MAE), and cross-validation scores.

To determine the relative importance of the predictors, feature importance analysis based on gain values and SHAP (Shapley Additive Explanations) values was conducted. These methods enabled the identification and ranking of the variables that contributed most strongly to the prediction of psychological flourishing. SHAP analysis further facilitated the interpretation of the direction and magnitude of each predictor's influence on the outcome variable. Statistical significance for preliminary analyses was established at $p < .05$, while the machine-learning analyses focused primarily on predictive accuracy, model generalizability, and the relative importance of predictors rather than traditional null-hypothesis significance testing.

3. Findings and Results

A total of 642 women participated in the study and were included in the final analyses. Participants ranged in age from 18 to 65 years (M = 36.84, SD = 11.27). Regarding age distribution, 24.9% were between 18 and 25 years, 29.6% were between 26 and 35 years, 26.3% were between 36 and 45 years, 13.7% were between 46 and 55 years, and 5.5% were older than 55 years. In terms of educational attainment, 17.4% had completed high school or equivalent education, 28.8% held a college diploma, 35.5% possessed a bachelor's degree, and 18.3% had completed graduate-level education. Employment status indicated that 58.9% were employed full-time, 14.6% were employed part-time, 12.5% were students, 7.8% were self-employed, and 6.2% reported being unemployed. With respect to marital status, 51.4% were married, 37.5% were single, 7.3% were divorced, and 3.8% were widowed. The sample represented women from multiple Canadian provinces, providing substantial demographic diversity for evaluating the predictive determinants of psychological flourishing.

Table 1

Descriptive Statistics and Correlations Among Study Variables

Variable	Mean	SD	1	2	3	4	5
Psychological Flourishing	42.83	7.16	1.00				
Self-Compassion	83.54	14.72	.68**	1.00			
Resilience	71.48	12.83	.72**	.61**	1.00		
Emotional Intelligence	124.36	18.91	.64**	.58**	.67**	1.00	
Social Support	65.27	11.54	.59**	.47**	.52**	.49**	1.00

Table 1 presents the descriptive statistics and Pearson correlation coefficients for all study variables. Psychological flourishing demonstrated strong positive associations with resilience ($r = .72$, $p < .001$), self-compassion ($r = .68$, $p <$

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.001), emotional intelligence (r = .64, p < .001), and perceived social support (r = .59, p < .001). Furthermore, all predictor variables were significantly intercorrelated, suggesting that women who reported higher levels of self-compassion also tended to exhibit greater resilience, stronger emotional intelligence, and more perceived social support. The strongest association among the predictors was observed between resilience and emotional intelligence (r = .67, p < .001). Overall, the correlation matrix provided preliminary evidence that all four psychological resources were positively related to flourishing and justified their inclusion in the subsequent machine-learning analyses.

Table 2

XGBoost Model Performance Metrics on Training and Test Sets

Metric	Training Set	Test Set
R^2	0.879	0.821
RMSE	2.41	3.18
MAE	1.86	2.47
Explained Variance	0.881	0.824
Cross-Validation R^2 (5-Fold)	0.813	-

The predictive performance of the XGBoost model is presented in Table 2. The model demonstrated excellent predictive accuracy for psychological flourishing. On the test dataset, the model explained 82.1% of the variance in flourishing scores (R^2 = .821), indicating that the selected psychological predictors accounted for a substantial proportion of individual differences in flourishing among women. The relatively small discrepancy between training and test performance suggested minimal overfitting and strong generalizability. Moreover, the low RMSE and MAE values indicated that prediction errors were limited, further supporting the robustness of the model. The five-fold cross-validation results confirmed the stability of the model across different data partitions, providing additional evidence for the reliability of the predictive framework.

