Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Determinants of Mechanical Ventilator Adoption in Healthcare Emergency Settings

Cosimo Caldararo
University of Salento
Marco Benvenuto
University of Salento
Anders Hauge Wien
anders.h.wien@uit.no

UiT The Arctic University of Norway
Luigi Piper
University of Salento

Article

Keywords: Mechanical ventilation, Emergency nursing, Clinical expertise, Technology adoption, Trust in technology, Attitude

Posted Date: November 20th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11236415/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Determinants of Mechanical Ventilator Adoption in Healthcare Emergency Settings

Cosimo Caldararo [1], Marco Benvenuto [2], Anders Hauge Wien [3,4], Luigi Piper [2]

Authors' details
[1] Department of Experimental Medicine, University of Salento, 73100 Lecce, Italy.
[2] Department of Economic Science, University of Salento, 73100 Lecce, Italy.
[3] School of Business and Economics, UiT Arctic University of Norway, Tromsø, Norway.
[4] Department of Business and Administration, Oslo New University College, Oslo, Norway.

Corresponding authors

Anders Hauge Wien, School of Business and Economics, UiT Arctic University of Norway, Tromsø, Norway; Department of Business and Administration, Oslo New University College, Oslo, Norway. Email: anders.h.wien@uit.no

Acknowledgements
The authors wish to thank all the nursing professionals who participated in the study, the emergency nursing associations, hospital networks and Martina Pipoli that facilitated participant recruitment, and the CURSUS (Regional University Coordination for Higher Education in Health and Social Care) for institutional support.

Authors' contributions
C.C. contributed to the study conception, data collection, and writing of the manuscript. M.B. contributed to study conception, interpretation of results, and writing of the manuscript. A.H.W. contributed to the theoretical framework and writing of the manuscript. L.P. contributed to the theoretical framework, the statistical analysis and writing of the manuscript. All authors read and approved the final manuscript.

Declaration

Consent to participate
Written informed consent was obtained from all participants prior to their participation in the study.

Clinical trial number:
Not applicable.

Ethics approval and consent to participate
This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Participation was voluntary, and written informed consent was obtained from all participants before the questionnaire was administered. Participants were informed of the study aims, the anonymous and confidential nature of data processing, and their right to withdraw at any time without consequence. No personal identifying information was collected or retained.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Funding
The authors received no financial support for the research, authorship, and/or publication of this article.

Data repository
Harvard Dataverse:
https://dataverse.harvard.edu/previewurl.xhtml?token=4cdfce87-a014-4ce3-a470-42ab1a11aa8b

Determinants of Mechanical Ventilator Adoption in Healthcare Emergency Settings

Abstract

Mechanical ventilation (MV) is the recommended standard of care in many emergencies, yet its adoption by nursing professionals remains inconsistent. This research examines whether perceived clinical expertise is associated with emergency nurses' intention to use MV, directly and indirectly through trust in MV technology and attitude toward MV, and whether emergency severity moderates these associations. Emergency nurses (N = 236) were randomly assigned to one of four vignettes of decreasing acuity: cardiorespiratory arrest, severe hypoxaemia, chest trauma with respiratory compromise, and acute pulmonary oedema. Structural equation modelling showed that expertise was associated with trust and intention, trust with attitude, and attitude with intention; the serial indirect effect of expertise on intention through trust and attitude was significant. Because these constructs were measured concurrently, this effect is interpreted as an indirect association rather than as evidence of causal transmission. Higher severity strengthened the direct association between expertise and intention and weakened the association between trust and attitude, so that the serial indirect association declined as acuity increased. These findings are consistent with a shift from deliberative to automatic processing under time pressure and suggest that training should build expertise to automaticity for maximum-acuity scenarios while fostering trust in lower-acuity ones.

Keywords: Mechanical ventilation; Emergency nursing; Clinical expertise; Technology adoption; Trust in technology; Attitude.

1. Introduction

Despite the recognized superiority of device-assisted ventilation over manual techniques in terms of tidal volume control, reduction of operator fatigue, and standardization of respiratory support [1,2], the transition from manual bag-mask ventilation to mechanical ventilation (MV) in real emergency

scenarios is not straightforward and remains influenced by a range of cognitive, attitudinal, and contextual factors [3,4].

Although technological advancements have made mechanical ventilators increasingly portable, intuitive, and adaptable to different clinical scenarios, adoption in emergency settings is not purely a function of device availability or technical capability. Behavioral research in healthcare has consistently shown that the intention to use a medical technology depends on individual perceptions, prior experience, and trust in the tool, mediated by situational pressures such as time constraints and clinical urgency. Nurses, who are often the first responders and frequently manage airway interventions in the pre-hospital and emergency department phases, occupy a critical role in this decision process.

To date, however, the behavioral determinants of nurses' intention to use MV in emergency contexts have received limited empirical attention. Existing studies tend to focus on barriers and facilitators at the organizational or systemic level or examine technology adoption in non-emergency healthcare settings where time pressure and acuity are substantially lower. The specific interplay between clinical expertise, trust in technology, attitude toward the device, and contextual emergency severity remains underexplored.

Drawing on the attitude component of the Theory of Planned Behavior [5] and the consumer expertise literature [6], the model postulates that perceived clinical expertise with MV is associated with intention to use the device both directly and indirectly through trust in the technology and attitude toward it. Furthermore, the study examines whether these relationships are moderated by the level of emergency severity, operationalized through four clinically distinct scenario conditions (cardiorespiratory arrest, severe hypoxemia, chest trauma with respiratory compromise, and acute pulmonary edema).

The contribution of this research is threefold. First, it extends behavioral models of technology adoption to the emergency nursing context, a domain where high acuity and time-dependent decision-making represent unique boundary conditions. Second, it introduces a multidimensional conceptualization of clinical expertise, capturing cognitive automaticity, analytical engagement, elaboration, memory, and product familiarity as distinct yet interrelated sub-dimensions. Third, it provides actionable evidence for healthcare organizations and policymakers seeking to design targeted

training programs and technology implementation strategies that improve both nurse preparedness and patient safety outcomes.

2. Theoretical framework and hypotheses development

Emergency nursing in high-acuity settings represents one of the most cognitively demanding professional contexts in healthcare, characterised by time pressure, clinical uncertainty, and the continuous management of life-threatening conditions that require rapid and accurate decision-making [4,7]. The decision to initiate mechanical ventilation — a time-sensitive, high-stakes clinical action — is rarely a simple function of protocol adherence or device availability, but requires clinical judgement that integrates the patient's respiratory status, haemodynamic stability, and the overall trajectory of the emergency presentation [3]. Despite the existence of international guidelines recommending early transition to device-assisted ventilation in conditions such as cardiorespiratory arrest, severe hypoxaemia, and acute respiratory failure, actual adoption by emergency nursing professionals remains inconsistent across settings and practitioners — a gap with direct implications for patient safety.

Research conducted across a range of healthcare technology contexts has documented that adoption decisions are shaped not only by clinical competence but by a broader set of cognitive, attitudinal, and contextual variables that operate alongside, and sometimes in tension with, formal training and protocol knowledge [8–10]. The study of these variables has generated a substantial literature centred on constructs such as perceived usefulness, perceived ease of use, behavioural intention, and attitude, primarily through applications of the Technology Acceptance Model (TAM) [11] and the Theory of Planned Behavior (TPB) [5]. Of particular relevance to the present study is the attitude component of TPB, which captures clinicians' evaluative orientations toward technology use; subjective norms and perceived behavioural control, while part of the full TPB framework, are not explicitly modelled here given the individual-level focus of the emergency decision context. Both frameworks have been applied extensively in healthcare settings, consistently demonstrating that

attitudinal and motivational constructs account for significant variance in clinicians' intention to use medical technologies beyond what is explained by access or training alone [3,9]. A further construct that has emerged as particularly relevant in high-stakes technology contexts is trust in technology, defined as the user's confidence that a device will perform reliably, safely, and in accordance with its specifications [12]. Trust has been shown to function as a cognitive-affective bridge between accumulated experience and the evaluative orientations that shape behavioural intention, particularly in environments where device failure carries immediate consequences for patient outcomes.

