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Modeling Health Trajectories Across the Life Course: A Multistate Analytical Framework

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ABSTRACT

Life-course health is shaped by a complex interaction of biological, behavioral, environmental, and socioeconomic factors that influence transitions between different health states over time. This study presents a multistate analytical framework to model health trajectories across the life course by capturing dynamic transitions among healthy, diseased, disabled, and deceased states. The proposed framework integrates longitudinal data with transition probability estimation to examine the timing, duration, and determinants of health changes from childhood to old age. By accounting for competing risks and individual heterogeneity, the model provides more accurate estimates of disease progression and recovery patterns than conventional survival analyses. The findings demonstrate the usefulness of multistate modeling in identifying critical intervention periods and evaluating the long-term effects of health policies. This approach offers valuable insights for researchers, healthcare providers, and policymakers seeking to improve population health through evidence-based planning and preventive strategies.

Keywords: Life Course, Health Trajectories, Multistate Model, Longitudinal Analysis, Disease Progression, Population Health, Health Policy----------

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I. INTRODUCTION

The effectiveness of teachers is viewed as a major influence on the quality of education, student learning outcomes, and the performance of an educational institution. In researching teacher effectiveness, there has been increasing emphasis—not only on the teachers' technical competencies but also on the psychosocial characteristics of teachers that contribute to their effectiveness as well as the satisfaction they receive from the profession and their retention in teaching—on understanding the relationship between students' learning and teacher self-efficacy, which is the belief by teachers that they can successfully organize and carry out their instructional responsibilities. Self-efficacy significantly contributes to the quality of instruction and the commitment of teachers to the profession. Self-efficacy leads to increased motivation, innovativeness in teaching, and greater resilience to the stressors faced by teachers in their profession.

The institution's climate (shared perceptions of workplace policies, practices, and norms) greatly influences teacher attitudes and actions. Supportive climate schools provide teachers with autonomy, opportunities for collegial collaboration, and recognition of their contributions, thus resulting in their greater levels of professional commitment to the school. Leadership support (administrative guidance, mentorship, and recognition) significantly influences the motivation and confidence of teachers. Transformational and supportive leadership styles have been found to be positively correlated with the self-efficacy and commitment of teachers. Therefore, teacher effectiveness can therefore be viewed as one of the most critical factors associated with the quality of education, student learning outcomes, and overall performance of educational institutions.

The characteristics of an effective teacher are not restricted to just either; their teaching skill or their content knowledge but also their ability to engage, motivate and create sustainable conditions for the learning of students is profoundly influenced by the interactions of a number of factors with psychological, social and organisational dimensions. Recently, increased inquiry into teaching has focused more closely upon the psychosocial aspects of teaching, particularly on factors such as self-efficacy, motivation, job satisfaction, and professional commitment;Teacher self-efficacy is the teacher's judgment of their ability to produce specific achievements. Self-efficacious teachers are likely to use innovative strategies as well as show adaptive responses to challenges in the classroom, and persist when faced with problems. Moreover self-efficacy affects

teachers' occupational perceptions, which subsequently influence their confidence-levels and commitment to the school they are working for, ultimately influencing the retention of teachers and stabilising their respective schools over a long period of time.

Additionally, a significant contributor of teacher self-efficacy is the surrounding organisational environment that they are a part of (also referred to as institutional climate). Institutional climate is the collective view of teachers and staff toward types of policies, practices, procedures and norms within the school. An institution with a strong institutional climate, has collegiality and collaboration among all members, clear expectations for all members, encouragement and support from one another, and all teachers are recognised for the contributions that they have made.

Teachers who receive support through teacher support networks will tend to be more engaged and committed to developing their careers compared to those who don't receive that support. In a negative or unsupported climate, where policies are perceived as inflexible or unpredictable, communication is substandard, and contributions by teachers are not properly recognized, teachers may lose confidence in themselves, thereby decreasing their self-efficacy, and may leave the profession (attrition).

The influence of leadership on the experiences of teachers is another critical factor impacting teacher outcomes. The role of the school leader goes much further than just administrative management; effective school leaders are those who develop a positive adult professional environment by providing mentorship to the adults who work in that professional environment, provide opportunities for professional development for those adults, and recognize individual members of that professional group for the contributions they make. Leadership styles of school leaders that are transformational and supportive of individuals, providing inspirational motivation or creating an environment where teachers can participate in shared decision-making, have all been shown to relate to increased teacher confidence in their ability to perform their jobs (self-efficacy) and their level of commitment to the work they perform. Teachers who experience a high level of leadership support will have greater confidence in their ability to perform their job, greater resiliency in coping with challenges in their classroom, and greater motivation for helping advance the mission of the school where they are employed.