Table 3

XGBoost Feature Importance Rankings

Predictor	Gain Importance	Relative Importance (%)	Rank
Resilience	0.341	34.1	1
Self-Compassion	0.286	28.6	2
Emotional Intelligence	0.223	22.3	3
Social Support	0.150	15.0	4

The feature importance analysis revealed substantial differences in the contribution of predictors to psychological flourishing. Resilience emerged as the most influential predictor, accounting for 34.1% of the total predictive importance within the model. Self-compassion represented the second most influential variable, contributing 28.6% of predictive power. Emotional intelligence ranked third with a relative importance of 22.3%, while social support contributed 15.0% of the overall prediction. These findings suggest that internal psychological resources, particularly resilience and self-compassion, play a more central role in explaining flourishing than external interpersonal resources. The ranking pattern indicates that adaptive coping capacity and compassionate self-relating may constitute the primary foundations of flourishing among adult women.

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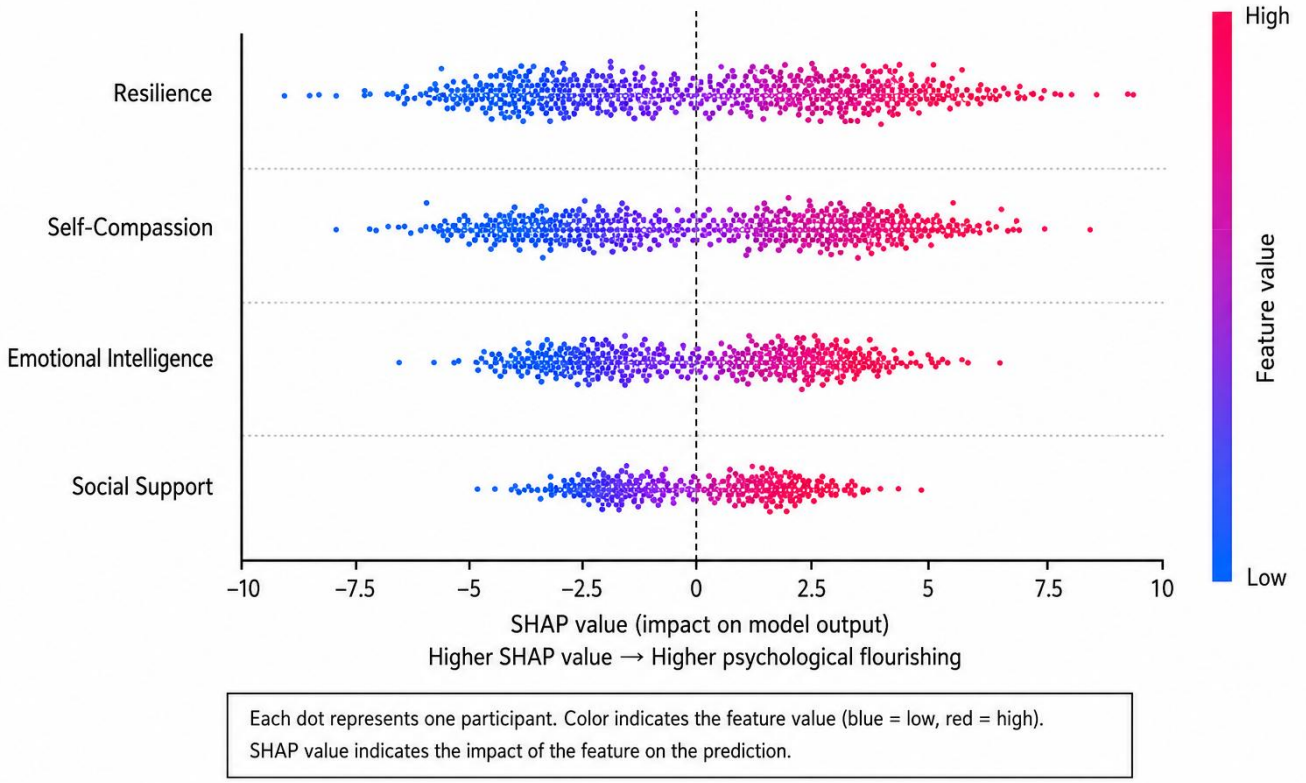
Figure 1

SHAP Summary Plot Illustrating the Relative Impact of Self-Compassion, Resilience, Emotional Intelligence, and Social Support on Psychological Flourishing



