

Random Forest Prediction of Employee Turnover Intention Using Organizational, Psychological, and Job-Related Variables

Camila . Araya¹ , Victor. Pelletier^{2*}

¹ Department of Innovation Management, Universidad Adolfo Ibáñez, Santiago, Chile

² Department of International Business, HEC Montréal, Montreal, Canada

* Corresponding author email address: victor.pelletier@hec.ca

Article Info

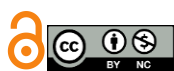
Article type:

Original Research

How to cite this article:

Araya, C., & Pelletier, V. (2026). Random Forest Prediction of Employee Turnover Intention Using Organizational, Psychological, and Job-Related Variables. *International Journal of Innovation Management and Organizational Behavior*, 6(4), 1-18.

<https://doi.org/10.61838/kman.ijimob.5674>



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ABSTRACT

Objective: This study aimed to develop and evaluate a Random Forest model for predicting employee turnover intention using organizational, psychological, and job-related variables among employees in Canada.

Methods and Materials: This quantitative, cross-sectional predictive study was conducted among 428 employees working in public and private organizations across Canada. Participants were recruited from diverse occupational sectors and completed measures of perceived organizational support, organizational commitment, organizational justice, supervisor support, career development opportunities, perceived stress, psychological well-being, work engagement, burnout, occupational self-efficacy, job satisfaction, workload, job autonomy, role clarity, job insecurity, work-life balance, compensation adequacy, and turnover intention. The dataset was stratified into training and independent test subsets using an 80:20 ratio. A Random Forest classifier was optimized through stratified five-fold cross-validation. Predictive performance was assessed using accuracy, precision, sensitivity, specificity, F1 score, and receiver operating characteristic area under the curve. Permutation importance and SHapley Additive exPlanations were used to interpret predictor contributions.

Findings: Turnover intention was significantly associated with all examined predictors. The strongest correlations were observed for job satisfaction ($r = -.62, p < .001$), organizational commitment ($r = -.58, p < .001$), burnout ($r = .55, p < .001$), perceived organizational support ($r = -.51, p < .001$), and job insecurity ($r = .49, p < .001$). In the independent test sample, the optimized Random Forest model achieved an accuracy of .86, precision of .83, sensitivity of .82, specificity of .89, F1 score of .82, and ROC-AUC of .92. Feature-importance analyses identified job satisfaction, organizational commitment, burnout, perceived organizational support, and job insecurity as the most influential predictors.

Conclusion: Employee turnover intention can be predicted with high discriminatory accuracy by integrating organizational, psychological, and job-related variables, with job satisfaction, commitment, burnout, organizational support, and job insecurity representing particularly important indicators of turnover risk.

Keywords: Employee Turnover Intention; Random Forest; Machine Learning; Job Satisfaction; Organizational Commitment; Burnout; Organizational Support; Job Insecurity

1 Introduction

Employee turnover intention has become a central concern in organizational research because it represents one of the most proximal psychological precursors of voluntary employee departure and has important implications for workforce stability, productivity, organizational knowledge retention, and human-resource planning. Although actual turnover is influenced by labor-market conditions, individual opportunities, economic constraints, and organizational policies, turnover intention captures the employee's conscious consideration of leaving the current organization and therefore provides an important early indicator of potential withdrawal behavior. Persistent turnover intention can undermine organizational continuity even before actual resignation occurs because employees who are psychologically disengaging from their organization may demonstrate lower commitment, weaker discretionary effort, reduced participation, and greater job-search behavior. Systematic reviews have consequently treated turnover intention as a multidimensional organizational problem shaped by attitudinal, interpersonal, structural, and psychological conditions rather than as an isolated decision determined by a single workplace factor (Fuji & Baki, 2025; Gupta & Bhatia, 2023).

The organizational context in which employees perform their work is particularly important for understanding why intentions to leave develop. Employees continuously interpret organizational decisions, managerial practices, interpersonal treatment, communication patterns, developmental opportunities, and the extent to which the organization appears to value their contribution. Social exchange perspectives suggest that employees who perceive favorable treatment are more likely to reciprocate through commitment, cooperation, and continued organizational membership, whereas unfavorable exchanges may weaken attachment and increase withdrawal intentions. Research addressing employee turnover from a social exchange perspective has emphasized that perceived reciprocity, supportive organizational practices, and positive employment relationships can reduce intentions to quit (Priyanka et al., 2024). Similarly, perceptions of organizational support may communicate that the employer values employee contributions and is concerned with employee well-being, thereby strengthening attachment and reducing the psychological attractiveness of leaving. Recent research on psychological empowerment has further indicated that organizational support and organizational

justice may operate as important mechanisms through which positive work experiences influence turnover intention (Zhang & Zhao, 2025).

Organizational justice is closely related to these processes because employees evaluate not only the outcomes they receive but also the fairness of procedures, managerial decisions, and interpersonal treatment. Perceived unfairness can gradually erode trust and commitment, whereas fair and transparent organizational practices can enhance employees' sense of security and organizational identification. Trust itself represents an important relational resource. Evidence indicates that psychological safety and job satisfaction are closely connected through employees' trust in their organizational environment, suggesting that trust can shape whether employees perceive the workplace as supportive and psychologically sustainable (Mitterer & Mitterer, 2023). Similarly, favorable organizational contexts have been associated with employee well-being through organizational trust, indicating that positive contextual characteristics may exert their effects partly by strengthening employees' confidence in their organization (Czerw et al., 2025). These findings suggest that turnover intention may be influenced by a broader configuration of organizational experiences rather than merely by isolated job conditions.

Leadership and supervisory relationships constitute another important component of this organizational configuration. Supervisors influence employees' access to information, resources, recognition, autonomy, feedback, and psychological support. Leadership research has consistently demonstrated that leadership quality is associated with employee attitudes and workplace outcomes across service-intensive settings (Guchait et al., 2023). Perceived leader concern can also promote authentic self-expression and enhance the fit between employees' self-concepts and their jobs, thereby strengthening the quality of the employee–organization relationship (Radigan et al., 2025). Conversely, abusive, destructive, or toxic leadership may increase psychological strain, undermine job satisfaction, and intensify withdrawal tendencies. Research on destructive leadership among technology professionals has shown that burnout can mediate the relationship between destructive leadership and turnover intention, emphasizing the psychological pathway through which harmful managerial behavior may translate into intentions to leave (Y. C. Chen et al., 2025). Multilevel research in nursing teams has likewise demonstrated that abusive supervision, leader–member exchange, and job satisfaction are

meaningfully associated with turnover-related outcomes (Caputo et al., 2025).

More severe forms of negative workplace behavior may further intensify employees' withdrawal cognitions. Workplace bullying has been linked to adverse consequences at both employee and organizational levels, reflecting the substantial psychological and behavioral costs of repeated interpersonal mistreatment (Chen et al., 2026). Workplace incivility among frontline employees has similarly been associated with emotional depletion and unfavorable work outcomes, demonstrating that even less overt forms of disrespect can contribute to deteriorating employee experiences (Choi & Choi, 2025). Recent evidence concerning workplace gaslighting has further shown that manipulative interpersonal environments may impair employees' mental health and broader quality of work life (Moisoglou et al., 2025). Social undermining can operate through comparable processes by weakening employees' interpersonal resources and increasing psychological strain, and recent research among healthcare workers has identified social undermining and coping mechanisms as relevant predictors of turnover intention (Boateng et al., 2026). Organizational silence may represent another dysfunctional contextual process because employees who believe that speaking up is ineffective or risky may become increasingly alienated from their work. Recent findings indicate that work alienation can mediate the effect of organizational silence on turnover intention, illustrating how negative organizational climates may progressively distance employees from their workplace (Katıtaş, 2026).