Extensive research has been conducted independently on the following: (1) institutional climate, (2) leadership support, (3) teacher self-efficacy, (4) teacher confidence, and (5) teacher commitment to the profession of teaching. There has been, however, limited research to date examining the relationship between those elements across multiple levels within the organization (school). Schools are complex hierarchical systems, therefore, how institutional climate and leadership support at the school level impacts an individual teacher's experience may not be the same.

Teachers at the same school may view climate differently because of personal experience, role, or beliefs about the environment; furthermore, leadership support will also have different impacts on teachers depending on their individual differences such as years of teaching experience, education(s), or intrinsic motivation. Addressing these differences requires statistical methods to account for nested data structures, and thus include school and individual effects.

Using hierarchical linear modeling (HLM), this study investigates multilevel relationships between institutional climate, leadership support, and self-efficacy of teachers and the combined impacts of those variables on teacher confidence and commitment to the profession. Both organizational and individual determinants are taken into account in order to provide a thorough understanding of how schools can increase teacher effectiveness, increase teacher well-being, and increase teacher engagement professionally. Findings from this research will provide actionable information to education policymakers, schooling officials, and teacher development agencies that will help them cultivate supportive schooling environments and sustain teacher effectiveness. Institutional climate and leadership support have both been studied independently but few studies have investigated their interaction with one another at different levels of an organization. This study addresses this gap by employing hierarchical linear modeling to analyze how school-level climate and leadership support interact with individual teacher characteristics to predict self-efficacy, confidence, and occupational commitment.

II. REVIEW OF RELATED LITERATURE

A variety of research has been conducted that shows how organizational climate can impact a teacher's motivation to work. In one study, Anderson and Liu (2020) looked at urban public schools and found that schools with collaborative practice, clear policies, and supportive environments promote greater teacher engagement and satisfaction. Another study by Liu and Chen (2020) on the institutional climate of Chinese secondary schools found that teachers in supportive environments who had developed positive relationships with their schools experienced a higher level of professional development and expressed a greater confidence and willingness to innovate in their teaching practices.

Several studies have examined the mediating role of teacher self-efficacy in the relationship between school-level factors and teacher outcomes. Chen and Wang (2020) found that self-efficacy mediated the influence of school climate on instructional innovation, thus suggesting that teachers who had a strong sense of self-efficacy were more likely to implement innovative teaching practices if they were working in an environment where they felt supported. Similarly, Li and Zhao (2022) found that self-efficacy was an important mediator in the relationship between institutional context and occupational commitment, and that self-efficacy might provide insight into how organizational support affects teacher retention and professional commitment.

A third area of focus in recent literature on teacher outcomes is the importance of leadership support. Davis and Thompson (2021) examined secondary schools and found that leadership support, particularly in the form of guidance, mentoring, and recognition, positively influenced teacher retention.

Miller and Green (2021) provided additional evidence in support of supportive leadership leading to enhanced teacher confidence in their instructional practices. Johnson, Lee and Kim (2021) also affirmed the positive influence of transformational leadership in school districts within the Asia-Pacific region by indicating that teachers led under transformational leaders experience greater levels of confidence, commitment, and professional engagement. Patel and Mehta (2020) demonstrated similar results in secondary schools located in India where leadership practices that promoted the use of structured feedback and provided opportunities for professional development positively contributed to the development of teacher self-efficacy.

Similar investigations have occurred in multilevel settings examining the relationship between school climate and the support of leadership. Kaur and Singh (2020) found in their research of Indian secondary schools that schools with both positive climates and effective leadership have higher levels of teacher engagement. Xie and Liu (2021) utilized structural equation modelling to provide evidence that teacher outcomes are jointly influenced by leadership style and school climate, suggesting that these two variables work in synergy to promote professional confidence and commitment to the teacher's work. Lee, Park and Choi (2021) also provided valuable information about the inclusion of multi-level analyses in research, indicating that hierarchical data structures require the use of multilevel modelling to adequately capture both school- and individual-level influences on teacher performance.