The SHAP summary analysis provided a more detailed understanding of how each predictor influenced flourishing scores. Consistent with the feature importance findings, resilience displayed the largest SHAP values, indicating the strongest overall contribution to model predictions. Higher resilience scores consistently increased predicted flourishing, whereas lower resilience scores substantially reduced flourishing estimates. Self-compassion demonstrated the second-largest SHAP contribution and showed a predominantly positive relationship with flourishing. Emotional intelligence also exerted a meaningful positive influence, particularly at moderate-to-high score ranges. Social support, although ranked fourth, continued to show a positive effect across the distribution. The SHAP visualization further suggested that resilience and self-compassion exhibited stronger nonlinear effects than emotional intelligence and social support, highlighting the value of machine-learning approaches for capturing complex psychological relationships that may not be adequately represented by traditional linear models.

Table 4

SHAP-Based Direction and Magnitude of Predictor Effects

Predictor	Mean Absolute SHAP Value	Direction of Effect	Effect Magnitude
Resilience	3.82	Positive	Very Strong
Self-Compassion	3.11	Positive	Strong
Emotional Intelligence	2.54	Positive	Moderate to Strong
Social Support	1.79	Positive	Moderate

The SHAP-based effect analysis demonstrated that all predictors exerted positive influences on psychological flourishing. Resilience showed the highest mean absolute SHAP value (3.82), confirming its dominant role in determining flourishing outcomes. Self-compassion displayed the second-largest effect, suggesting that individuals who treated themselves with kindness and maintained balanced self-awareness experienced higher

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flourishing. Emotional intelligence exhibited a substantial contribution, indicating that the ability to perceive, understand, and regulate emotions plays a meaningful role in promoting psychological well-being. Social support also contributed positively, although its impact was comparatively smaller than the intrapersonal psychological factors. Collectively, these findings indicate that psychological flourishing among women is best predicted by a combination of adaptive personal strengths and supportive social resources, with resilience emerging as the most influential determinant within the XGBoost predictive framework.

4. Discussion

The present study aimed to predict psychological flourishing among women using an XGBoost machine-learning model and to determine the relative importance of self-compassion, resilience, emotional intelligence, and perceived social support as predictors of flourishing. The findings demonstrated that the proposed model achieved a high level of predictive accuracy, explaining more than 80% of the variance in psychological flourishing. Furthermore, all four predictors contributed positively to flourishing, although their relative importance differed. Resilience emerged as the strongest predictor, followed by self-compassion, emotional intelligence, and social support. The SHAP analyses further confirmed the dominant contribution of resilience and highlighted the meaningful influence of self-compassion and emotional intelligence on flourishing outcomes. These findings provide important insights into the psychological resources that most strongly contribute to optimal functioning and well-being among women.

One of the most notable findings was the exceptionally strong predictive role of resilience. Both the feature importance analysis and SHAP values indicated that resilience was the most influential determinant of psychological flourishing. This result aligns closely with contemporary positive psychology theories suggesting that resilience serves as a fundamental adaptive capacity that enables individuals to maintain positive functioning despite adversity. Women encounter multiple sources of stress across personal, occupational, social, and family domains. Individuals who possess greater resilience are better able to recover from setbacks, adapt to changing circumstances, and sustain psychological well-being during difficult periods. Consequently, resilience appears to function as a foundational mechanism through which flourishing is maintained and strengthened.

The present findings are consistent with previous studies emphasizing the central role of resilience in psychological health and positive adaptation. Recent meta-analytic evidence has demonstrated that resilience-focused interventions significantly improve psychological functioning and well-being among healthcare professionals, suggesting that resilience is not merely associated with well-being but may actively contribute to its development (Liu, 2025). Similarly, network analyses of trauma survivors have shown that resilience-related character strengths facilitate posttraumatic growth and adaptive psychological outcomes following adversity (Kumar et al., 2025). The strong contribution of resilience observed in the present study supports these findings and suggests that resilience may be one of the most critical psychological resources underlying flourishing among women.