Psychological experiences are therefore inseparable from organizational determinants of turnover intention. One of the most frequently implicated psychological mechanisms is burnout, particularly emotional exhaustion. Burnout reflects prolonged depletion of emotional and cognitive resources in response to chronic job demands and can substantially weaken employees' capacity to remain engaged with their work. Evidence from nursing settings indicates that toxic leadership may contribute to turnover-related outcomes through emotional exhaustion and job insecurity, while coworker support may buffer some of these adverse effects (Abdou & Albohnayh, 2026). Similarly, emotional experiences can spread between employees through processes of emotional contagion, influencing psychological well-being, job performance, and turnover intention (Azazz et al., 2026). These findings indicate that employee turnover risk is not simply a response to objective working conditions

but is also shaped by the psychological interpretation and emotional consequences of those conditions.

Perceived stress represents another important psychological predictor. Stress arises when employees perceive that job demands exceed available personal or organizational resources and can become especially consequential when employees have limited control, inadequate support, or weak confidence in their ability to manage occupational challenges. Research integrating psychological contract perceptions, self-efficacy, job stress, and turnover intention within the Job Demand-Control-Support framework has shown that stress and self-efficacy are meaningfully linked to employees' intentions to leave (Shao et al., 2022). The importance of demands and resources has also been demonstrated across blue- and white-collar workers, where distinct configurations of job demands and job resources influence work-related outcomes (İlhan et al., 2025). These findings reinforce the argument that turnover intention reflects the balance between workplace pressures and the psychological, interpersonal, and structural resources available to employees.

Workload is one of the most visible manifestations of job demand. Excessive workload can increase fatigue, reduce opportunities for recovery, intensify work-family conflict, and contribute to perceptions that organizational expectations are unsustainable. Meta-analytic evidence indicates that workload is associated with personality characteristics, employee perceptions of positive and negative workplace behaviors, and organizational conditions, highlighting the complexity of workload as both an objective and perceptual job characteristic (S. Chen et al., 2025). However, high demands do not inevitably result in turnover intention when employees are provided with sufficient resources. Transformational leadership, for example, may moderate the relationship between job demands and turnover intentions by increasing meaning support, motivation, and perceived coping capacity (Nielsen et al., 2023). Job characteristics may also interact with employee age and career stage, indicating that the same work demands may not produce equivalent turnover intentions across all employees (Christensen & Knardahl, 2022).

Job satisfaction remains one of the most established attitudinal correlates of turnover intention. Employees who experience their jobs as rewarding, meaningful, fair, and compatible with their needs are generally less inclined to consider leaving, whereas persistent dissatisfaction can stimulate withdrawal cognition and active job-search behavior. Research among nurses has demonstrated that job

satisfaction may be linked to turnover intention through cognitive rumination and career insecurity, suggesting that dissatisfaction can have both immediate and psychologically mediated consequences (Alharbi, 2023). Flexible work arrangements may similarly influence turnover intention partly through their effects on job satisfaction, while supervisory support may modify these relationships (Poluru, 2024). These findings are particularly relevant in contemporary workplaces, where employees increasingly evaluate not only compensation and advancement but also flexibility, autonomy, and the compatibility of work with personal life.

Job autonomy is another resource with potentially important implications for retention. Employees who have greater discretion over how they perform their work may experience stronger intrinsic motivation, competence, and ownership, whereas highly controlled work environments may increase frustration and withdrawal. Evidence from the banking sector suggests that performance-management practices can influence turnover intention through employee motivation and job autonomy, demonstrating that autonomy may operate as an important motivational mechanism linking organizational systems to employee retention (Qureshi et al., 2024). Psychological empowerment may function in a similar manner by strengthening employees' perceptions of meaning, competence, self-determination, and impact, while supportive and fair organizational conditions can reinforce these effects (Zhang & Zhao, 2025). Job crafting further illustrates the active role employees can play in modifying work demands and resources; evidence suggests that job crafting can contribute to employee well-being and innovation in sustainable organizations (Mondo et al., 2023).

Work-life balance has also become a significant determinant of employee sustainability and retention, particularly in occupations involving demanding schedules, emotional labor, or high role expectations. Systematic evidence from nursing has identified multiple antecedents of work-life balance and underscored its importance for employees' broader occupational functioning (Rani et al., 2022). Inadequate balance between work and personal life may increase exhaustion and dissatisfaction, while greater flexibility may reduce strain and strengthen retention-related attitudes. These mechanisms became especially visible during and after the COVID-19 period, when changes in working arrangements, health concerns, job instability, and intensified occupational demands reshaped employees' assessments of their employment relationships. Research in

the hotel sector during the COVID phenomenon identified multiple intangible factors contributing to turnover intention, emphasizing the combined role of psychological and organizational experiences during periods of disruption (Chaichi et al., 2024).

Job insecurity is particularly salient in this context. Perceived uncertainty about continued employment can weaken psychological safety, reduce engagement, and elevate stress even when actual job loss does not occur. Recent research has shown that job insecurity can negatively affect psychological well-being and work engagement through complex moderated and mediated pathways (Pires, 2025). Career insecurity has likewise been implicated in the relationship between job satisfaction and turnover intention (Alharbi, 2023). These findings indicate that employees' expectations regarding the stability and future viability of their employment may be as important as their current working conditions. Furthermore, job insecurity can interact with leadership, exhaustion, and social support, indicating that its effects may depend on the broader psychosocial environment (Abdou & Albohnayh, 2026).

Sector-specific research further demonstrates that the antecedents of turnover intention may vary across occupational environments. Public transport employees, for example, face distinctive demands associated with scheduling, customer interaction, safety, and limited control, and recent research has linked employee well-being to turnover intention within this sector (Carbone et al., 2026). Healthcare research has emphasized emotional exhaustion, job insecurity, social undermining, support, and leadership (Boateng et al., 2026; Ivziku et al., 2025). Hospitality research has highlighted leadership, emotional contagion, incivility, intangible work experiences, and work-life factors (Azazz et al., 2026; Chaichi et al., 2024; Choi & Choi, 2025). Technology-sector studies have emphasized destructive leadership and burnout (Y. C. Chen et al., 2025), while financial-services research has identified a broad "quit mindset" involving organizational, psychological, and employment-related antecedents (Fuzi & Baki, 2025). The diversity of these findings indicates that turnover intention is generated through multiple pathways that may interact differently depending on occupational and organizational context.

The Job Demands-Resources perspective offers a useful theoretical framework for integrating these findings. From this perspective, job demands such as workload, insecurity, interpersonal mistreatment, emotional strain, and role pressure consume employees' physical and psychological

resources, whereas job resources such as autonomy, organizational support, supervisory support, fairness, meaningful work, and opportunities for development can facilitate motivation and buffer adverse consequences. Structural modeling among nurses has shown that turnover intentions can be meaningfully explained by mechanisms derived from both the Job Demands-Resources framework and Social Exchange Theory (Ivziku et al., 2025). Similarly, studies examining compulsory citizenship behaviors have demonstrated that excessive or pressured extra-role demands are systematically related to theoretically relevant employee outcomes, reinforcing the importance of considering hidden or socially imposed demands that may contribute to withdrawal (Yildiz et al., 2023).