Numerous studies have also been conducted examining self-efficacy as a critical element in determining teacher attitudes toward their instructional outcomes. According to Wang and Chen (2020), teachers with high levels of self-efficacy participate in innovative teaching techniques and readily modify to meet curricular changes. Results from Singh and Kaur's (2021) multilevel analysis suggested that self-efficacy is a strong predictor of good occupational commitment & confidence, due to its mediating effects between organizational supports and individual outcomes. Zhou & Li (2020) also found that self-efficacy had a direct effect on secondary teachers' occupational commitment, indicating that it is vital to develop teachers' confidence in their own abilities. There were multiple studies conducted about the relationship between organizational factors and teacher retention. According to Ramirez and Torres (2021) teacher retention could be predicted by the school climate in which a teacher worked. A positive school climate would result in decreased intention to leave their positions for teachers. Supportive environments enhance the occupational commitment of teachers within diverse classrooms (Nguyen & Le, 2022). Garcia and Rodriguez (2022) also indicated that both institutional context and self-efficacy had significant effects on long term occupational commitment=f, illustrating the necessity of both organizational & individual factors in promoting teacher motivation over time.

Overall, the literature suggested a clear consensus: institutional climate and leadership support shaped teachers' beliefs and behaviors, with self-efficacy mediating the relationship between organizational factors and outcomes. However, few studies integrated all three constructs in a multilevel analytical framework, particularly in the Indian context, which highlighted the need for comprehensive research examining how school-level and individual-level variables simultaneously influence teacher confidence and occupational commitment. This study sought to address this gap by employing hierarchical linear modeling to analyze the combined effects of institutional climate, leadership support, and teacher self-efficacy on teacher outcomes in urban and semi-urban schools of Northern India.

Objectives of the Study

The primary objective of this study is to examine the relationships between institutional climate, leadership support, and teacher self-efficacy, and their collective impact on teacher confidence and occupational commitment.

Specifically, the study seeks to

(1) Assess the influence of institutional climate on teacher self-efficacy,

(2) evaluate the impact of leadership support on teacher confidence and commitment,

(3) Investigate the mediating role of self-efficacy in the relationship between organizational factors and occupational commitment

(4) Employ a multilevel analytical framework to account for both school-level and individual-level effects.

III. RESEARCH METHODOLOGY

The research adopted a quantitative, cross-sectional survey design. The study population included teachers from urban and semi-urban schools in Northern India, purposively selected to ensure variability in school size, ownership, and disciplinary focus. Fifteen schools were included, with a total of 450 teachers participating in the study. A structured questionnaire was developed, comprising validated scales for institutional climate, leadership support, teacher self-efficacy, confidence, and occupational commitment. Institutional climate was measured using a 20-item scale adapted from the Organizational Climate Measure (OCM), while leadership support was assessed with a 15-item leadership support scale. Teacher self-efficacy was evaluated using the Teachers' Sense of Efficacy Scale (TSES). Confidence and occupational commitment were measured using adapted scales from prior research.

The data analysis strategy involved hierarchical linear modeling to account for the nested structure of teachers within schools. Preliminary analyses included descriptive statistics, reliability testing, and correlation analyses. Following this, multilevel regression models were estimated to examine the effects of school-level variables (institutional climate and leadership support) and individual-level variables (teacher self-efficacy and demographics) on teacher confidence and occupational commitment. Model fit was assessed using standard criteria including the Akaike Information Criterion (AIC) and intraclass correlation coefficients (ICC).

IV. DATA ANALYSIS AND INTERPRETATION

The data collected from 450 teachers across 15 schools were subjected to thorough statistical analyses to examine the relationships between institutional climate, leadership support, teacher self-efficacy, professional confidence, and occupational commitment. Descriptive statistics, reliability analysis, correlation analysis, and hierarchical linear modeling (HLM) were used to understand the complex interactions at both the school and individual levels.

Initial descriptive analysis revealed that teachers generally rated their schools as moderately supportive, with a mean score of 3.8 on the institutional climate scale, suggesting that while many teachers perceived their schools positively, there was some variation in how policies, practices, and shared norms were implemented across schools. Leadership support received a slightly higher mean score of 3.9, indicating that teachers generally felt they had adequate guidance and mentorship from administrators. Teacher self-efficacy was high, with a mean score of 4.1 on a five-point scale, reflecting considerable confidence in their instructional abilities. Occupational commitment and professional confidence were similarly elevated, with mean values of 4.0 and 3.9, respectively, suggesting that teachers were motivated and committed to their roles despite variations in school support.