2.1 Clinical expertise and intention to use technology

In the consumer behavior literature, expertise has been conceptualised as a multidimensional construct encompassing both objective knowledge and subjective experience accumulated through product interaction [13]. Building on this foundational work, Kleiser and Mantel [6] identified five key sub-dimensions of expertise: cognitive automaticity, referring to effortless and routinised decision-making; analytical engagement, capturing active interest in and critical appraisal of available options; elaboration depth, reflecting in-depth knowledge and the ability to process technical content; memory, referring to the capacity to recall clinical characteristics and device-specific information; and product familiarity, denoting direct and accumulated experience with the device across diverse use contexts. These sub-dimensions collectively capture the spectrum from novice, effortful processing to expert, automatic decision-making. When applied to clinical contexts, expertise reflects the accumulated competence a practitioner develops in using a specific device or technique across diverse situations.

Prior research in healthcare technology adoption has demonstrated that expertise is associated with stronger intentions to use medical technologies [8]. Experienced clinicians are more likely to perceive a device as controllable and appropriate, to anticipate its benefits, and to act with confidence in time-sensitive situations. In emergency nursing, this relationship is expected to be particularly salient, as automaticity and familiarity with MV devices may significantly reduce cognitive load and increase decisional speed. Accordingly, the following hypothesis is proposed:

H1: Perceived clinical expertise with MV is positively associated with the intention to use MV in an emergency scenario.

2.2 The mediating role of trust in technology and attitude

Building on the direct relationship between clinical expertise and intention proposed in H1, the present study argues that expertise may also influence intention through a sequential process involving trust in MV technology and attitude toward its use. Expertise provides practitioners with knowledge and experience that may affect not only their ability to operate a device, but also their confidence in its performance and their overall evaluation of using it. Trust and attitude are therefore proposed as conceptually distinct but connected mechanisms through which expertise may translate into a stronger intention to use MV in emergency situations. Trust is positioned as an antecedent to attitude rather than as a parallel predictor of intention, on the grounds that confidence in device performance constitutes one of the beliefs from which a broader evaluative judgement is formed rather than a substitute for that judgement.

Trust in technology refers to the clinician's confidence that a device will perform reliably, predictably, and safely under the relevant conditions of use [12]. In healthcare settings, such trust may involve confidence in the accuracy of device-generated information, perceived control over device functioning, confidence in the system's technical reliability, and reassurance provided by regulatory approval and institutional endorsement [10,12]. Trust in a specific technology is not necessarily a stable or general disposition; rather, it develops and becomes calibrated through knowledge of and interaction with the system [14]. Repeated experience provides users with evidence about a technology's dependability, predictability, and operational limitations, while technical understanding allows them to form more accurate mental models of how the system is likely to perform across different conditions [15]. Similarly, research on familiarity and technology-related trust suggests that familiarity structures

expectations about how a system will behave and thereby reduces the uncertainty associated with its use [16].

This logic is particularly consistent with the product familiarity dimension of expertise [6]: exposure across varied situations gives clinicians experience with how a ventilator responds to parameter adjustments and what its alarms may signify. Clinicians with greater expertise are thus likely to have encountered MV devices across a broader range of emergency situations and to be better able to distinguish between conditions in which the device can be relied upon and those in which additional caution is required. When prior experience indicates that the device performs reliably, expertise should therefore contribute to stronger and more appropriately calibrated trust in MV technology.

H2: Perceived clinical expertise with MV is positively associated with trust in MV technology.

Trust is subsequently expected to shape clinicians' attitudes toward using the device. Attitude refers to a person's overall favourable or unfavourable evaluation of performing a particular behaviour [5]. In the present context, attitude concerns the clinician's summary evaluation of the utility of deploying MV in the assigned emergency scenario, rather than any affective or experiential appraisal of the technology itself. Clinicians who perceive an MV device as reliable, controllable, accurate, and safe have grounds to regard its use as beneficial and clinically appropriate. Conversely, uncertainty about whether the device will function predictably may lead to a less favourable evaluation, even when its potential clinical benefits are recognised. Trust-related beliefs may therefore contribute to the behavioural beliefs from which attitudes are formed, an ordering consistent with research on healthcare technology adoption in which confidence in the reliability of a system contributes to more favourable evaluations of its use [9,10].

H3: Trust in MV technology is positively associated with attitude toward using MV.

Attitude, in turn, is expected to predict intention to use MV in an emergency scenario. Within the Theory of Planned Behavior, behavioural intention reflects an individual's readiness to perform a behaviour and

is shaped partly by the person's evaluation of it, making attitude one of the proximal determinants of intention [5]. Research on healthcare technology adoption has consistently identified attitude as an important predictor of clinicians' intentions to use medical technologies [3,10]. This relationship should be particularly relevant when clinicians must decide whether to deploy MV rather than rely on more familiar manual ventilation techniques. Even when the device is available and the clinician is competent to operate it, use remains less likely if MV is evaluated as impractical or unnecessary.

H4: Attitude toward using MV is positively associated with the intention to use MV in an emergency scenario.

2.3 The serial mediation pathway

Beyond the direct effect of expertise on intention (H1) and the individual mediation paths described above, the present model postulates a serial indirect pathway — EXP → TR → ATT → INT — through which expertise is expected to relate to intention by first shaping trust, which in turn shapes attitude, which then relates to behavioral intention. This structure reflects a theoretically derived sequence: accumulated expertise reduces uncertainty about device behavior, which builds trust; trust in turn generates a positive evaluative stance toward the device; and that evaluative stance consolidates into the intentional readiness to act. This serial logic differs from a parallel mediation account, in which trust and attitude would each independently mediate the expertise–intention relationship without being linked to one another. The serial specification is theoretically preferable here because trust — as a cognitive-affective confidence judgment — is conceptually antecedent to attitude, which represents a higher-order evaluative integration of beliefs including, but not limited to, trust-related appraisals [5,17]. Empirical support for analogous serial mediation pathways — in which confidence or perceived reliability shapes evaluative attitude, which then predicts behavioral intention — has been reported in healthcare technology adoption contexts [3,9,10]. Because all constructs in the chain are measured concurrently, the sequence is tested here as a theoretically informed serial mediation model of indirect

associations: the empirical test can establish whether the data are consistent with the hypothesised ordering, but not its temporal precedence or causal direction [18]. The indirect association between expertise and intention through this sequential chain is expected to be significant and positive, offering a theoretically informed account of how clinical experience with MV may relate to adoption readiness beyond its direct association with intention:

H5: Perceived clinical expertise is indirectly and positively associated with intention to use MV through trust in MV technology and attitude toward MV, in serial.

2.4 The moderating role of emergency severity

There is theoretical and empirical reason to expect that emergency severity moderates the relationships in the proposed model. Drawing on the recognition-primed decision (RPD) model [19], expert practitioners under time pressure match situational cues to stored prototypes and act without deliberation — a process that is expected to be most dominant in maximum-acuity scenarios such as cardiorespiratory arrest, where the therapeutic window is measured in seconds [2]. In such conditions, the direct pathway from expertise to intention is expected to be particularly strong, while the deliberative attitude-formation process may be bypassed [20]. In contrast, in moderate-severity scenarios, more cognitive space is available for evaluative reasoning [20]: trust in the device and attitude toward its use are expected to function as active mediating mechanisms, playing a more prominent role in shaping intention [5,12]. The moderating role of severity on the mediation chain thus introduces a condition of moderated mediation, wherein the indirect effect of expertise on intention through trust and attitude varies as a function of emergency severity:

H6: Emergency severity moderates the expertise–intention pathway, such that higher severity strengthens the direct effect of expertise on intention while attenuating the mediating role of trust and attitude.