Despite the breadth of prior research, much of the literature has relied on conventional correlational, regression-based, mediation, or structural-equation approaches. These methods are highly valuable for theory testing and estimating average linear relationships but may be less suited to capturing nonlinearities, complex interactions, threshold effects, and higher-order combinations of predictors. Employee turnover intention is unlikely to emerge from a simple additive process. For example, high workload may be tolerable when organizational support, autonomy, job satisfaction, and supervisor support are strong, whereas moderate workload may become problematic when combined with insecurity, burnout, weak commitment, and poor work-life balance. Likewise, the influence of job satisfaction may change depending on organizational justice, psychological well-being, career opportunities, or perceived support. A predictive method capable of accommodating such complexity may therefore provide additional insight beyond traditional explanatory models.

Machine-learning approaches, particularly ensemble tree-based methods such as Random Forest, offer advantages for this purpose because they can model complex nonlinear relationships, automatically detect interactions, accommodate heterogeneous predictors, and generate individualized predicted probabilities without requiring strict assumptions regarding functional form. In turnover-intention research, such an approach allows organizational, psychological, and job-related indicators to be evaluated simultaneously while preserving the possibility that predictors differ substantially in their relative importance. It also enables the evaluation of out-of-sample predictive accuracy rather than relying exclusively on statistical significance within the observed dataset. Nevertheless,

predictive accuracy alone is insufficient for organizational decision-making because human-resource professionals also need to understand which factors drive model predictions. Feature-importance procedures and explainable machine-learning techniques can therefore complement Random Forest models by identifying the variables that contribute most strongly to turnover-risk classification.

A multidimensional predictive framework is particularly appropriate because recent evidence repeatedly demonstrates that employee withdrawal is associated with interconnected organizational and psychological processes. Supportive leadership, organizational justice, trust, psychological safety, autonomy, engagement, job satisfaction, and work-life balance can function as resources, whereas burnout, stress, insecurity, incivility, bullying, social undermining, and excessive demands can function as risk factors (Czerw et al., 2025; Mitterer & Mitterer, 2023; Moisoglou et al., 2025). At the same time, employees may actively alter aspects of their jobs through job crafting, seek resources through supportive relationships, or adapt differently according to personal and occupational characteristics (Mondo et al., 2023). Consequently, an integrated predictive model can offer a more realistic representation of turnover intention than an approach focusing exclusively on one theoretical domain.

The Canadian employment context provides an appropriate setting for such an integrated analysis because the workforce encompasses substantial diversity in occupational sector, employment arrangement, organizational structure, career stage, and work location. Contemporary Canadian employees may work in traditional on-site environments, hybrid arrangements, or fully remote settings, and the relevance of autonomy, supervisory support, engagement, workload, and work-life balance may differ across these conditions. Although international research has generated substantial knowledge concerning turnover intention, findings from specific industries or national contexts cannot automatically be generalized to a heterogeneous Canadian workforce. An empirically derived predictive model based on multiple domains can therefore help determine which factors are most informative when employees from different organizational and occupational backgrounds are evaluated together.

Accordingly, the aim of the present study was to develop and evaluate a Random Forest model for predicting employee turnover intention among Canadian employees using organizational, psychological, and job-related

variables and to determine the relative contribution of these predictors to elevated turnover risk.

2 Methods and Materials

This study employed a quantitative, cross-sectional, predictive design to develop and evaluate a machine-learning model for predicting employees' turnover intention on the basis of organizational, psychological, and job-related variables. The target population consisted of employed adults working in public and private organizations across Canada. Participants were recruited from organizations located in several Canadian provinces, including Ontario, British Columbia, Alberta, and Quebec, in order to increase occupational and organizational diversity within the sample. The final sample consisted of 428 employees. Eligibility criteria included being at least 18 years of age, currently employed on either a full-time or part-time basis, having worked for the current organization for at least six months, and being able to read and respond to the study questionnaire in English. Employees who were self-employed, temporary workers with less than six months of organizational tenure, individuals who were on extended leave during the data collection period, and questionnaires with substantial missing information were excluded from the final analysis. Participants represented a range of occupational sectors, including education, healthcare, financial and professional services, information technology, retail and customer services, public administration, manufacturing, and other service industries. Both managerial and non-managerial employees were included to provide sufficient heterogeneity in occupational responsibilities, organizational status, and employment conditions.

Participants were recruited through organizational networks, professional online platforms, workplace mailing lists, and electronic announcements distributed to eligible employees. Data were collected using an anonymous online questionnaire. Before accessing the questionnaire, participants were provided with information regarding the purpose of the study, voluntary participation, confidentiality of responses, estimated completion requirements, and their right to discontinue participation at any stage without penalty. Electronic informed consent was obtained before participants proceeded to the study measures. No personally identifying information was included in the analytical dataset. Responses were screened prior to analysis for eligibility, completion status, implausible response patterns, duplicate submissions, and excessive missingness. The

study was conducted in accordance with established ethical principles for research involving human participants, including confidentiality, voluntary participation, informed consent, and secure management of research data.

Data were collected through a structured questionnaire composed of demographic and occupational information as well as standardized measures representing organizational, psychological, job-related, and turnover-intention constructs. Demographic and occupational variables included age, gender, educational level, employment status, occupational sector, organizational tenure, total work experience, managerial responsibility, weekly working hours, and work arrangement, including on-site, hybrid, and remote employment. These variables were included because employee turnover intention may vary according to career stage, employment conditions, organizational experience, and occupational characteristics.

Organizational variables were assessed through measures of perceived organizational support, organizational commitment, perceived organizational justice, supervisor support, and opportunities for career development. Perceived organizational support reflected employees' beliefs regarding the extent to which their organization valued their contribution and cared about their occupational well-being. Organizational commitment assessed employees' psychological attachment to and willingness to remain within their organization. Organizational justice covered employees' perceptions of fairness regarding organizational decisions, procedures, interpersonal treatment, and the distribution of workplace outcomes. Supervisor support represented the extent to which immediate supervisors were perceived as available, respectful, supportive, and responsive to work-related needs. Career development opportunities assessed employees' perceptions of promotion opportunities, professional growth, skill development, and future advancement within their current organization. Higher scores on these organizational measures represented more favorable perceptions of the corresponding workplace characteristic.

Psychological variables included perceived stress, psychological well-being, work engagement, burnout, and occupational self-efficacy. Perceived stress assessed the degree to which employees experienced their recent circumstances as unpredictable, difficult to manage, or overwhelming. Psychological well-being represented positive functioning, emotional balance, and the ability to cope effectively with everyday demands. Work engagement was conceptualized through employees' vigor, dedication,

and absorption in their work activities. Burnout was assessed through experiences of emotional exhaustion, psychological distancing from work, and reduced occupational effectiveness. Occupational self-efficacy assessed employees' confidence in their capacity to successfully manage work demands, solve job-related problems, and perform occupational responsibilities. Collectively, these variables were selected to represent both psychological resources and psychological strain that could contribute to employees' decisions regarding continued organizational membership.