Table 1. Descriptive Statistics of Study Variables

Variable	N	Mean	SD	Min	Max	Cronbach's α
Institutional Climate	450	3.80	0.58	2.0	5.0	0.88
Leadership Support	450	3.90	0.62	2.0	5.0	0.91
Teacher Self-Efficacy	450	4.10	0.55	2.5	5.0	0.89
Professional Confidence	450	3.90	0.60	2.0	5.0	0.84
Occupational Commitment	450	4.00	0.57	2.5	5.0	0.82

The Cronbach's alpha values indicate that all scales demonstrated satisfactory internal consistency, with values ranging from 0.82 to 0.91. This confirms the reliability of the instruments used in measuring institutional climate, leadership support, teacher self-efficacy, confidence, and occupational commitment.

To examine the relationships among the variables, Pearson correlation coefficients were calculated. Institutional climate exhibited a significant positive correlation with teacher self-efficacy ($r = 0.62$, $p < 0.001$), suggesting that teachers in schools with more supportive climates felt more capable in their teaching. Similarly,

leadership support was positively associated with self-efficacy ($r = 0.58$, $p < 0.001$), indicating that administrative guidance, mentorship, and recognition contribute to teachers' belief in their instructional competence. Teacher self-efficacy also showed strong positive correlations with both professional confidence ($r = 0.61$, $p < 0.001$) and occupational commitment ($r = 0.65$, $p < 0.001$), indicating that self-efficacy may mediate the effects of school-level factors on teacher outcomes.

Table 2. Correlation Matrix of Study Variables

Variable	1	2	3	4	5
1. Institutional Climate	1				
2. Leadership Support	0.54^{***}	1			
3. Teacher Self-Efficacy	0.62^{***}	0.58^{***}	1		
4. Professional Confidence	0.48^{***}	0.50^{***}	0.61^{***}	1	
5. Occupational Commitment	0.51^{***}	0.55^{***}	0.65^{***}	0.63^{***}	1

***$p < 0.001$

The correlation matrix confirms strong positive associations among institutional climate, leadership support, self-efficacy, and teacher outcomes, supporting the theoretical expectation that supportive environments and effective leadership enhance teacher performance and commitment.

Hierarchical Linear Modeling (HLM) Analysis

Given the nested structure of the data (teachers within schools), HLM was employed to examine both school-level and individual-level effects. In the first model, institutional climate and leadership support at the school level were entered as predictors of teacher self-efficacy at the individual level. The results indicated that institutional climate significantly predicted teacher self-efficacy ($\beta = 0.43$, $p < 0.01$), confirming that teachers in schools with more positive climates tend to have higher confidence in their instructional abilities.

Table 3. HLM Results: School-Level Predictors of Teacher Self-Efficacy

Predictor	β	SE	t	p
Institutional Climate	0.43	0.11	3.91	0.001
Leadership Support	0.28	0.12	2.33	0.02
Intercept	3.65	0.09	40.56	< 0.001

At the individual level, teacher self-efficacy emerged as a strong predictor of professional confidence ($\beta = 0.56$, $p < 0.001$) and occupational commitment ($\beta = 0.52$, $p < 0.001$). Leadership support also had direct positive effects on both confidence ($\beta = 0.37$, $p < 0.01$) and occupational commitment ($\beta = 0.41$, $p < 0.01$), highlighting the combined influence of organizational and individual factors.

Table 4. HLM Results: Individual-Level Predictors of Teacher Outcomes

Outcome Variable	Predictor	β	SE	t	p
Professional Confidence	Teacher Self-Efficacy	0.56	0.08	7.00	< 0.001
	Leadership Support	0.37	0.12	3.08	0.002
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Occupational Commitment	Teacher Self-Efficacy	0.52	0.09	5.78	< 0.001
	Leadership Support	0.41	0.11	3.73	0.001

The multilevel model accounted for a substantial proportion of the variance in teacher outcomes. Specifically, the model explained approximately 45% of the variance in professional confidence and 48% of the variance in occupational commitment, indicating a strong predictive power of the combination of school-level and individual-level variables.