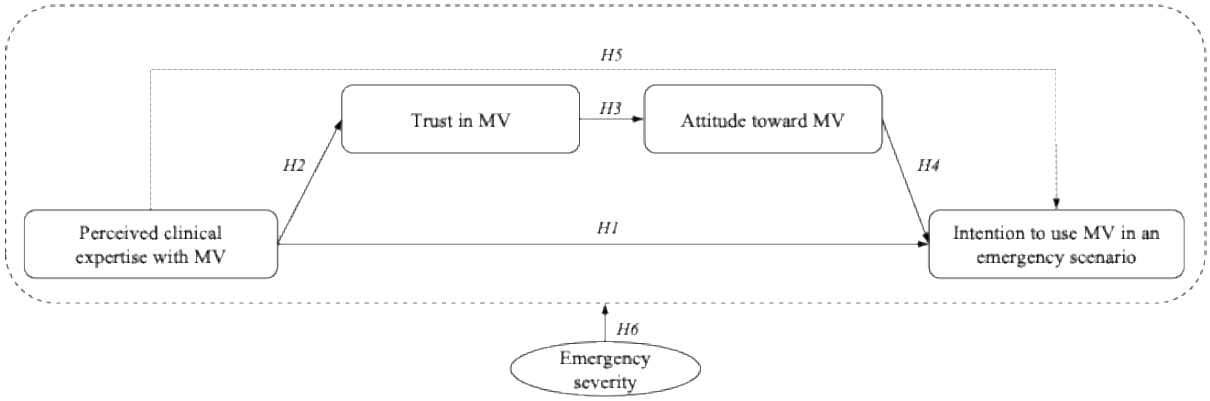


Fig. 1 Proposed theoretical model

3. Methods

3.1 Study design and experimental structure

A quantitative cross-sectional and observational study was conducted to examine a theoretical model of nurses' intention to use mechanical ventilation (MV) in emergency settings (Fig. 1). Consistent with behavioral research on intention [5], the model specifies the variables according to a sequential, theory-driven logic, in which perceived clinical expertise is expected to be associated with trust in the technology and attitude toward the device, which in turn are associated with the intention to use MV [21]. This structure reflects a multiple (serial) mediation model, where the association between expertise and intention can be partly accounted for by more than one intermediate construct. Since only emergency severity was experimentally varied, whereas expertise, trust, attitude, and intention were measured concurrently, the mediation component of the model is correlational: indirect effects are interpreted as hypothesised indirect associations rather than as evidence of temporal precedence or causal direction [18,22]. Accordingly, the design enables: (i) testing the direct effects of the cognitive/perceptual determinants on intention (attitude, trust, perceived expertise); (ii) assessing the moderating role of emergency severity (scenario condition); and (iii) evaluating the hypothesized

indirect pathway linking expertise to intention through trust and attitude, as well as whether the strength of this indirect effect differs across emergency-severity levels. In line with methodological standards in the literature, integrated systems of direct effects, mediation, and moderated (conditional) indirect effects are commonly tested using Structural Equation Modeling (SEM), as it enables simultaneous estimation of latent constructs and structural paths [22].

The study also incorporates a contextual component, the emergency severity, operationalized through a scenario-based structure, which allows testing whether both direct and indirect relationships vary across severity conditions, in line with experimental vignette methodology recommendations [23]. Four main scenarios were identified: *Scenario A* – Cardiorespiratory arrest (red code), representing the highest-acuity, strictly time-dependent condition requiring immediate intervention for survival; *Scenario B* – Severe hypoxemia ($SpO_2 < 85\%$) unresponsive to oxygen therapy (red code), which is a severe emergency with high risk of neurological deterioration or progression to cardiorespiratory arrest, requiring rapid escalation of care; *Scenario C* – Chest trauma with severe impairment of respiratory mechanics (orange/red code), which is a potentially critical condition characterized by unstable respiratory mechanics with rapid evolution risk; *Scenario D* – Acute pulmonary edema (orange code), which is a moderate-to-severe emergency characterized by marked respiratory compromise and potentially fast evolution but typically manageable with timely treatment and escalation when needed.

Together, the four scenarios provide the acuity variation necessary to test the proposed moderation hypothesis (H6) with sufficient contrast between groups. Importantly, the severity gradient operationalized in this study does not require subjective manipulation checks because it is grounded in objective, clinically validated triage classifications. The Manchester Triage System (MTS) colour codes assigned to each scenario (red, orange/red, orange) are internationally recognized severity indicators with established clinical validity and inter-rater reliability [24]. Furthermore, the specific conditions represented by each scenario correspond to well-defined clinical entities with guideline-mandated acuity classifications: cardiorespiratory arrest (Scenario A) and severe hypoxaemia with $SpO_2 < 85\%$ (Scenario B) are classified as red-code emergencies requiring immediate intervention by the European Resuscitation Council (ERC) Guidelines 2021 [2]; chest trauma with respiratory compromise (Scenario C) is classified at the orange/red boundary by national and international emergency triage protocols

[25]; and acute pulmonary oedema (Scenario D) is classified as an orange-code condition manageable with timely medical intervention, consistent with ERS/ATS clinical practice guidelines [1]. The acuity gradient is therefore inherent to the clinical content of the scenarios rather than a manipulation requiring perceptual verification.

3.2 Measures and questionnaire structure

A structured online questionnaire was administered in four versions, each embedding a different emergency scenario representing a distinct level of severity, explicitly linked to a triage priority code (Scenarios A–D). Participants were randomly assigned to one version and were instructed to answer all items with reference to the assigned scenario. The questionnaire was designed to operationalize the constructs of the conceptual framework (Fig. 1) and the study objectives. All latent variables were measured using 7-point Likert-type scales (1 = strongly disagree; 7 = strongly agree) and were phrased with explicit reference to the assigned scenario.

Perceived clinical expertise with MV (EXP) was measured by adapting the multidimensional product expertise framework proposed by Kleiser and Mantel [6]. The original scale was recontextualised to the emergency healthcare setting to assess participants' expertise with mechanical ventilation. The adapted instrument comprised five dimensions—cognitive effort/automaticity, analysis, elaboration, memory, and product familiarity—capturing both theoretical knowledge and practical experience in the use of mechanical ventilation during prehospital emergency care.

Trust in MV technology (TR) was assessed by adapting five items from van Velsen et al. [12], originally developed to measure trust in telemedicine services, and systematically reworded to fit the ventilator-in-emergency context. While some items in the original scale address confidentiality and data integrity — dimensions more salient in telemedicine than in device-based emergency care — these were retained and recontextualised to reflect analogous concerns in MV use: confidence in device readings (data integrity), control over ventilatory parameters (perceived control), and assurance provided by regulatory certification and device maintenance protocols (security ensured by legal and technological

measures). This adaptation preserves the multidimensional structure of the trust construct while ensuring content relevance for the emergency clinical context.

Attitude toward MV (ATT) was measured using five semantic differential items adapted from Voss et al. [17]. Originally developed to assess attitudes toward products and services, the scale was reworded to capture respondents' overall evaluation of using mechanical ventilation in the assigned emergency scenario, reflecting perceptions of its effectiveness, helpfulness, functionality, necessity, and practicality.

Finally, intention to use MV (INT) was measured using two items adapted from Ajzen [5], assessing participants' intention and perceived likelihood of using mechanical ventilation in the assigned emergency scenario.

