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Development and Validation of an Integrated Electronic Patient Progress Note-Based Healthcare Evaluation Instrument for Diabetes Management

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ABSTRACT

Purpose of the study: This research sought to design and rigorously evaluate an Integrated Electronic Progress Note instrument intended to support frailty risk monitoring and strengthen care coordination among older adults.

Methodology: A methodological research approach was undertaken, beginning with conceptual framework development and item generation, followed by expert review for content adequacy and empirical validation. Data were obtained from 210 healthcare professionals alongside 320 de-identified electronic progress notes collected at Uzsoki Street Hospital. Psychometric evaluation included content validity indexing, internal consistency assessment, and construct validation using Partial Least Squares Structural Equation Modeling with bootstrapping procedures to test structural relationships.

Main Findings: The developed instrument demonstrated high content agreement among experts (S-CVI = 0.93) and strong reliability indicators, with composite reliability values exceeding 0.90. Convergent validity met recommended thresholds (AVE > 0.50), while discriminant validity was confirmed through HTMT ratios below 0.90. The structural analysis indicated that the model accounted for 68% of the variance in documentation quality (R^2 = 0.68) and showed meaningful predictive capability (Q^2 = 0.49). Among the examined constructs, Care Coordination exerted the most substantial positive influence on documentation quality (β = 0.41, $p < 0.001$). Furthermore, improved documentation performance was significantly linked to a lower likelihood of 30-day readmission ($\beta = -0.32$, $p < 0.01$).

Novelty/Originality of this study: This study presents a validated multidimensional measurement tool that connects frailty risk assessment elements with the quality evaluation of electronic clinical documentation, thereby advancing the integration of geriatric clinical assessment and digital health governance frameworks.

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1. INTRODUCTION

The ongoing shift in global population structure toward an increasingly older society poses substantial pressure on modern healthcare systems. As life expectancy continues to rise across regions, the number of adults aged 60 years and above is expanding at an unprecedented pace [1]-[3]. This demographic change is closely linked to a growing prevalence of chronic diseases, progressive functional limitations, and age-related clinical

syndromes [4]-[6]. Frailty is strongly associated with falls, hospitalization, institutionalization, prolonged length of stay, and mortality [7]-[9]. As healthcare systems shift toward value-based and person-centered models, the need for systematic frailty risk monitoring and coordinated care strategies in aging populations becomes increasingly urgent.

Frailty is not merely a clinical diagnosis but a dynamic condition that evolves over time and across care settings [10]-[12]. Its identification requires longitudinal assessment of physical, cognitive, psychological, and social domains [13]-[15]. However, in routine clinical practice, frailty risk is often under-recognized or inconsistently documented [11]-[17]. Fragmented documentation across disciplines hinders comprehensive risk profiling and delays preventive interventions [18], [19]. The absence of structured, integrated documentation mechanisms limits clinicians' ability to detect early deterioration and coordinate timely multidisciplinary responses. Consequently, older adults at high risk frequently experience preventable complications that strain both healthcare resources and family support systems.

Nursing documentation plays a pivotal role in capturing patient status, clinical reasoning, and care interventions, particularly in complex geriatric cases [20], [21]. High-quality documentation ensures continuity of care, facilitates interprofessional communication, and provides a legal and professional record of services delivered [22], [23]. In aging populations, where care trajectories are often nonlinear and multifaceted, systematic documentation becomes essential for tracking functional changes and evaluating outcomes over time [24]. Nevertheless, persistent challenges remain, including incomplete entries, inconsistent terminology, and limited integration between nursing notes and other professional records. These deficiencies compromise the reliability of documentation as a foundation for frailty risk monitoring.

The transition toward electronic health records has been promoted as a strategy to enhance documentation quality and interoperability. Integrated electronic progress notes enable multiple healthcare professionals to document patient assessments, plans, and evaluations within a unified system, often structured around standardized frameworks such as SOAP (Subjective, Objective, Assessment, Plan) [25], [26]. Such integration has demonstrated potential benefits in improving communication efficiency and reducing information silos [27]-[29]. However, most implementations prioritize usability and workflow optimization rather than the development of psychometrically sound instruments to evaluate the quality and clinical relevance of documented content, particularly in relation to frailty risk assessment.

The research gap becomes more pronounced within the context of integrated electronic progress note systems. Existing studies Colucci et al., [30] predominantly focus on general documentation completeness or user satisfaction, with limited attention to multidimensional constructs such as frailty risk monitoring, interdisciplinary coordination, and longitudinal care planning. Furthermore, few studies have applied rigorous psychometric validation procedures including construct validity, reliability testing, and structural modeling to develop standardized instruments tailored to aging populations [31]. This gap restricts the capacity of health information management systems to support proactive, data-driven decision-making in geriatric care [32], [33].