Job-related predictors included job satisfaction, workload, job autonomy, role clarity, job insecurity, work-life balance, and perceived compensation adequacy. Job satisfaction reflected the degree of positive evaluation employees expressed toward their work and major aspects of their job. Workload assessed perceptions concerning the amount, pace, and intensity of assigned responsibilities. Job autonomy represented employees' perceived discretion over how, when, and in what sequence work-related activities were completed. Role clarity assessed the extent to which employees understood their responsibilities, performance expectations, and organizational duties. Job insecurity referred to perceived uncertainty regarding the continuity and stability of current employment. Work-life balance assessed the perceived compatibility between occupational responsibilities and personal or family life, whereas perceived compensation adequacy reflected employees' evaluation of whether their salary and employment benefits were appropriate in relation to their responsibilities, performance, and comparable positions.

Turnover intention constituted the primary outcome variable. It was operationalized as employees' conscious and deliberate tendency to consider leaving their current organization, search for alternative employment, or expect to terminate their current organizational membership in the foreseeable future. Participants responded to multiple items addressing thoughts of quitting, intentions to seek another job, and anticipated likelihood of remaining with the organization. Responses were recorded using Likert-type scales, with higher total scores indicating stronger turnover intention. For machine-learning classification, turnover intention scores were transformed into a binary outcome representing lower versus elevated turnover intention. The classification threshold was determined using the distribution of the turnover-intention measure and its established scoring characteristics so that the predicted outcome reflected a practically interpretable level of

employee retention risk. Internal consistency of all multi-item measures was examined in the present sample before predictive modeling, and composite scores were calculated only after confirming satisfactory reliability.

Data analysis was performed using Python and its machine-learning and statistical-analysis libraries. Initial data screening included examination of missing values, response distributions, duplicate observations, impossible values, and potentially influential observations. The amount and pattern of missing data were evaluated before model construction. Cases with substantial missing information were excluded, whereas limited missing values in predictor variables were handled within the preprocessing procedure using appropriate imputation techniques based exclusively on the training data in order to prevent information leakage. Continuous variables were summarized using means, standard deviations, ranges, and distributional characteristics, while categorical variables were summarized using frequencies and percentages. Correlations among continuous predictors and preliminary associations between predictor variables and turnover intention were also examined to characterize the dataset prior to machine-learning analysis. Categorical predictors were transformed into machine-readable indicator variables where necessary. Because random forest algorithms are tree-based and are not dependent on standardized measurement scales, conventional normalization of continuous predictors was not required for the primary model.

The complete dataset of 428 employees was randomly partitioned into training and testing subsets using a stratified procedure that preserved the proportion of employees with lower and elevated turnover intention in both subsets. Eighty percent of the cases were allocated to the training dataset and 20% to the independent testing dataset. The training dataset was used for model development, hyperparameter optimization, and internal validation, whereas the testing dataset was retained exclusively for evaluation of final out-of-sample predictive performance. A Random Forest classifier was selected as the primary prediction algorithm because it can model nonlinear associations, higher-order interactions, complex decision boundaries, and heterogeneous relationships among organizational, psychological, and job-related predictors without requiring strong parametric assumptions. The model generated an ensemble of decision trees using bootstrap samples of the training observations and random subsets of candidate predictors at individual tree splits, thereby reducing the

instability and overfitting associated with individual decision trees.

Model hyperparameters were optimized within the training dataset using cross-validated hyperparameter tuning. The tuning process considered the number of trees in the forest, maximum tree depth, minimum number of observations required to split an internal node, minimum number of observations permitted in terminal nodes, and the number of predictors considered at each split. Stratified five-fold cross-validation was used during model development so that each training observation contributed to both model fitting and internal validation while maintaining the outcome-class distribution across folds. Hyperparameter combinations were selected according to cross-validated predictive performance, with particular emphasis on the area under the receiver operating characteristic curve. Where imbalance between lower and elevated turnover-intention groups was observed, class weighting was incorporated into model training so that misclassification of employees with elevated turnover intention received appropriate representation without artificially altering the independent test dataset.

The predictive performance of the optimized Random Forest model was subsequently evaluated using the held-out testing dataset. Performance was assessed through accuracy, precision, recall or sensitivity, specificity, F1 score, and the area under the receiver operating characteristic curve. The confusion matrix was examined to distinguish true-positive, true-negative, false-positive, and false-negative classifications. Particular attention was given to sensitivity because failure to identify employees with elevated turnover intention may be especially consequential for organizational retention strategies. Receiver operating characteristic analysis was used to evaluate the model's ability to discriminate between employees with relatively low and elevated turnover intention across possible classification thresholds. Model performance was interpreted on the basis of the convergence of multiple evaluation indices rather than accuracy alone.

To identify the variables contributing most strongly to prediction, feature importance was examined after estimation of the final Random Forest model. Permutation-based importance was used to determine the extent to which model performance deteriorated when the values of individual predictors were randomly permuted. In addition, SHapley Additive exPlanations were used to provide a more interpretable assessment of the contribution of each organizational, psychological, and job-related variable to

model predictions. SHAP values were examined both globally, to determine the predictors with the strongest overall influence on turnover intention, and locally, to understand how particular predictor values contributed to individual predictions. This interpretability procedure made it possible to identify not only which variables were important but also whether specific levels of factors such as organizational support, burnout, job satisfaction, job insecurity, work engagement, workload, and organizational commitment were associated with higher or lower predicted turnover risk. All preprocessing procedures, model fitting, cross-validation, hyperparameter tuning, and performance evaluation were performed using reproducible analytical procedures, and the independent testing dataset was not used during model selection or optimization.

3 Findings and Results

A total of 428 employees were included in the final analysis. Participants ranged in age from 21 to 64 years, with a mean age of 38.47 years ($SD = 9.62$). Of the total sample, 229 participants (53.50%) were women, 191 (44.63%) were men, and 8 (1.87%) identified as another gender or preferred not to disclose their gender. Regarding educational attainment, 61 employees (14.25%) had completed high school or an equivalent qualification, 103 (24.07%) held a college diploma or associate-level qualification, 173 (40.42%) held a bachelor's degree, and 91 (21.26%) held a graduate degree. A total of 341 participants (79.67%) were employed full-time and 87 (20.33%) were employed part-time. Organizational tenure ranged from 6 months to 29 years, with a mean of 6.84 years ($SD = 5.73$), while total occupational experience averaged 11.92 years ($SD = 8.04$). Fifty-eight participants (13.55%) held managerial or supervisory positions, whereas 370 (86.45%) occupied non-managerial positions. In terms of work arrangement, 183 employees (42.76%) worked primarily on-site, 171 (39.95%) followed a hybrid arrangement, and 74 (17.29%) worked primarily remotely. The participants represented a broad range of occupational sectors, including healthcare, education, financial and professional services, information technology, public administration, retail and customer services, manufacturing, and other service-related industries. Based on the predefined classification criterion for turnover intention, 169 employees (39.49%) were categorized as having elevated turnover intention, whereas 259 employees (60.51%) were categorized as having lower turnover intention. The distribution of the outcome variable

therefore indicated moderate class imbalance but was sufficiently balanced to support stratified machine-learning analysis.