At the end of the questionnaire, socio-demographic and professional data were collected, comprising: gender; age; educational level, classified into four categories (regional vocational diploma, bachelor's degree, master's degree, and postgraduate qualifications, the latter encompassing first- and second-level master's programmes, doctoral degrees, and advanced professional training courses); years of experience in emergency care settings; and prior completion of specific training in mechanical ventilation.

Furthermore, the questionnaire included an entry screening question to verify respondents' familiarity with the emergency condition described in the assigned scenario and an attention-check item embedded in the questionnaire (*e.g.*, "If you are reading this question, please select option 4"). Respondents who reported no familiarity with the clinical condition or who failed the attention check were excluded from the final analysis. The questionnaires were initially administered to a small pilot group to check understanding and coherence. Finally, ethical approval from a local Ethics Committee was sought before data collection.

3.3 Procedure

Data collection took place over three weeks. Participants were recruited by disseminating the Google Forms questionnaire link through professional channels (*e.g.*, nursing associations, emergency-care professional networks, hospital networks, and professional social media). After accessing the link, participants were randomly assigned to a condition, whereupon they read the presented emergency scenario and then completed the questionnaire. Participation was voluntary, and to reduce anxiety caused by the evaluation [26], the questionnaire assured the participants that there were no right or wrong answers and that the responses would be classified as anonymous. Before starting the questionnaire, respondents were provided with explicit informed consent that described the study aims, the voluntary nature of participation, the right to withdraw at any time, and the methods for maintaining anonymity and managing data. It was also indicated that the collected data would be used only for scientific and academic purposes.

3.4 Sample

Sample size was determined following Westland [27], whose formula is specifically designed for structural equation modelling with latent variables and incorporates the z-statistic at the desired confidence level:

$$n \geq \frac{z^2 \cdot (1 - R^2_{min})}{R^2_{min} \cdot \varepsilon^2}$$

where $z = 1.96$ (two-tailed, $\alpha = .05$), R^2_{min} is the minimum expected coefficient of determination for the key structural paths, and ε is the tolerable estimation error. Adopting a conservative $R^2_{min} = .20$ — consistent with the minimum proportion of variance in the outcome construct expected to be accounted for by the model, given the theoretical grounding of the proposed paths — and $\varepsilon = .10$, the formula yields $n \geq 154$. Sample adequacy was further corroborated against the 10:1 observations-to-parameters ratio recommended by Hair et al. [28]:

$$n \geq q \times 10$$

With approximately 18 free structural parameters, the minimum recommended sample size is $n = 180$. Additionally, the experimental vignette design — in which emergency severity is directly manipulated across four scenario conditions — reduces the effective sample size requirement relative to purely observational designs [23].

The main study included participants operating in emergency and urgent care settings, including Emergency Departments, critical care areas, and pre-hospital emergency services. The sample consisted of 236 participants — satisfying all three criteria and confirming adequate statistical power for the estimation of the proposed model — balanced by gender, with 114 men (48.3%) and 122 women (51.7%), aged 22–64 years ($M = 44.76$; $SD = 12.14$). With regard to educational level, respondents were classified into four categories: regional vocational diploma ($n = 50$, 21.2%), bachelor's degree ($n = 94$, 39.8%), master's degree ($n = 28$, 11.9%), and postgraduate qualifications — including first- and second-level master's programmes, doctoral degrees, and advanced professional training courses ($n = 64$, 27.1%). Overall, 78.8% of participants held a university-level qualification or higher (Table 1).

With regard to the emergency scenario assignment, 81 respondents (34.3%) were allocated to Scenario A – Cardiorespiratory arrest (red code); 52 (22.0%) to Scenario B – Severe hypoxaemia ($SpO_2 < 85\%$) unresponsive to oxygen therapy (red code); 51 (21.6%) to Scenario C – Chest trauma with severe impairment of respiratory mechanics (orange/red code); and 52 (22.0%) to Scenario D – Acute pulmonary oedema (orange code).

Table 1 Sample characteristics

	Category	*Sample*
Gender	Male	48.3 %
	Female	51.7 %
Age cohort (years)	Min-Max	22-64
	Mean	44.76
	Standard Deviation	12.14
Education	Diploma	21.2 %
	Bachelor degree	39.8 %
	Master degree	11.9 %

	Post graduate qualifications	27.1 %
Emergency Scenario	Scenario A - (red code)	34.3 %
	Scenario B - (red code)	22.0 %
	Scenario C - (orange/red code)	21.6 %
	Scenario D - (orange code)	22.0 %

N = 236

3.5 Data analysis

Descriptive statistics and preliminary demographic analyses were conducted using IBM SPSS Statistics (version 29.0). Prior to the structural equation analysis, a series of preliminary analyses were performed: item-level normality was assessed by examining skewness and kurtosis values following Kline's [22] criteria, multivariate normality was assessed using Mardia's [29] test, common method variance (CMV) was evaluated using the Common Latent Factor (CLF) technique [26,30], and bivariate correlations among construct scores and sociodemographic variables were computed. A confirmatory factor analysis (CFA) was then performed to evaluate the psychometric properties of the measurement model, including factor loadings, composite reliability (CR), average variance extracted (AVE), and discriminant validity [31], with model fit assessed against established thresholds [28,32]. The structural equation model (SEM) was subsequently estimated using maximum-likelihood estimation (MLE) to test the hypothesised direct paths and the serial indirect effect of expertise on intention through trust and attitude. The moderating role of emergency severity was examined through two complementary approaches: a moderation analysis using a product indicator approach [33] with interaction terms EXP×SEV, TR×SEV, and ATT×SEV on the full sample (N = 236), and a multigroup analysis comparing structural paths across the four scenario conditions using a simplified model specification. Whether the serial indirect effect varied with severity was assessed through the index of moderated mediation [34]. Gender, age, and educational level were included as control variables in all moderation models. CFA was estimated using the lavaan package in R (v. 4.3.1); all structural analyses were performed using the semopy library (Python 3.12).

4. Results

4.1 Preliminary Analysis

All items fell within acceptable thresholds for univariate normality (skewness range: −1.257 to 0.753; kurtosis range: 1.604 to 4.026), confirming that no individual indicator exhibited severe distributional anomalies [22]. The distribution of responses across all 27 items is illustrated in Fig. 2A. Despite the acceptable item-level distributions, Mardia's test indicated a clear departure from multivariate normality, with both multivariate skewness ($b = 300.872$, $p < .001$) and multivariate kurtosis ($b = 1{,}138.692$, $p < .001$) being statistically significant. Therefore, a bootstrapping procedure ($k = 5{,}000$) was adopted to estimate and evaluate the measurement model [35]. The CLF analysis suggested that Common Method Variance was unlikely to represent a major concern, since the average variance explained by the common factor was 41.6%, remaining below the conventional 50% threshold [26,30].

The CFA model specified a set of latent constructs, each measured by multiple observed indicators reflecting the underlying theoretical dimensions of the study [36–38]. The results reveal a satisfactory model fit (see Table 2): the chi-square to degrees of freedom ratio was 3.053 ($\chi^2 = 961.78$; $df = 315$, $p < .001$), which is within the commonly accepted threshold of 5.000 [28]. The Comparative Fit Index (CFI = 0.914), Tucker-Lewis Index (TLI = .904), and Normed Fit Index (NFI = .878) supported the adequacy of the model [28,32]. The Standardized Root Mean Square Residual (SRMR = .044) was below the .08 threshold, while the Root Mean Square Error of Approximation (RMSEA = .093) suggested an acceptable, though not optimal, fit. Overall, these results provide support for the adequacy of the measurement model.