The results also revealed that self-compassion was the second most important predictor of flourishing. Women who demonstrated greater levels of self-compassion tended to report substantially higher flourishing scores. This finding is theoretically meaningful because self-compassion promotes emotional balance, reduces self-criticism, and encourages adaptive responses to personal failures and stressful experiences. Rather than engaging in harsh self-judgment, self-compassionate individuals treat themselves with kindness and understanding, thereby preserving emotional resources that support well-being and psychological growth. Self-compassion may therefore contribute to flourishing by facilitating healthier emotional regulation, greater acceptance of personal imperfections, and enhanced psychological flexibility.

The relationship between self-compassion and flourishing observed in the present study is highly consistent with previous research. Studies have shown that self-compassion acts as a protective factor against psychological distress and stigma, enabling individuals to maintain positive functioning even under challenging circumstances (Shani & Wübbelt, 2025). Research conducted among civilians exposed to war-related trauma has similarly demonstrated that self-compassion reduces traumatic stress symptoms and promotes adaptive psychological adjustment (Hovnanyan et al., 2024). Furthermore, compassion-based intervention programs have been shown to improve emotional regulation, stress management, and well-being across various populations (Bock et al., 2025; Tendhar et al., 2024). The current findings extend this body of evidence by

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demonstrating that self-compassion remains one of the strongest predictors of flourishing even when examined alongside resilience, emotional intelligence, and social support within an advanced machine-learning framework.

Another important finding concerned the predictive role of emotional intelligence. Although emotional intelligence ranked below resilience and self-compassion, it remained a substantial contributor to flourishing. Women with higher emotional intelligence demonstrated greater psychological flourishing, suggesting that emotional awareness, understanding, and regulation play important roles in optimal functioning. Emotional intelligence may facilitate flourishing by enhancing interpersonal effectiveness, improving coping responses, and supporting adaptive emotional management during stressful situations. Individuals who can accurately identify and regulate emotions are more likely to maintain positive relationships, solve problems effectively, and experience greater psychological stability, all of which contribute to flourishing.

The current findings are consistent with a growing body of literature emphasizing the positive role of emotional intelligence in psychological well-being. Previous research has shown that emotional intelligence contributes to stress regulation, leadership effectiveness, professional quality of life, and psychological adjustment (Goodwin et al., 2025; Nayak & Satpathy, 2023; Z. et al., 2023). Studies conducted among university students have demonstrated that emotional intelligence promotes academic buoyancy and adaptation through enhanced psychological resources (Liu et al., 2025). Likewise, investigations among healthcare professionals and students have found that emotional intelligence predicts ethical sensitivity, adaptive coping, and reduced emotional difficulties (Bhattacharjee, 2024; Mosallanezhad et al., 2023). The present study supports these findings and suggests that emotional intelligence contributes directly to flourishing while also potentially strengthening other psychological resources such as resilience and self-compassion.

The fourth predictor, perceived social support, also contributed positively to flourishing, although its relative importance was lower than that of the intrapersonal variables. This finding suggests that social support remains an important component of flourishing but may operate differently from internal psychological strengths. Social support provides emotional reassurance, practical assistance, and opportunities for interpersonal connection, all of which contribute to psychological well-being. However, the lower predictive importance observed in the current model may indicate that social support exerts its influence partly through its effects on other psychological resources. For example, supportive relationships may facilitate the development of resilience, self-compassion, and emotional intelligence, which in turn directly promote flourishing.

This interpretation is supported by previous studies demonstrating strong associations between social support and flourishing. Research among students has shown that support systems significantly contribute to flourishing and psychological adjustment (Rofiqah, 2023). Similarly, investigations among healthcare workers have revealed that supportive work environments contribute to professional quality of life and well-being, particularly when combined with emotional intelligence and self-care practices (Goodwin et al., 2025). Systematic reviews of wellness interventions have likewise highlighted the importance of supportive interpersonal environments in promoting psychological health and resilience (Kolobaric et al., 2025). Therefore, although social support demonstrated the lowest relative importance among the predictors examined, its contribution remains meaningful and should not be underestimated.