Table 1

Descriptive Statistics and Bivariate Associations of the Main Study Variables with Turnover Intention

Variable	M	SD	Minimum	Maximum	Correlation with Turnover Intention (r)	p
Perceived organizational support	3.42	0.78	1.21	5.00	-.51	< .001
Organizational commitment	3.57	0.74	1.18	5.00	-.58	< .001
Organizational justice	3.39	0.71	1.35	4.96	-.43	< .001
Supervisor support	3.61	0.83	1.00	5.00	-.36	< .001
Career development opportunities	3.18	0.81	1.00	5.00	-.41	< .001
Perceived stress	2.91	0.69	1.08	4.83	.47	< .001
Psychological well-being	3.54	0.64	1.46	4.91	-.39	< .001
Work engagement	3.66	0.72	1.22	5.00	-.46	< .001
Burnout	2.87	0.76	1.00	4.92	.55	< .001
Occupational self-efficacy	3.83	0.61	1.73	5.00	-.28	< .001
Job satisfaction	3.49	0.73	1.17	5.00	-.62	< .001
Workload	3.31	0.67	1.25	4.88	.31	< .001
Job autonomy	3.58	0.69	1.38	5.00	-.34	< .001
Role clarity	3.72	0.66	1.42	5.00	-.29	< .001
Job insecurity	2.74	0.82	1.00	5.00	.49	< .001
Work–life balance	3.37	0.75	1.08	5.00	-.45	< .001
Perceived compensation adequacy	3.16	0.79	1.00	5.00	-.37	< .001
Turnover intention	2.96	0.91	1.00	5.00	—	—

As shown in Table 1, turnover intention demonstrated statistically significant relationships with all organizational, psychological, and job-related variables included in the analysis. The strongest negative bivariate association was observed between job satisfaction and turnover intention ($r = -.62$, $p < .001$), indicating that employees who reported greater satisfaction with their jobs were substantially less likely to report an intention to leave their organization. Organizational commitment also demonstrated a strong inverse association with turnover intention ($r = -.58$, $p < .001$), followed by perceived organizational support ($r = -.51$, $p < .001$), work engagement ($r = -.46$, $p < .001$), work–life balance ($r = -.45$, $p < .001$), organizational justice ($r = -.43$, $p < .001$), and career development opportunities ($r = -.41$, $p < .001$). Among the positively related predictors, burnout showed the strongest association with turnover intention ($r = .55$, $p < .001$), suggesting that employees experiencing greater occupational exhaustion and

psychological disengagement were substantially more likely to consider leaving their organization. Job insecurity was also moderately and positively associated with turnover intention ($r = .49$, $p < .001$), as was perceived stress ($r = .47$, $p < .001$). Workload showed a smaller but still statistically significant positive relationship with turnover intention ($r = .31$, $p < .001$). Occupational self-efficacy, role clarity, job autonomy, supervisor support, and compensation adequacy were all significantly and inversely related to turnover intention. Taken together, the descriptive and correlational findings indicated that turnover intention was not attributable to a single workplace dimension but rather reflected the joint contribution of organizational attachment, psychological strain, perceived employment security, work conditions, and attitudes toward the job. These patterns further supported the use of a multivariable machine-learning model capable of capturing nonlinear relationships and interactions among the predictors.

Table 2

Performance of the Optimized Random Forest Model in the Training, Cross-Validation, and Independent Test Samples

Performance Index	Training Sample	Five-Fold Cross-Validation	Test Sample
Accuracy	.93	.84	.86
Precision	.91	.81	.83

Recall/Sensitivity	.90	.79	.82
Specificity	.95	.88	.89
F1 score	.91	.80	.82
ROC-AUC	.97	.90	.92

Table 2 presents the overall predictive performance of the optimized Random Forest classifier. The model demonstrated strong discrimination between employees with lower and elevated turnover intention. In the training sample, the classifier achieved an accuracy of .93 and an ROC-AUC of .97, indicating very strong apparent predictive performance. More importantly, the five-fold cross-validation results remained comparatively high, with an average accuracy of .84 and a mean ROC-AUC of .90, suggesting that the model retained substantial predictive ability when evaluated on observations not used in fitting each cross-validation fold. On the independent test dataset, which was completely withheld from model development and hyperparameter optimization, the Random Forest achieved an accuracy of .86, precision of .83, sensitivity of .82, specificity of .89, F1 score of .82, and ROC-AUC of .92. The relatively small difference between the cross-validation

and test-sample results suggested that the model generalized adequately and that severe overfitting was not evident. The sensitivity of .82 indicated that approximately 82% of employees with elevated turnover intention were correctly identified by the model, whereas the specificity of .89 indicated that approximately 89% of employees with lower turnover intention were correctly classified. The balanced performance across precision, recall, specificity, and F1 score also demonstrated that the high overall accuracy was not merely the consequence of the moderately larger low-turnover-intention class. Furthermore, the test-sample ROC-AUC of .92 indicated excellent discrimination across alternative classification thresholds and provided evidence that the ensemble model was capable of differentiating employees at relatively high and low turnover risk with substantial accuracy.

Table 3

Confusion Matrix and Classification Results of the Random Forest Model in the Independent Test Sample

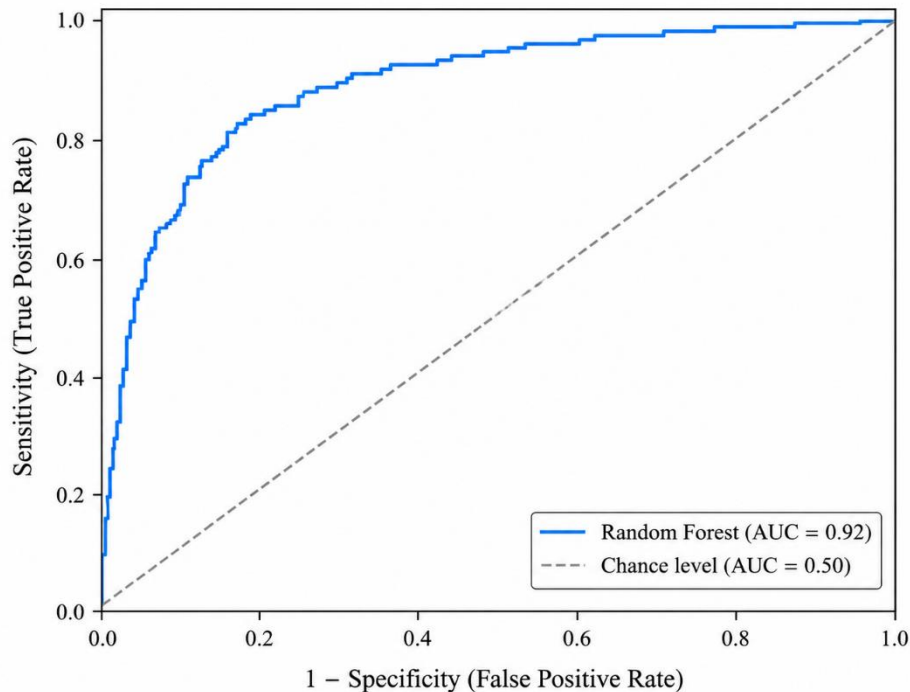
Actual Turnover Intention	Predicted Lower Turnover Intention	Predicted Elevated Turnover Intention	Total
Lower turnover intention	46	6	52
Elevated turnover intention	6	27	33
Total	52	33	85

As presented in Table 3, the final test sample consisted of 85 employees, of whom 52 were categorized as having lower turnover intention and 33 as having elevated turnover intention. The Random Forest model correctly classified 46 of the 52 employees with lower turnover intention and correctly identified 27 of the 33 employees with elevated turnover intention. Consequently, only six lower-risk employees were incorrectly classified as elevated risk, while six employees with elevated turnover intention were incorrectly classified as lower risk. The resulting distribution of true-positive, true-negative, false-positive, and false-negative classifications demonstrated that prediction errors were relatively limited and approximately balanced across the two outcome categories. From a practical human-resource perspective, the model's ability to correctly identify

27 of 33 higher-risk employees is particularly important because false-negative classifications represent individuals whose intention to leave could remain undetected if organizational retention interventions were guided by the predictive system. At the same time, the relatively low number of false-positive predictions suggested that the model did not excessively label employees as being at risk of turnover when their observed turnover intention was comparatively low. Thus, the confusion matrix supported the performance statistics reported previously and demonstrated that the model achieved both acceptable sensitivity to elevated turnover intention and a comparatively high capacity to recognize employees who were less likely to leave.