As shown in Table 3, convergent validity was confirmed, as all standardized factor loadings (FL) were above .70, ranging from .731 to .990, and all Average Variance Extracted (AVE) values exceeded the recommended threshold of .50, ranging from .707 to .905. In addition, construct reliability (CR) values were all above .70, ranging from .884 to .950, consistent with the criteria proposed by Fornell and Larcker [31] and Hair et al. [28]. Lastly, internal consistency was also satisfactory, with all Cronbach's α coefficients ranging from .883 to .948, indicating excellent internal consistency and

reliability for all constructs [39]. Discriminant validity (see Table 4) was confirmed through the Fornell–Larcker criterion, as the square root of the AVE for each construct (INT = .950, ATT = .869, TR = .841, EXP = .931) was greater than its correlations with the remaining constructs. Additionally, no severe issues with multicollinearity were detected. Although the highest pairwise correlation, observed between INT and TR, exceeded the .70 threshold (r = .766), the overall pattern of correlations did not suggest problematic collinearity among the main constructs [40].

Table 2 Results of the Confirmatory Factor Analysis (CFA)

Index	*Value*	*Satisfactory level*	*References*
Chi-square/d.f. (χ^2/d.f.)	3.053	< 5.000	Anderson and Gerbing [41]; Bentler and Bonett [42]; Byrne [43]; Fornell and Larcker [31]; Hair *et al*. [28]; Hoe [44]; Hu and Bentler [32]
Comparative Fit Index (CFI)	.914	> .900	
Normed Fit Index (NFI)	.878	> .800	
Standardized Root Mean Square Residual (SRMR)	.044	< .080	
Tucker-Lewis Index (TLI)	.904	> .900	
Root Mean Square Error of Approximation (RMSEA)	.093	< .080	

Table 3 Items, factor loadings, and internal consistency of measurement scales.

Cod.		*FL*	*CR*	*AVE*	*α*
Attitude toward MV (ATT)			*.939*	*.756*	*.936*
ATT_1	Effective/ineffective	.863			
ATT_2	Helpful/unhelpful	.925			
ATT_3	Functional/not functional	.927			
ATT_4	Necessary/unnecessary	.886			
ATT_5	Practical/impractical	.731			
Trust in MV technology (TR)			*.923*	*.707*	*.922*
TR_1	Perceived control	.849			
TR_2	Confidentiality and privacy	.788			
TR_3	Data integrity	.811			
TR_4	Perceived ease of use	.845			
TR_5	Perceived security ensured by legal and technological measures	.907			
Clinical expertise with MV			*.970*	*.866*	*.974*
	Cognitive effort/automaticity (EXP_A)		*.884*	*.719*	*.883*
EXP_A1	Clinical decision-making confidence	.914			
EXP_A2	Established personal routine / habitual use	.744			
EXP_A3	Functional familiarity (interface knowledge)	.876			
	Analysis (EXP_AN)		*.939*	*.836*	*.938*
EXP_AN1	Interest in new features/innovations	.942			
EXP_AN2	Prehospital evidence and best-practice scanning	.928			

EXP_AN3	Preparation before using new devices	.872			
	Elaboration (EXP_E)		*.931*	*.818*	*.930*
EXP_E1	Self-perceived expertise in emergency use	.915			
EXP_E2	Technical understanding/literacy	.931			
EXP_E3	Critical appraisal of manufacturer guidance	.867			
	Memory (EXP_M)		*.947*	*.857*	*.947*
EXP_M1	Recall of key features	.924			
EXP_M2	Model recognition	.936			
EXP_M3	Comparative differentiation	.917			
	Product familiarity (EXP_F)		*.946*	*.854*	*.945*
EXP_F1	Familiarity in ambulance setting	.927			
EXP_F2	Exposure across emergency scenarios	.903			
EXP_F3	Perceived depth of practical experience	.941			
Intention to use MV (INT)			*.950*	*.905*	*.948*
INT_1	Strength of intention to use MV in the proposed scenario	.990			
INT_2	Likelihood of using MV in the proposed scenario	.911			

Notes: N = 236; FL = Standardized factor loading (all significant at a 0.01 level); CR = Construct Reliability; AVE = Average Variance Extracted; α = Cronbach's α.

Table 4 Discriminant validity matrix

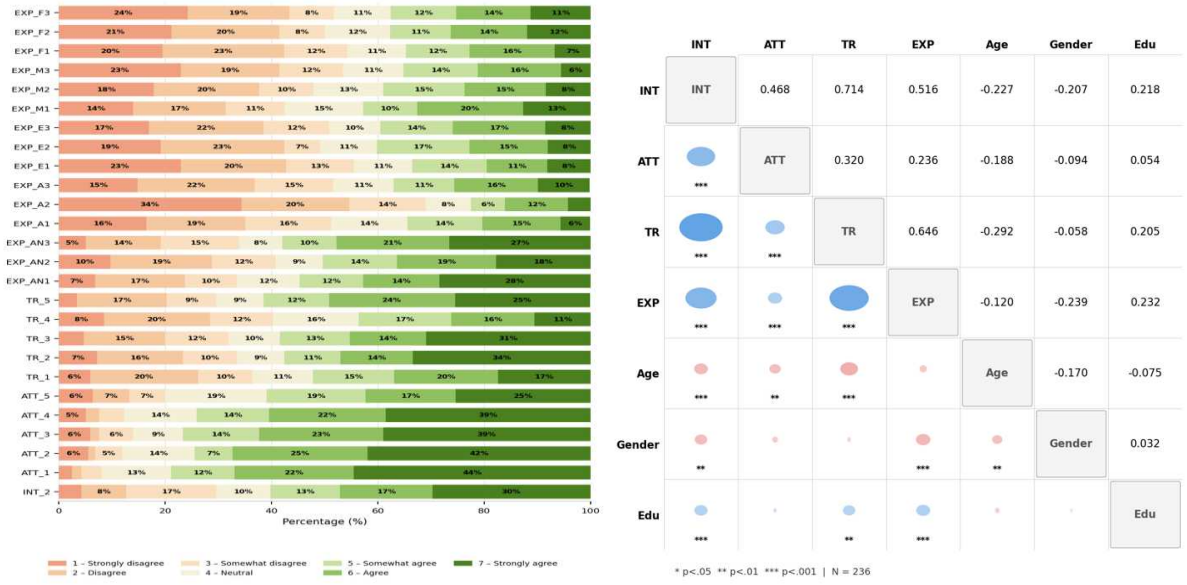
	INT	*ATT*	*TR*	*EXP*
Intention to use MV (INT)	*.950*			
Attitude toward MV (ATT)	.501	*.869*		
Trust in MV technology (TR)	.766	.336	*.841*	
Clinical expertise with MV (EXP)	.494	.210	.656	*.931*

Notes: N = 236; The square root of AVE indices for each variable are reported in italics along the diagonal.

4.2 Bivariate correlations

Prior to the structural equation analysis, Pearson bivariate correlations were computed among the four main latent construct scores (EXP, TR, ATT, INT) and the key socio-demographic and professional variables (gender, age, educational level, years of experience in emergency care, and specific training in MV). Fig. 2B reports the correlation matrix. All construct-level correlations were positive and statistically significant ($p < .001$): expertise correlated most strongly with trust ($r = .656$), followed by its correlations with intention ($r = .494$) and attitude ($r = .210$). Trust and intention showed the highest pairwise correlation ($r = .766$), while attitude and intention were moderately correlated ($r = .501$). These patterns are compatible with, though not demonstrative of, the proposed sequential structure, in which expertise is positioned upstream and trust and attitude sequentially link it to intention. Among the professional variables, years of experience in emergency care was positively associated with expertise

(r = .312, p < .001) and with trust (r = .241, p < .001), suggesting that longer professional exposure is associated with both device familiarity and perceived device reliability. Specific training in MV was associated with higher expertise (r = .381, p < .001), higher trust (r = .279, p < .001), and stronger intention (r = .198, p < .01). Once years of experience were partialled out, age showed no significant bivariate association with the main constructs (partial r range: −.08 to .11, all ns). In the multivariate moderation models, however, where age is estimated jointly with expertise, severity, and the other controls, age emerged as a significant negative predictor of trust and intention (Section 4.4), indicating that, at equal levels of expertise, older nurses reported lower trust in MV technology and weaker intention to use it. With regard to gender, male nurses reported significantly higher perceived expertise (M = 4.170 vs M = 3.351; U = 8,828.0, p < .001) and stronger intention to use MV (M = 5.281 vs M = 4.508; U = 8,415.5, p = .005) than female nurses, while no significant bivariate differences were found for trust (p = .551) or attitude (p = .319). These gender differences in the bivariate analysis are consistent with the multivariate moderation results, in which gender remained a significant negative predictor of intention after controlling for expertise, trust, attitude, and severity (β = −.160, p < .001). These preliminary associations support the plausibility of the structural pathways subsequently tested in the SEM and confirm that the sample displays sufficient variance across construct scores and demographic subgroups to enable meaningful analysis.