The urgency of addressing this gap is amplified by the economic and societal implications of frailty. Unmanaged frailty contributes to avoidable hospital readmissions, increased healthcare expenditures, and reduced quality of life among older adults. In aging societies, sustainable health system performance depends on early detection, preventive strategies, and coordinated interventions across primary, secondary, and community care settings [34], [35]. An integrated electronic progress note based instrument specifically designed to evaluate frailty risk documentation could serve as a strategic tool for quality assurance, clinical governance, and resource optimization [36]. Such an instrument aligns with contemporary priorities in health information management, including interoperability, standardization, and outcome-based performance measurement.

The novelty of this study lies in the development and psychometric validation of an integrated electronic progress note based instrument specifically designed for frailty risk monitoring and care coordination in aging populations. Unlike previous tools that focus solely on clinical screening or generic documentation audits, the proposed instrument integrates multidimensional frailty indicators with structured evaluation of interdisciplinary care planning and follow-up documentation. By embedding frailty constructs within an electronic documentation framework, this study bridges the gap between clinical assessment and health information quality measurement.

Methodologically, this research advances the field by employing comprehensive psychometric testing to ensure construct validity, internal consistency, and structural robustness of the instrument. Through rigorous validation procedures, the study establishes empirical evidence supporting the reliability and applicability of the tool across healthcare settings serving older adults [35]-[38]. This approach responds directly to calls within nursing informatics and health information management literature for standardized, evidence-based evaluation frameworks capable of supporting digital transformation in geriatric care [39], [40].

Therefore, the primary objective of this study is to develop and psychometrically validate an integrated electronic progress note based instrument for frailty risk monitoring and care coordination in aging populations. Specifically, the study aims to (1) construct a theoretically grounded instrument reflecting multidimensional frailty and coordination constructs, (2) evaluate its validity and reliability using advanced statistical modeling,

and (3) provide a standardized evaluation framework to enhance documentation quality and support proactive, coordinated care for older adults. By addressing critical gaps in documentation evaluation and frailty management, this research seeks to contribute to the advancement of health information management practices and to strengthen patient-centered care in rapidly aging societies.

2. RESEARCH METHOD

2.1 Study Design and Setting

This study employed a methodological research design consisting of instrument development and psychometric validation [41]-[43]. The study was conducted at Uzsoki Street Hospital, a tertiary care teaching hospital in Budapest that provides comprehensive services for adult and geriatric populations. The hospital has implemented an integrated electronic health record (EHR) system with structured electronic progress notes used collaboratively by physicians, nurses, and allied health professionals. This setting was considered appropriate due to its high volume of older adult patients, multidisciplinary care pathways, and established digital documentation infrastructure [44], which allowed for systematic evaluation of frailty-related documentation practices. Data collection was carried out between January and June 2025 across selected inpatient medical and geriatric units. The study focused on electronic progress notes documenting care for patients aged 60 years and older who were admitted for acute or chronic medical conditions.

2.2 Instrument Development Process

The development of the integrated electronic progress note–based frailty monitoring instrument (IEPN-FMI) followed a multi-stage process to ensure conceptual rigor and empirical robustness. First, a comprehensive literature review was conducted to identify core constructs of frailty, geriatric risk indicators, and interdisciplinary care coordination domains. The conceptual framework integrated multidimensional frailty components (physical, cognitive, psychological, and social vulnerability) with documentation quality indicators (completeness, clarity, timeliness, interdisciplinary integration, and continuity planning).

In the second phase, 52 preliminary statements were developed and organized into three core constructs: Frailty Risk Identification, Ongoing Clinical Monitoring and Reassessment, and Care Coordination with Continuity Planning. The statements were intentionally designed to capture the presence and quality of documentation within the electronic progress note system, focusing on recorded clinical evidence rather than direct bedside assessment outcomes. Responses for each statement were rated on a five-level Likert format, ranging from 1 indicating absence of documentation to 5 indicating thorough, structured, and consistent documentation.

The third phase involved evaluation of content adequacy through a structured expert appraisal process. Five specialists with backgrounds in geriatric nursing, health information management, and clinical governance participated in the review. Content validity was quantified using the Content Validity Index at both the individual item and overall scale levels. Items that did not reach the acceptable agreement threshold (I-CVI < 0.78) were either refined for improved clarity or excluded from the instrument to strengthen conceptual alignment and measurement relevance. Before proceeding to empirical testing, the finalized domains and their conceptual definitions are presented in Table 1 to clarify the theoretical structure underpinning the instrument [45], [46].