Figure 1

Receiver Operating Characteristic Curve of the Random Forest Model for Predicting Elevated Employee Turnover Intention in the Independent Test Sample



The receiver operating characteristic curve summarized the discrimination performance of the final Random Forest model across the complete range of possible probability thresholds. The curve remained substantially above the diagonal reference line representing chance-level classification, and the area under the curve was .92. This result indicated that the model had a 92% probability of assigning a higher predicted turnover-risk score to a randomly selected employee with elevated turnover intention than to a randomly selected employee with lower turnover intention. The strong area under the curve also demonstrated that the predictive performance of the classifier was not dependent on a single arbitrarily selected

classification threshold. Rather, the model preserved a favorable balance between true-positive and false-positive rates over a wide range of decision thresholds. This finding is especially relevant for organizational applications because the threshold for intervention can be adjusted according to organizational objectives. For example, organizations seeking to minimize missed high-risk employees could adopt a lower classification threshold to increase sensitivity, whereas organizations with limited retention resources could use a more conservative threshold to increase precision. The ROC findings therefore supported the robustness of the Random Forest model as a tool for estimating employee turnover risk.

Table 4

Permutation Feature Importance and Mean Absolute SHAP Values for Predicting Employee Turnover Intention

Rank	Predictor	Permutation Importance	Mean Absolute SHAP Value
1	Job satisfaction	.142	.184
2	Organizational commitment	.126	.163
3	Burnout	.114	.151
4	Perceived organizational support	.096	.132
5	Job insecurity	.083	.118
6	Work engagement	.071	.102
7	Work-life balance	.064	.094

8	Perceived stress	.058	.087
9	Organizational justice	.046	.073
10	Career development opportunities	.041	.067
11	Perceived compensation adequacy	.034	.056
12	Supervisor support	.029	.049
13	Job autonomy	.025	.043
14	Workload	.021	.039
15	Role clarity	.017	.033
16	Occupational self-efficacy	.014	.028

The feature-importance results presented in Table 4 showed that turnover intention was primarily predicted by a combination of attitudinal, organizational, psychological, and employment-security factors rather than by any single domain. Job satisfaction emerged as the most influential predictor, with the highest permutation importance (.142) and mean absolute SHAP value (.184). Organizational commitment ranked second, followed by burnout, perceived organizational support, and job insecurity. These variables collectively represented the strongest contributors to individual turnover-risk predictions. Inspection of the SHAP-value direction indicated that lower job satisfaction, weaker organizational commitment, higher burnout, lower perceived organizational support, and greater job insecurity consistently shifted predictions toward the elevated-turnover-intention category. Work engagement and work-life balance were the sixth and seventh most influential variables, respectively, with lower levels of both factors associated with greater predicted turnover risk. Perceived stress also made a meaningful contribution, with higher stress values increasing the probability of elevated turnover intention. Organizational justice and career development opportunities occupied intermediate positions in the importance hierarchy, demonstrating that employees' perceptions of fairness and future advancement remained relevant even after stronger predictors such as job satisfaction and burnout had been considered. Compensation adequacy, supervisor support, autonomy, workload, role clarity, and occupational self-efficacy produced smaller independent contributions, although none was entirely irrelevant to the predictive model. The convergence between permutation importance and SHAP-based rankings increased confidence in the interpretability of the findings because both approaches independently identified job satisfaction, organizational commitment, burnout, organizational support, and job insecurity as the dominant predictive features.

The SHAP analysis further revealed nonlinear patterns in the relationship between several key predictors and model-

generated turnover risk. The probability of elevated turnover intention increased markedly when job satisfaction fell below approximately the midpoint of its scale, while the protective effect of higher job satisfaction became progressively stronger at the upper end of the distribution. A similar pattern was observed for organizational commitment, in which low and moderately low scores exerted a pronounced positive contribution to predicted turnover risk, whereas high commitment substantially reduced the predicted probability of elevated turnover intention. Burnout exhibited an inverse pattern: relatively low burnout contributed little to turnover risk, but the predicted probability increased sharply once burnout reached moderate-to-high levels. Job insecurity also demonstrated a threshold-like relationship, with employees reporting relatively high insecurity showing substantially greater predicted turnover intention than those reporting low or moderate insecurity. Perceived organizational support reduced predicted turnover risk most strongly among employees reporting consistently favorable organizational treatment, recognition, and concern for their well-being. These nonlinear patterns demonstrate an important advantage of the Random Forest approach over conventional linear prediction techniques because the contribution of several predictors was not constant across their full measurement range.

Overall, the findings demonstrated that the Random Forest model provided strong and generalizable prediction of employee turnover intention in the Canadian sample. The model achieved an ROC-AUC of .92 and an overall test accuracy of .86, while maintaining satisfactory sensitivity and specificity. The results also showed that the most influential predictors were distributed across multiple conceptual domains. Job satisfaction and organizational commitment reflected employees' attitudinal connection to their work and organization, burnout and perceived stress represented psychological strain, perceived organizational support and organizational justice reflected employees' evaluations of the organizational environment, and job

insecurity captured perceived instability in the employment relationship. The simultaneous contribution of these factors indicates that employee turnover intention is best understood as a multidimensional phenomenon arising from the interaction of job attitudes, psychological experiences, organizational conditions, and perceived future employment prospects. The machine-learning findings therefore extended beyond simple bivariate associations by identifying the relative predictive contribution of each factor within a multivariable and potentially nonlinear predictive framework.

4 Discussion

The present study developed and evaluated a Random Forest model for predicting employee turnover intention among 428 employees in Canada using organizational, psychological, and job-related variables. The findings demonstrated that turnover intention was associated with a broad constellation of workplace and psychological factors and that these variables could be combined within a machine-learning framework to produce strong predictive performance. The final model achieved an accuracy of .86, sensitivity of .82, specificity of .89, an F1 score of .82, and an ROC-AUC of .92 in the independent test sample. These results indicate that the Random Forest model was able to discriminate effectively between employees with lower and elevated turnover intention while maintaining a relatively balanced classification performance across the two groups. Feature-importance analyses further showed that job satisfaction, organizational commitment, burnout, perceived organizational support, and job insecurity were the most influential predictors, followed by work engagement, work-life balance, perceived stress, organizational justice, and career development opportunities. The overall pattern suggests that turnover intention is best understood as the product of interdependent organizational, psychological, and job-related conditions rather than as the consequence of a single isolated workplace characteristic.