(A) **(B)**

Fig. 2 (**A**) Stacked bar chart of items included in the questionnaire. (**B**) Bivariate correlations between constructs and sample variables. INT = intention to use MV; ATT = attitude toward MV; TR = trust in MV technology; EXP = clinical expertise composite; Edu = education.

4.3 Structural Equation Model

The structural equation model was estimated using maximum likelihood with bootstrapping (k = 5,000), consistent with the non-normality of the data identified in the preliminary analysis. The overall fit of the structural model was satisfactory (χ^2/df = 3.053; CFI = .914; NFI = .878; TLI = .904; SRMR = .044), meeting the conventional thresholds recommended in the literature [28,32,41], with the exception of RMSEA (.093), which slightly exceeded the .08 threshold but remained within acceptable limits for models of this complexity [28].

Regarding the structural paths, perceived clinical expertise with MV was significantly and positively associated with trust in MV technology (β = .664, SE = .067, $p < .001$), supporting H2. Trust in technology, in turn, was significantly associated with attitude toward MV (β = .342, SE = .054, $p < .001$), in line with H3. Attitude toward MV was a significant predictor of the intention to use MV (β = .418, SE = .082, $p < .001$), confirming H4. Additionally, a significant direct effect of expertise on intention was found (β = .411, SE = .067, $p < .001$), supporting H1. These results are summarized in Table 5.

With respect to the serial mediation hypothesis (H5), the indirect effect of expertise on intention through trust and attitude was significant (indirect effect = .095, 95% CI [.041, .158], $p < .001$), as estimated via the bootstrapping procedure. The total effect of expertise on intention was .506 ($p < .001$), reflecting the combined direct and indirect pathways. These results indicate a significant serial indirect association between clinical expertise and intention to use MV via trust in MV technology and attitude

toward MV, consistent with the proposed serial mediation model; given the concurrent measurement of these constructs, the indirect effect is not interpreted as evidence of causal transmission.

Table 5 Results of the Structural Equation Model

Path	*Std. β*	*SE*	*p*
Direct effects			
EXP → TR	.664	.067	< .001
TR → ATT	.342	.054	< .001
ATT → INT	.418	.082	< .001
EXP → INT	.411	.067	< .001
Indirect effects (serial mediations)			
EXP → TR → ATT → INT	.095	.030	< .001
Total effect			
EXP → INT	.506	–	< .001

Notes: EXP = clinical expertise; TR = trust in MV technology; ATT = attitude toward MV; INT = intention to use MV. Unstandardized (Estimate) and standardized (Std. β) coefficients reported; N = 236. Bootstrap 95% confidence intervals (k = 5,000) for indirect effects.

4.4 Multigroup analysis and moderation by emergency severity

The role of emergency severity (H6) was examined through two complementary approaches. First, a moderation analysis using a product indicator approach [33] was conducted on the full sample (N = 236), with severity operationalised as an ordinal variable (Scenario D = 1, Scenario C = 2, Scenario B = 3, Scenario A = 4) reflecting the acuity gradient of the Manchester Triage System. Gender, age, and educational level were included as control variables in all models.

The moderation analysis provided partial and exploratory support for H6 (Table 6). The interaction term EXP×Severity on the direct EXP→INT path was significant and positive (β = .125, SE = .057, t = 2.195, p = .029), indicating that expertise exerts a stronger direct influence on intention under maximum-severity conditions (β = .568 at +1SD) than under lower-severity conditions (β = .318 at −1SD), consistent with the proposition that expert automaticity dominates under extreme time pressure. Emergency severity also significantly moderated the TR→ATT path (β = −.129, SE = .063, t = −2.029, p = .044): simple slope analysis revealed that the effect of trust on attitude was stronger under lower-severity conditions (β = .416 at −1SD) than under higher-severity conditions (β = .158 at +1SD), consistent with the proposition that extreme time pressure attenuates the deliberative process through

which trust consolidates into a positive evaluative stance toward MV. The interaction EXP×Severity on TR showed a marginal positive trend (β = .084, p = .093), while ATT×Severity on INT was not significant (β = −.049, p = .256), suggesting that once attitude is formed, its translation into intention remains stable across severity levels. Among the control variables, age was a significant negative predictor of trust (β = −.192, p < .001) and of intention in the direct path model (β = −.201, p < .001), while gender significantly predicted intention (β = −.160, p < .001), with male nurses reporting stronger intention to use MV. Because severity significantly moderated the TR→ATT path, which lies on the serial indirect pathway, the index of moderated mediation [34] was computed as the product of the EXP→TR path, the TR×Severity interaction, and the ATT→INT path, with a Monte Carlo confidence interval (20,000 draws) [45]. The index was negative and its confidence interval excluded zero (index = −.036, 95% CI [−.078, −.002]), indicating that the serial indirect association between expertise and intention weakened as severity increased: the conditional indirect effect was .115 at low severity (−1SD) and .044 at high severity (+1SD).

The omnibus chi-square difference test was not significant ($\Delta\chi^2(12) = 17.154$, p = .144), suggesting overall path stability across scenario conditions. This result should be interpreted with caution given the limited statistical power of the subgroup models (n = 51–81). As an exploratory and descriptive complement, inspection of the per-scenario coefficients revealed patterns consistent with H6 (Table 6): the EXP→INT direct path decreased from β = .620 in Scenario A (highest severity) to β = .189 in Scenario C, while the TR→ATT path increased monotonically from β = .206 in Scenario A to β = .566 in Scenario D (lowest severity). These descriptive patterns are consistent with the significant interactions identified in the moderation analysis and lend suggestive support to H6 but should be replicated in larger samples before definitive conclusions are drawn.

Table 6. Moderation and multigroup analysis: emergency severity as moderator (N = 236)

	β	*SE*	*t* / $\Delta\chi^2$	*p*
Omnibus path stability test (constrained vs. unconstrained model)				
All scenarios (A, B, C, D)	—	—	$\Delta\chi^2(12) = 17.154$	.144
Moderation analysis: interaction terms (product indicator approach)				
TR × Severity → ATT	−.129	.063	−2.029	.044*
EXP × Severity → INT (direct)	.125	.057	2.195	.029*

EXP × Severity → TR	.084	.050	1.687	.093 ns
ATT × Severity → INT	−.049	.043	−1.138	.256 ns
Simple slopes				
	High Severity (+1SD)		*Low Severity (−1SD)*	
TR → ATT	.158		.416	
EXP → INT (direct)	.568		.318	
Per-scenario standardized β (descriptive)				
	Sc. A (n=81)	*Sc. B (n=52)*	*Sc. C (n=51)*	*Sc. D (n=52)*
EXP → TR	.668	.764	.549	.645
TR → ATT	.206	.260	.412	.566
ATT → INT	.270	.373	.541	.512
EXP → INT (direct)	.620	.417	.189	.343