Table 1. Domains and Constructs of the IEPN-FMI Instrument

Domain	Construct Description	Number of Items
Frailty Risk Identification	Documentation of multidimensional frailty indicators (mobility decline, polypharmacy risk, cognitive changes, nutritional status, social vulnerability)	18
Clinical Monitoring and Reassessment	Evidence of ongoing frailty monitoring, symptom progression tracking, and structured reassessment	16
Care Coordination and Continuity Planning	Interdisciplinary communication, discharge planning, referral documentation, and follow-up coordination	14
Total		48 items

As shown in Table 1, the final instrument consisted of 48 items distributed across three theoretically grounded domains. This structure ensured comprehensive evaluation of frailty-related documentation within integrated electronic progress notes.

2.3 Participants and Sampling

The validation phase involved two distinct samples: expert respondents for construct validation and electronic record samples for field testing. For construct validation using structural modeling, nurses and clinical documentation officers working in geriatric and internal medicine wards were recruited using purposive sampling. Inclusion criteria included a minimum of two years of clinical experience and routine use of the electronic progress note system. A total of 210 respondents participated, exceeding the minimum recommended sample size for partial least squares structural equation modeling (PLS-SEM), which requires at least 10 times the maximum number of structural paths directed at any construct. For documentation audit analysis, 320 anonymized electronic progress notes of patients aged ≥60 years were randomly selected from hospital records to evaluate instrument applicability and scoring stability.

2.4 Data Collection Procedures

Following institutional approval, eligible participants were invited to complete the IEPN-FMI instrument by evaluating anonymized electronic progress note excerpts. Training sessions were conducted to standardize interpretation of scoring criteria and minimize inter-rater variability [47]-[49]. For documentation audit purposes, patient identifiers were removed to ensure confidentiality. The evaluation focused exclusively on documented evidence within the electronic progress note system rather than direct patient assessment. This approach aligned with the study objective of assessing documentation quality and integration rather than clinical frailty diagnosis.

2.5 Construct Validation and Psychometric Testing

Psychometric evaluation was conducted in several stages to ensure methodological transparency and robustness. Preliminary data screening included assessment of missing values (<3%), normality (skewness ±2; kurtosis ±7), and multicollinearity (Variance Inflation Factor <3.3). Construct validity and internal consistency were examined through partial least squares structural equation modeling using SmartPLS. The measurement model was specified as reflective and evaluated through several quality indicators. Indicator reliability was confirmed by examining outer loadings, with values close to or above 0.70 considered acceptable. Internal consistency was assessed[i] through both composite reliability and cronbach's alpha, ensuring that construct reliability met established adequacy standards. Convergent validity was determined by calculating the average variance extracted, with values exceeding 0.50 indicating that the constructs explained more than half of the variance of their indicators.

Discriminant validity was verified using complementary approaches, including comparison of the square root of AVE across constructs and examination of the Heterotrait–Monotrait ratio to ensure that inter-construct correlations remained within acceptable limits. The structural model was subsequently analyzed to determine the strength and significance of hypothesized relationships. Path coefficients were tested using a bootstrapping procedure with 5,000 resamples to obtain stable standard errors and confidence intervals. Model explanatory power was evaluated using the coefficient of determination (R^2), while effect size (f^2) analysis assessed the relative contribution of each predictor construct.

For clarity and methodological transparency, the benchmark values applied for evaluating measurement and structural model adequacy are presented in Table 2.

Table 2. Psychometric Evaluation Criteria

Parameter	Acceptable Threshold	Interpretation
Factor Loading	≥ 0.70	Indicator reliability
Cronbach's Alpha	≥ 0.70	Internal consistency
Composite Reliability	≥ 0.70	Construct reliability
AVE	≥ 0.50	Convergent validity
HTMT Ratio	< 0.90	Discriminant validity
VIF	< 3.3	Absence of multicollinearity

These criteria reflect internationally recognized standards for instrument validation in health services research and health information management.

2.6 Methodological Rigor

To enhance reliability and minimize bias, inter-rater reliability testing was conducted on 10% of audited records using intraclass correlation coefficients (ICC). Additionally, pilot testing was performed prior to full-scale data collection to refine item clarity and scoring guidelines. The study adhered to established reporting standards for instrument development and validation studies in healthcare research.

2.7 Ethical Considerations

Participation of healthcare professionals was voluntary, and written informed consent was secured. Electronic patient records were anonymized before analysis to protect confidentiality in accordance with institutional and European data protection regulations.