Job satisfaction emerged as the strongest predictor of turnover intention in both the bivariate analysis and the machine-learning model. It demonstrated the largest negative correlation with turnover intention and the highest permutation importance and mean absolute SHAP value. This result indicates that employees who evaluate their jobs positively are substantially less likely to contemplate leaving their organizations, whereas dissatisfaction represents a major signal of withdrawal risk. This finding is consistent

with previous research identifying job satisfaction as a central element in turnover processes. Research among nurses has shown that lower job satisfaction is associated with greater turnover intention, with cognitive rumination and career insecurity providing additional mechanisms through which dissatisfaction may translate into intentions to leave (Alharbi, 2023). Similarly, evidence concerning flexible work arrangements suggests that favorable working conditions can influence turnover intention through their effect on job satisfaction, while perceived supervisory support can modify the strength of these relationships (Poluru, 2024). Systematic evidence from the financial-services sector has also emphasized job satisfaction as one of the recurring elements in the development of a “quit mindset” (Fuzy & Baki, 2025). The present findings extend these studies by showing that job satisfaction remains the most influential predictor even when multiple organizational and psychological variables are considered simultaneously within a nonlinear predictive model.

Organizational commitment was the second most influential predictor and also exhibited a strong inverse association with turnover intention. Employees with stronger psychological attachment to their organizations were less likely to be classified as having elevated turnover risk. This result is theoretically consistent with Social Exchange Theory, according to which employees develop stronger attachment when they perceive organizational relationships as reciprocal, fair, and supportive. Prior research has emphasized that favorable employment exchanges can promote retention by strengthening employees’ motivation to reciprocate organizational support through continued membership and constructive behavior (Priyanka et al., 2024). The present results suggest that organizational commitment may operate as a relatively proximal attitudinal expression of employees’ overall evaluation of their relationship with the organization. When employees believe that remaining in the organization is meaningful, worthwhile, and consistent with their professional identity, turnover intention is less likely to develop. Conversely, low commitment may indicate that the psychological bond between employee and organization has weakened sufficiently for departure to become a realistic option.

Burnout was the third most important predictor and the strongest positive psychological correlate of turnover intention. Employees reporting greater burnout were considerably more likely to demonstrate elevated turnover intention, and the SHAP analysis suggested that turnover

risk increased sharply at moderate-to-high levels of burnout. This finding is consistent with research showing that chronic psychological depletion is one of the key mechanisms linking adverse working conditions to withdrawal. Among technology professionals, destructive leadership has been associated with turnover intention through job burnout, supporting the proposition that harmful organizational experiences may produce turnover cognitions by exhausting employees' psychological resources (Y. C. Chen et al., 2025). Likewise, research on toxic nursing leadership has identified emotional exhaustion as a central mechanism connecting adverse leadership with unfavorable employee outcomes, with job insecurity intensifying and coworker support buffering these effects (Abdou & Albohnayh, 2026). Workplace incivility has also been shown to contribute to emotional depletion among frontline employees (Choi & Choi, 2025). Collectively, these findings support the present result that burnout is not merely a correlate of dissatisfaction but a central predictor of turnover risk. When employees experience sustained exhaustion, disengagement, and diminished occupational efficacy, leaving the organization may increasingly be perceived as a means of restoring psychological resources.

Perceived organizational support was the fourth strongest predictor and showed a substantial negative relationship with turnover intention. Employees who believed that their organization valued their contribution and cared about their well-being were less likely to consider leaving. This result is consistent with research indicating that organizational support can mediate or modify the relationship between positive work experiences and turnover-related outcomes (Zhang & Zhao, 2025). It also aligns with broader evidence emphasizing organizational trust as an important pathway through which a favorable organizational context contributes to employee well-being (Czerw et al., 2025). From a social exchange perspective, perceived support can strengthen employee attachment by signaling that the employment relationship is reciprocal rather than purely transactional. Employees who perceive that their organization is willing to provide resources, recognition, and concern may therefore develop stronger obligations to remain and contribute. In contrast, low organizational support can communicate replaceability, lack of concern, or limited investment in employee welfare, thereby weakening retention.

Job insecurity ranked fifth in predictive importance and showed a relatively strong positive association with turnover intention. This finding indicates that uncertainty regarding

continued employment may itself stimulate intentions to leave, even in the absence of actual job loss. Previous research has shown that job insecurity can undermine psychological well-being and work engagement through complex mediated and moderated mechanisms (Pires, 2025). Career insecurity has similarly been identified as an important factor connecting job satisfaction with turnover intention (Alharbi, 2023). Moreover, job insecurity has been implicated in models examining toxic leadership, emotional exhaustion, and turnover-related processes (Abdou & Albohnayh, 2026). The present findings reinforce the interpretation that employees do not simply remain passive when they perceive uncertainty in their employment relationship. Instead, insecurity may motivate them to psychologically distance themselves from the organization, search for alternatives, or plan a voluntary exit before an involuntary employment disruption occurs.

Work engagement also emerged as an important protective predictor. Employees with higher levels of vigor, dedication, and absorption in their work were less likely to demonstrate elevated turnover intention. This result is consistent with the Job Demands-Resources perspective, which proposes that job resources foster motivation and engagement and thereby reduce withdrawal. Research based on the Job Demands-Resources and Social Exchange frameworks has demonstrated that turnover intention can be explained through the interplay of job demands, resources, and employee psychological responses (Ivziku et al., 2025). Similarly, research across blue- and white-collar workers has shown that job demands and resources are meaningfully associated with work-related outcomes (İlhan et al., 2025). The current findings suggest that work engagement may function as an indicator of the extent to which employees remain psychologically invested in their work. Once vigor and dedication decline, turnover intention may become more likely, particularly when disengagement occurs simultaneously with low satisfaction, burnout, or insecurity.

Work-life balance also contributed meaningfully to prediction, with poorer balance associated with higher turnover intention. This finding is consistent with systematic evidence demonstrating the importance of work-life balance for occupational well-being, particularly in demanding professions (Rani et al., 2022). Flexible working conditions may also influence turnover intention through their effects on job satisfaction and perceived support (Poluru, 2024). The present finding is especially relevant to contemporary employment contexts in which employees increasingly evaluate jobs in terms of compatibility with family

responsibilities, recovery time, personal goals, and flexibility. Persistent conflict between work and non-work roles can deplete psychological resources and reduce the perceived sustainability of employment, thereby increasing the attractiveness of alternative positions.

Perceived stress was another meaningful predictor of elevated turnover intention. Higher stress was positively associated with withdrawal intentions, although its contribution to the Random Forest model was smaller than that of burnout. This distinction is informative because stress may represent an earlier or more general reaction to excessive demands, whereas burnout reflects a more chronic and accumulated form of psychological depletion. Prior research integrating psychological contract, self-efficacy, job stress, and turnover intention has shown that stress can play a meaningful role in employees' decisions to remain or leave (Shao et al., 2022). The Job Demand-Control-Support perspective further suggests that the consequences of stress depend on employees' access to autonomy and supportive resources. Therefore, high stress may not necessarily lead to turnover intention when organizational support, autonomy, engagement, and coping resources remain strong, whereas the combination of high stress and limited resources may substantially elevate turnover risk.