*Notes: β = standardized coefficient; SE = standard error. Moderation analysis based on product indicator approach [33]; gender, age, and educational level included as controls. Severity: 1 = Scenario D (orange) to 4 = Scenario A (red, highest acuity). Simple slopes computed at ±1SD of Severity. Per-scenario β derived from multigroup model using observed EXP composite (mean of 15 items). Sc. A = cardiorespiratory arrest; Sc. B = severe hypoxaemia; Sc. C = chest trauma; Sc. D = acute pulmonary oedema. * p < .05; ns = not significant.*

5. Discussion

This study examined the behavioral determinants of nurses' intention to use mechanical ventilation in emergency settings, proposing and testing a moderated serial mediation model. The findings contribute to the literature on healthcare technology adoption by showing that perceived clinical expertise, trust in technology, and attitude toward MV are jointly and sequentially associated with nurses' behavioral intentions, and that the pattern of these associations varies with the severity of the emergency context. With respect to the direct and mediated paths (H1–H5), results from the full structural equation model are consistent with the proposed framework. Expertise emerged as a significant direct predictor of intention and was also indirectly associated with it through the sequential pathway involving trust and attitude. This finding aligns with theoretical accounts of expertise as a multi-layered cognitive resource that facilitates both automatic and deliberative decision-making. High-expertise nurses, by virtue of their deeper familiarity, elaboration capacity, and clinical memory, reported greater trust in MV devices and more favorable evaluations of their utility, which were in turn associated with a stronger intent to use them in critical situations.

The significant indirect effect of expertise on intention through trust and attitude (indirect β = .095, p < .001) is consistent with the conceptual proposition that part of the association between

competence and intention runs through affective-evaluative appraisals, although the larger share of the total effect remained direct (.411 of .506). Trust, as an affective-cognitive response to accumulated experience and device-related information, may bridge the gap between what nurses know and what they favorably evaluate, and attitude toward MV may crystallize this appraisal into a dispositional readiness to act. Because these constructs were measured concurrently, alternative orderings (e.g., favorable attitudes fostering trust, or trust reinforcing perceived expertise) cannot be ruled out, and the serial pathway should be regarded as a theoretically informed account awaiting longitudinal or experimental confirmation. These findings are consistent with evidence in other healthcare technology contexts [8,12] and extend those findings to the specific domain of life-support device use under emergency conditions.

The direct effect of attitude on intention ($\beta = .418$) was among the strongest in the model, underscoring the central role of evaluative orientations in emergency nursing behavior. This result resonates with Ajzen's [5] foundational proposition that attitudes are among the most proximal determinants of behavioral intent and suggests that training and socialization efforts aimed at fostering positive evaluations of MV technology may yield meaningful improvements in adoption rates.

Regarding the moderating role of emergency severity (H6), the findings provide exploratory support. Two of the four interaction terms reached significance, consistent with the proposed moderation: the direct effect of expertise on intention (EXP→INT) was significantly stronger under higher-severity conditions, while the effect of trust on attitude (TR→ATT) was more strongly operative under lower-severity conditions, and the index of moderated mediation indicated that the serial indirect association weakened as severity increased. However, the remaining two interactions were non-significant, and the omnibus multigroup test did not reach significance. These results should be interpreted as suggestive rather than confirmatory: the pattern of evidence is theoretically coherent with the recognition-primed decision model [19] and dual-process theory [20] but warrants replication in larger samples with sufficient power for multigroup structural comparisons.

A noteworthy finding concerns the role of gender: male nurses reported significantly higher perceived expertise and stronger intention to use MV than female nurses, yet no significant gender differences were found for trust or attitude. This asymmetric pattern suggests that the gender gap in MV

adoption operates at the level of competence perception rather than affective-evaluative appraisal — male nurses may have greater confidence in their MV expertise without necessarily holding more positive attitudes toward the device. This finding aligns with broader literature on gender and self-assessed clinical competence [46] and suggests that targeted training interventions focused on building expertise self-efficacy among female nurses may be effective in reducing adoption disparities. Taken together, the findings highlight that nurses' propensity to use MV in emergencies is not a simple function of technical skill or device availability, but is embedded in a complex of perceptual, affective, and contextual factors. This has important implications for how healthcare organizations conceptualize and support technology adoption in high-stakes environments.

6. Implications

6.1 Theoretical implications

This research makes several theoretical contributions to the literature on behavioral intention and healthcare technology adoption. First, it extends Ajzen's [5] Theory of Planned Behavior to a clinical emergency domain characterized by high acuity, time pressure, and life-or-death consequences, demonstrating the framework's utility beyond its original consumer and organizational behavior contexts. Second, it integrates a multidimensional conceptualization of clinical expertise, drawing on the consumer expertise model of Kleiser and Mantel [6], into a healthcare behavioral model, thereby bridging the marketing and nursing literatures in a novel and theoretically productive way.

Third, the finding that trust in technology links expertise and attitude within a serial indirect pathway advances our understanding of how experience may relate to evaluative orientations. This has implications for technology acceptance models more broadly, suggesting that affective intermediaries such as trust may be relevant links in the chain between competence and attitude, even when attitudinal formation is not ordinarily the focus of expertise research. Fourth, the identification of scenario severity

as a contextual moderator contributes to the emerging literature on conditional technology adoption, supporting theoretical propositions about the differential role of deliberative versus automatic processing across urgency conditions.

6.2 Practical implications

The results of this study carry important practical implications for emergency nursing education, training, and clinical governance. The central role of expertise, acting both directly and indirectly through trust and attitude, underscores the value of deliberate practice and hands-on simulation training as potential levers for improving MV adoption. Training programs that move beyond procedural competence to cultivate deeper familiarity, analytical engagement with device features, and memory of clinical scenarios may be associated with stronger behavioral intentions in real emergencies.

The position of trust within the indirect pathway suggests that healthcare organizations should actively communicate device-related information, quality standards, and safety certifications to nursing staff. When nurses have greater confidence in the reliability, safety, and ease of use of MV devices, they may be more likely to translate expertise into favorable attitudes and ultimately into decisive action. Procurement processes and onboarding protocols should therefore include dedicated trust-building activities, such as extended hands-on familiarization sessions and post-incident debriefs that reinforce positive device-performance experiences.

The differences observed across emergency scenarios also have implications for scenario-based simulation design. Training programs that simulate lower-acuity emergencies should place particular emphasis on attitude formation and trust development, as these appear to be more closely associated with intention in such contexts. Conversely, maximum-acuity simulations should focus on building expertise to the point of automaticity, as this appears to be the pathway most strongly associated with intention under extreme time pressure. Tailoring training content to specific emergency types may therefore enhance its transferability to clinical practice.

6.3 Limitations and future research

Some limitations frame these findings and, more usefully, define the agenda they open. The cross-sectional design precludes causal inference: because expertise, trust, attitude, and intention were measured concurrently and only emergency severity was experimentally varied, the serial indirect effect reflects a pattern of associations consistent with the hypothesised sequence, not evidence of its temporal precedence or causal direction [18], and alternative orderings among the constructs remain plausible. In addition, the scenario-based vignette approach [23] and the exclusive reliance on self-report — although common method variance proved unproblematic [26,30] — capture intention rather than enacted behavior; recruitment through professional networks further constrained the power of the multigroup comparisons [27].