Table 5. Model Fit and Variance Explained

Outcome Variable	ICC	Variance Explained (%)	AIC	Model Significance
Professional Confidence	0.21	45%	1532.45	$p < 0.001$
Occupational Commitment	0.19	48%	1498.62	$p < 0.001$

The intraclass correlation coefficients (ICC) indicate that approximately 19–21% of the variance in teacher outcomes can be attributed to differences between schools, justifying the use of multilevel modeling. The results underscore that both school-level factors (institutional climate, leadership support) and individual-level factors (teacher self-efficacy) are critical in determining teacher confidence and occupational commitment.

The analyses collectively demonstrate that teachers' perceptions of their organizational environment and leadership support are closely intertwined with their sense of self-efficacy, professional confidence, and commitment to their occupation. Schools that foster positive climates, provide clear policies, promote collaboration, and recognize teacher contributions enable teachers to feel capable and confident in their professional roles. Leadership support amplifies this effect by offering guidance, feedback, and encouragement, which directly enhances occupational commitment. Furthermore, teacher self-efficacy emerges as a mediating factor, linking organizational conditions to individual outcomes. The results highlight the necessity of considering both organizational and personal factors in efforts to improve teacher performance, engagement, and retention.

V. FINDINGS OF THE STUDY

The study sheds meaningful light on how institutional climate, leadership support, teacher self-efficacy, professional confidence, and occupational commitment are connected.

To begin with, institutional climate stood out as a powerful influence on teacher self-efficacy. Teachers who saw their schools as supportive, collaborative, and well-organized tended to feel more capable in their classrooms. When educators feel valued, when their work is acknowledged, and when policies are clear and applied fairly, their confidence naturally grows. Schools that cultivate this kind of positive environment don't just improve morale—they strengthen teachers' motivation, engagement, and resilience when facing everyday challenges.

Leadership support also played a critical role. Teachers who received steady guidance, mentoring, and recognition from school leaders reported higher professional confidence and a stronger commitment to their careers. Supportive administrators made a noticeable difference, not only by offering practical direction but also by reinforcing teachers' sense of purpose. This reinforces what many educators already know from experience: leadership that is encouraging and attentive can have a lasting impact on teacher morale and long-term dedication.

Another important finding was the central role of teacher self-efficacy. It acted as a bridge between organizational factors and teacher outcomes. Teachers who believed strongly in their ability to manage classrooms, deliver instruction effectively, and support student learning were more confident and more committed to staying in the profession. In fact, self-efficacy amplified the positive effects of both institutional climate and leadership support. This suggests that efforts to strengthen teachers' sense of competence—through professional development, mentoring programs, and collaborative learning—can create ripple effects that extend far beyond skill development alone.

The analysis also showed that both school-level and individual-level factors matter. Differences between schools accounted for a meaningful share of the variation in professional confidence and occupational commitment, highlighting the importance of the broader institutional context. At the same time, individual beliefs—especially self-efficacy—explained a significant portion of the differences in outcomes. In other words,

teacher engagement and retention are shaped by the interaction between personal confidence and the support structures around them.

Ultimately, the findings point to a complementary relationship between institutional climate and leadership support. A positive climate lays the groundwork by creating a culture of trust, structure, and shared purpose. Strong leadership then reinforces that foundation through guidance, recognition, and sustained encouragement. Together, these elements create an environment where teachers can thrive professionally, feel confident in their roles, and remain committed to their careers over the long term.

VI. CONCLUSION

This study demonstrates that teacher outcomes—specifically professional confidence and occupational commitment—are influenced by a dynamic interplay between organizational conditions and individual beliefs. Institutional climate and leadership support were shown to significantly enhance teacher self-efficacy, which in turn serves as a mediator that strengthens both confidence and commitment. Teachers who perceive their schools as supportive and their leaders as encouraging are more likely to feel competent, motivated, and dedicated to their profession. These findings emphasize that improving teacher outcomes requires a holistic approach that addresses both the organizational context and individual teacher capabilities. In conclusion, the study highlights that sustaining high-quality education depends not only on teachers' technical competencies but also on the psychosocial and organizational environments that shape their professional lives. By fostering supportive climates and effective leadership, educational institutions can empower teachers, enhance instructional quality, and ensure long-term commitment to the teaching profession. Future research may extend this work through longitudinal studies to examine how changes in institutional climate and leadership support over time influence teacher self-efficacy and retention, as well as exploring cross-cultural variations in these relationships.

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