Organizational justice and career development opportunities occupied intermediate positions in the feature-importance hierarchy but remained relevant to turnover prediction. Employees who perceive organizational procedures and outcomes as unfair may experience reduced trust and a weaker sense of reciprocity, thereby increasing withdrawal cognitions. The moderating role of organizational justice has been highlighted in research examining psychological empowerment, organizational support, and turnover intention (Zhang & Zhao, 2025). Trust may be particularly important in this process, as evidence shows that it mediates associations between psychological safety and job satisfaction (Mitterer & Mitterer, 2023). Career development opportunities may similarly shape whether employees perceive a viable future within their current organization. When advancement, learning, and professional development are limited, employees may seek opportunities elsewhere even when other work conditions are acceptable. These findings are compatible with systematic research suggesting that employee turnover develops through multiple interacting organizational experiences rather than one dominant determinant (Gupta & Bhatia, 2023).

The lower-ranked variables—including perceived compensation adequacy, supervisor support, job autonomy, workload, role clarity, and occupational self-efficacy—still contributed to prediction, although their independent importance was comparatively smaller after stronger predictors were considered. These findings should not be interpreted as indicating that such factors are unimportant. Rather, Random Forest importance reflects the additional predictive information provided by each variable in the presence of correlated predictors. For example, supervisor support may overlap with perceived organizational support, organizational justice, and job satisfaction, while workload may influence turnover indirectly through stress and burnout. Research has shown that leader concern can strengthen self-expression and self-concept–job fit (Radigan et al., 2025), while leadership may moderate the association between job demands and turnover intention (Nielsen et al., 2023). Similarly, job autonomy has been identified as a mechanism linking organizational management practices to turnover intention (Qureshi et al., 2024). Meta-analytic evidence also demonstrates that workload is connected with multiple personal, behavioral, and organizational factors (S. Chen et al., 2025). Accordingly, the modest feature importance of these variables may reflect indirect, shared, or conditional effects rather than an absence of relevance.

The observed nonlinear patterns provide further support for using a machine-learning approach. SHAP analyses suggested that turnover risk increased particularly sharply when job satisfaction and organizational commitment fell below moderate levels, when burnout reached moderate-to-high levels, and when job insecurity became pronounced. These threshold-like patterns suggest that employee withdrawal may not develop in a strictly linear manner. Employees may tolerate modest dissatisfaction, stress, or insecurity without seriously considering departure, but once a critical combination of negative conditions accumulates, turnover intention may increase rapidly. This interpretation is consistent with evidence that harmful workplace experiences such as bullying, gaslighting, incivility, social undermining, and organizational silence can produce cascading psychological consequences rather than isolated effects (Boateng et al., 2026; Chen et al., 2026; Katitaş, 2026; Moisoglou et al., 2025). Similarly, intangible organizational factors may exert substantial influence on turnover during periods of disruption (Chaichi et al., 2024). The Random Forest framework is advantageous in such settings because it can accommodate interactions and

nonlinearities that may not be adequately represented by conventional linear regression models.

The strong predictive performance of the model also supports the practical value of integrating multiple domains. An ROC-AUC of .92 indicates excellent discrimination, while sensitivity of .82 and specificity of .89 demonstrate that the model was capable of identifying a substantial proportion of high-risk employees without producing excessive false-positive classifications. This balanced performance is important because turnover prediction systems that maximize overall accuracy while failing to detect employees with elevated turnover intention would have limited practical value. The present model instead achieved relatively strong performance across accuracy, precision, recall, specificity, and F1 score. The convergence of predictive performance and interpretable feature-importance results suggests that machine learning can complement established organizational theories by identifying not only whether workplace variables are statistically associated with turnover intention, but also how well they jointly distinguish employees at higher and lower risk.

5 Conclusion

The findings also reinforce the multidimensional nature of turnover intention across occupational settings. Prior studies have identified sector-specific risks in nursing, hospitality, technology, banking, transportation, and other occupational groups. For instance, quit intentions among nurses have been modeled through job demands, resources, and social exchange processes (Ivziku et al., 2025); public transport research has highlighted well-being as an important determinant of turnover intention (Carbone et al., 2026); and hospitality research has emphasized emotional contagion, leadership, incivility, and broader psychosocial experiences (Azazz et al., 2026; Guchait et al., 2023). These diverse findings are consistent with the present cross-sector Canadian results, which suggest that despite occupational differences, a common set of underlying processes—including satisfaction, attachment, exhaustion, support, insecurity, and engagement—may form a general predictive structure of turnover intention.

Several limitations should be considered when interpreting the findings. First, the cross-sectional design limits causal inference, and the observed associations cannot establish whether organizational and psychological conditions caused turnover intention or whether employees

already considering departure evaluated their work environments more negatively. Second, all predictors and the outcome were based primarily on employee self-report, which may introduce common-method variance, response tendencies, and perceptual bias. Third, turnover intention was examined rather than objectively observed voluntary turnover; although turnover intention is an important precursor of departure, not all employees who intend to leave will ultimately resign. Fourth, the sample included employees from multiple Canadian sectors and provinces, which increased heterogeneity but did not constitute a probability sample of the entire Canadian workforce. Consequently, generalization to all Canadian employees should be made cautiously. Fifth, the independent test sample was relatively modest in size, and although predictive performance was strong, external validation in an entirely separate organizational sample would provide stronger evidence of model transportability. Finally, the Random Forest model identified predictive importance rather than causal priority, and variables receiving lower importance scores may still exert meaningful indirect, interactive, or context-dependent effects on turnover intention.

Future studies should employ longitudinal designs that follow employees over time and link turnover-intention predictions to actual voluntary turnover. Such designs would clarify temporal relationships among job demands, resources, psychological strain, and withdrawal behavior and would permit evaluation of how prediction accuracy changes as employees approach resignation. Future research should also validate the model using larger independent samples from different Canadian provinces, occupational sectors, organizational sizes, and employment arrangements. Comparative studies could examine whether predictor importance differs between remote, hybrid, and on-site employees or between public- and private-sector organizations. Additional machine-learning algorithms, including gradient boosting, support vector machines, regularized logistic regression, and neural-network approaches, could be compared with Random Forest to determine whether predictive performance can be improved without sacrificing interpretability. Researchers should also incorporate organizational-level variables, objective workload indicators, compensation data, absenteeism, performance records, promotion history, and longitudinal human-resource information where ethically and legally appropriate. Finally, future studies should examine interactions among high-ranking predictors and investigate

whether distinct turnover-risk profiles exist, such as employees characterized primarily by burnout, insecurity, low commitment, or poor work–life balance.

Organizations can use the present findings to develop more targeted and preventive employee-retention strategies. Rather than relying on isolated indicators such as salary dissatisfaction or workload, human-resource systems should monitor combinations of job satisfaction, organizational commitment, burnout, perceived organizational support, job insecurity, engagement, and work–life balance. Periodic anonymous employee surveys can be used to identify emerging risk patterns before turnover intention becomes entrenched. Managers should prioritize interventions aimed at improving job quality, strengthening meaningful recognition, increasing transparency about organizational decisions and employment stability, supporting reasonable workloads, and improving access to development opportunities. Burnout prevention should be treated as a retention priority through workload review, recovery opportunities, staffing adequacy, flexible scheduling, and psychologically supportive supervision. Organizations should also ensure that predictive tools are used ethically and transparently; turnover-risk estimates should support employee well-being and organizational improvement rather than punitive monitoring or adverse employment decisions. Machine-learning outputs are most useful when treated as decision-support information that identifies areas requiring organizational attention and enables earlier, more individualized retention interventions.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

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

Transparency Statement

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

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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