The most immediate direction is longitudinal and observational work following nurses from expertise acquisition through trust formation to documented device use, addressing the intention–behaviour gap inherent in the Theory of Planned Behavior [5]. Complementing perceived expertise with objective indicators — simulation performance, certification records, logged ventilator use — would clarify whether competence itself or its subjective appraisal drives trust [6,13], a distinction with direct consequences for training design. Equally promising is the experimental manipulation of clinical acuity in high-fidelity simulation, where psychophysiological indicators of cognitive load can be recorded alongside decision outcomes [7,19], testing more rigorously the exploratory moderation observed here and clarifying when trust becomes miscalibrated under pressure [14,15]. Cross-national replication would establish the boundary conditions of the model across regulatory regimes and technological cultures [10], while organizational and digital antecedents — peer norms, nurse–physician communication, digital health literacy, and telemedicine-integrated ventilation monitoring — offer a natural extension as emergency care continues to digitalize [9].

References

1. Rochwerg, B. et al. Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure. *Eur. Respir. J.* **50**, 1602426 (2017).
2. Soar, J. et al. European Resuscitation Council Guidelines 2021: adult advanced life support. *Resuscitation* **161**, 115–151 (2021).
3. Cheng, J. et al. Factors influencing nurses' behavioral intention toward caring for COVID-19 patients on mechanical ventilation: a cross-sectional study. *PLoS ONE* **16**, e0259658 (2021).
4. Surendran, A., Beccaria, L. & McIlveen, P. Cognitive burden in emergency care: a qualitative exploratory study of emergency nurses. *J. Nurs. Manag.* **2025**, 6332434 (2025).
5. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **50**, 179–211 (1991).
6. Kleiser, S. B. & Mantel, S. P. The dimensions of consumer expertise: a scale development. In *Proc. AMA Summer Educators' Conference* Vol. 5, 20–26 (1994).
7. Surendran, A., Beccaria, L., Rees, S. & McIlveen, P. Cognitive mental workload of emergency nursing: a scoping review. *Nurs. Open* **11**, e2111 (2024).
8. Ezeudoka, B. C. & Fan, M. Determinants of behavioral intentions to use an e-pharmacy service: insights from TAM theory and the moderating influence of technological literacy. *Res. Soc. Adm. Pharm.* **20**, 605–617 (2024).
9. Qiu, R. et al. From awareness to adoption: a panoramic perspective on the utilization of Internet Medical Services among Chinese patients with chronic disease. *BMC Health Serv. Res.* **25**, 1415 (2025).
10. Senthilrajah, T. & Ahangama, S. The Sri Lankan enigma: demystifying public healthcare information systems acceptance. *BMC Health Serv. Res.* **25**, 24 (2025).
11. Davis, F. D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* **13**, 319–340 (1989).
12. van Velsen, L., Tabak, M. & Hermens, H. Measuring patient trust in telemedicine services: development of a survey instrument and its validation for an anticoagulation web-service. *Int. J. Med. Inform.* **97**, 52–58 (2017).

13. Alba, J. W. & Hutchinson, J. W. Dimensions of consumer expertise. *J. Consum. Res.* **13**, 411–454 (1987).

14. Lee, J. D. & See, K. A. Trust in automation: designing for appropriate reliance. *Hum. Factors* **46**, 50–80 (2004).

15. Hoff, K. A. & Bashir, M. Trust in automation: integrating empirical evidence on factors that influence trust. *Hum. Factors* **57**, 407–434 (2015).

16. Gefen, D. E-commerce: the role of familiarity and trust. *Omega* **28**, 725–737 (2000).

17. Voss, K. E., Spangenberg, E. R. & Grohmann, B. Measuring the hedonic and utilitarian dimensions of consumer attitude. *J. Mark. Res.* **40**, 310–320 (2003).

18. Maxwell, S. E. & Cole, D. A. Bias in cross-sectional analyses of longitudinal mediation. *Psychol. Methods* **12**, 23–44 (2007).

19. Klein, G. *Sources of Power: How People Make Decisions* (MIT Press, 1999).

20. Evans, J. St. B. T. Dual-processing accounts of reasoning, judgment, and social cognition. *Annu. Rev. Psychol.* **59**, 255–278 (2008).

21. Preacher, K. J. & Hayes, A. F. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav. Res. Methods* **40**, 879–891 (2008).

22. Kline, R. B. *Principles and Practice of Structural Equation Modeling* 4th edn (Guilford Press, 2015).

23. Aguinis, H. & Bradley, K. J. Best practice recommendations for designing and implementing experimental vignette methodology studies. *Organ. Res. Methods* **17**, 351–371 (2014).

24. Australasian College for Emergency Medicine. *Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments* (ACEM, 2016).

25. ATLS Subcommittee, American College of Surgeons' Committee on Trauma & International ATLS Working Group. Advanced trauma life support (ATLS®): the ninth edition. *J. Trauma Acute Care Surg.* **74**, 1363–1366 (2018).

26. Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y. & Podsakoff, N. P. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* **88**, 879–903 (2003).

27. Westland, J. C. Lower bounds on sample size in structural equation modeling. *Electron. Commer. Res. Appl.* **9**, 476–487 (2010).

28. Hair, J. F., Sarstedt, M., Ringle, C. M. & Mena, J. A. An assessment of the use of partial least squares structural equation modeling in marketing research. *J. Acad. Mark. Sci.* **40**, 414–433 (2012).

29. Mardia, K. V. Measures of multivariate skewness and kurtosis with applications. *Biometrika* **57**, 519–530 (1970).

30. Richardson, H. A., Simmering, M. J. & Sturman, M. C. A tale of three perspectives: examining post hoc statistical techniques for detection and correction of common method variance. *Organ. Res. Methods* **12**, 762–800 (2009).

31. Fornell, C. & Larcker, D. F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **18**, 39–50 (1981).

32. Hu, L. & Bentler, P. M. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* **6**, 1–55 (1999).

33. Marsh, H. W., Wen, Z. & Hau, K. T. Structural equation models of latent interactions: evaluation of alternative estimation strategies and indicator construction. *Psychol. Methods* **9**, 275–300 (2004).

34. Hayes, A. F. An index and test of linear moderated mediation. *Multivar. Behav. Res.* **50**, 1–22 (2015).

35. Cain, M. K., Zhang, Z. & Yuan, K.-H. Univariate and multivariate skewness and kurtosis for measuring nonnormality: prevalence, influence and estimation. *Behav. Res. Methods* **49**, 1716–1735 (2017).

36. Henseler, J., Hubona, G. & Ray, P. A. Using PLS path modeling in new technology research: updated guidelines. *Ind. Manag. Data Syst.* **116**, 2–20 (2016).

37. Rigdon, E. E. Rethinking partial least squares path modeling: in praise of simple methods. *Long Range Plan.* **45**, 341–358 (2012).

38. Sarstedt, M., Hair, J. F., Ringle, C. M., Thiele, K. O. & Gudergan, S. P. Estimation issues with PLS and CBSEM: where the bias lies! *J. Bus. Res.* **69**, 3998–4010 (2016).

39. Nunnally, J. C. *Psychometric Theory* 3rd edn (McGraw-Hill, 1994).

40. Grewal, R., Cote, J. A. & Baumgartner, H. Multicollinearity and measurement error in structural equation models: implications for theory testing. *Mark. Sci.* **23**, 519–529 (2004).

41. Anderson, J. C. & Gerbing, D. W. Structural equation modeling in practice: a review and recommended two-step approach. *Psychol. Bull.* **103**, 411–423 (1988).

42. Bentler, P. M. & Bonett, D. G. Significance tests and goodness of fit in the analysis of covariance structures. *Psychol. Bull.* **88**, 588–606 (1980).

43. Byrne, B. M. *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming* 2nd edn (Routledge, 2010).

44. Hoe, S. L. Issues and procedures in adopting structural equation modelling technique. *J. Appl. Quant. Methods* **3**, 76–83 (2008).

45. Preacher, K. J. & Selig, J. P. Advantages of Monte Carlo confidence intervals for indirect effects. *Commun. Methods Meas.* **6**, 77–98 (2012).

46. Bandura, A. *Self-Efficacy: The Exercise of Control* (Freeman, 1997).