An important contribution of the present study lies in its use of XGBoost and SHAP analyses to investigate flourishing. Traditional statistical approaches generally assume linear relationships among variables and may not adequately capture complex interactions. In contrast, machine-learning methods allow researchers to model nonlinear associations and identify subtle predictive patterns. The high predictive performance of the XGBoost model suggests that flourishing is influenced by complex combinations of psychological strengths rather than isolated factors. The SHAP analyses further demonstrated that predictor effects varied in magnitude and direction across participants, highlighting the multifaceted nature of flourishing. These findings support emerging perspectives emphasizing the value of machine learning for advancing psychological research and improving understanding of complex well-being outcomes (Ding et al., 2024).

The findings also contribute to contemporary strengths-based theories of psychological well-being. Across diverse contexts, studies have increasingly emphasized the role of positive psychological resources in promoting adaptation and flourishing. Research examining spiritual emotional intelligence, empathy, metacognition, emotional competence, and stress management consistently demonstrates that individuals thrive when equipped with

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multiple psychological strengths (Gannamraju, 2025; Kuzmić et al., 2025; S. & K., 2024). The present study extends these perspectives by demonstrating that flourishing among women is best understood as the outcome of interacting internal and external resources, with resilience and self-compassion emerging as particularly influential determinants.

Another noteworthy implication concerns the distinction between internal and external resources. The findings revealed that resilience, self-compassion, and emotional intelligence collectively accounted for substantially more predictive power than social support. This pattern suggests that although environmental resources are valuable, women's flourishing may depend primarily on internal capacities that influence how challenges are interpreted and managed. Such a conclusion is consistent with recent research indicating that psychological strengths often serve as proximal determinants of well-being, while social and environmental resources function as contextual supports that facilitate the development of these strengths (Amartyavanda et al., 2024; Mustabeen & Arshad, 2025; Saoji et al., 2024).

5. Conclusion

Overall, the present findings underscore the importance of resilience, self-compassion, emotional intelligence, and social support in promoting women's psychological flourishing. By applying advanced machine-learning techniques, this study provides a more nuanced understanding of the relative importance of these predictors and offers valuable insights into the psychological mechanisms that contribute to optimal functioning and well-being.

6. Limitations and Suggestions

Several limitations should be acknowledged when interpreting the findings. First, the cross-sectional design prevents conclusions regarding causal relationships among the study variables. Second, all measures relied on self-report instruments, which may be influenced by social desirability bias, response tendencies, and subjective perceptions. Third, although the sample was geographically diverse within Canada, the findings may not generalize to women from different cultural contexts or socioeconomic backgrounds. Fourth, other potentially important predictors of flourishing, such as personality traits, physical health, spirituality, life events, and socioeconomic status, were not included in the predictive model. Finally, despite the strong predictive performance of the XGBoost model, machine-learning approaches identify patterns and associations rather than definitive causal mechanisms.

Future studies should employ longitudinal designs to examine causal pathways linking resilience, self-compassion, emotional intelligence, social support, and flourishing over time. Researchers may also investigate additional psychological and contextual factors that could enhance predictive accuracy, including personality characteristics, mindfulness, optimism, meaning in life, and coping strategies. Comparative studies involving women from different cultural and demographic backgrounds would further clarify the universality of the identified predictors. Future research could additionally explore interactions among predictors and evaluate whether specific combinations of strengths produce synergistic effects on flourishing. Experimental and intervention-based studies may also help determine whether enhancing resilience, self-compassion, emotional intelligence, or social support directly increases flourishing.

The findings suggest that interventions designed to enhance women's flourishing should prioritize the development of resilience and self-compassion while also strengthening emotional intelligence and supportive social relationships. Mental health professionals may incorporate resilience-building exercises, compassion-focused interventions, and emotional intelligence training into counseling and prevention programs. Educational institutions and workplaces can develop wellness initiatives that foster adaptive coping, emotional awareness, and supportive interpersonal environments. Community-based programs may also provide opportunities for women to strengthen social connections while cultivating personal psychological resources. By targeting these strengths simultaneously, practitioners may be able to promote sustainable improvements in flourishing, well-being, and overall quality of life among women.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

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Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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