3. RESULTS AND DISCUSSION

3.1 Preliminary Analysis

A total of 210 healthcare professionals participated in the construct validation phase, yielding a response rate of 93.7%. Respondents were predominantly registered nurses (71.4%), followed by clinical documentation officers (18.1%) and interdisciplinary care coordinators (10.5%). The mean professional experience was 8.6 years (SD = 3.9), indicating adequate familiarity with the electronic progress note system. Missing data accounted for less than 2.1% across items and were handled using mean substitution, as the proportion was below the acceptable threshold. Normality assessment showed skewness values ranging from –1.21 to 1.34 and kurtosis from –1.85 to 2.76, indicating acceptable distributional properties. Variance Inflation Factor (VIF) values ranged from 1.21 to 2.88, confirming the absence of multicollinearity.

3.2 Content Validity

Content validation was conducted by a five-member expert panel. After two rounds of review, four items were removed due to conceptual redundancy and insufficient clarity, resulting in a final 48-item instrument.

Table 3. Content Validity Results

Domain	I-CVI Range	S-CVI/Ave	Interpretation
Frailty Risk Identification	0.80–1.00	0.94	Excellent
Clinical Monitoring and Reassessment	0.82–1.00	0.93	Excellent
Care Coordination and Continuity Planning	0.78–1.00	0.92	Excellent
Overall Scale		0.93	Highly valid

As presented in table 3, all domains demonstrated strong content validity, with scale-level content validity index (S-CVI/Ave) values exceeding 0.90, indicating excellent expert agreement regarding relevance and clarity.

3.3 Measurement Model Evaluation

Construct validity and reliability were assessed using partial least squares structural equation modeling (PLS-SEM). Indicator loadings were examined first. Of the 48 items, 44 demonstrated loadings ≥0.70. Four items with loadings between 0.60 and 0.69 were retained due to theoretical relevance and acceptable composite reliability.

Table 4. Convergent Validity and Reliability

Construct	Cronbach's Alpha	Composite Reliability (CR)	AVE
Frailty Risk Identification	0.94	0.95	0.58
Clinical Monitoring and Reassessment	0.92	0.94	0.56
Care Coordination and Continuity Planning	0.91	0.93	0.55

As presented in Table 4, both cronbach's alpha and composite reliability coefficients were greater than 0.90 across all measured constructs, indicating a strong level of internal consistency among the items. In addition, the average variance extracted values surpassed 0.50, suggesting that each construct adequately captured the variance of its respective indicators and supporting evidence of convergent validity.

3.4 Discriminant Validity

To examine whether each construct was empirically distinct from the others, discriminant validity was evaluated using two complementary approaches, namely comparison of the square root of AVE with inter-construct correlations and assessment of the heterotrait–monotrait ratio.

Table 5. HTMT Ratio Results

Constructs Compared	HTMT Value	Threshold (<0.90)	Interpretation
Frailty Risk Identification – Clinical Monitoring	0.74	<0.90	Adequate
Frailty Risk Identification – Care Coordination	0.69	<0.90	Adequate
Clinical Monitoring – Care Coordination	0.77	<0.90	Adequate

All HTMT values were below 0.90, indicating satisfactory discriminant validity. The fornell larcker criterion further confirmed that the square root of AVE for each construct exceeded inter-construct correlations.

3.5 Structural Model

The structural model was evaluated to examine the predictive relationships between frailty documentation components and overall documentation quality. Bootstrapping with 5,000 subsamples was conducted to assess path significance.

Table 6. Structural Model Path Coefficients

Path	β	t-value	p-value	Effect Size (f^2)
Frailty Risk Identification → Documentation Quality	0.38	6.12	<0.001	0.19 (medium)
Clinical Monitoring → Documentation Quality	0.29	4.87	<0.001	0.13 (small–medium)
Care Coordination → Documentation Quality	0.41	7.03	<0.001	0.22 (medium)

All hypothesized paths were statistically significant ($p < 0.001$). Care Coordination and Continuity Planning demonstrated the strongest influence on overall documentation quality ($\beta = 0.41$), followed by Frailty Risk Identification ($\beta = 0.38$). The model explained 68% of the variance in documentation quality ($R^2 = 0.68$), indicating substantial explanatory power. Predictive relevance assessed using blindfolding produced $Q^2 = 0.49$, confirming strong predictive capability. To ensure scoring stability, 10% of electronic progress notes (n = 32) were independently evaluated by two raters. The intraclass correlation coefficient (ICC) was 0.87 (95% CI: 0.81–0.92), indicating excellent agreement.

3.6 Documentation Audit Findings

A total of 320 anonymized electronic progress notes of patients aged ≥60 years were analyzed using the validated instrument. The mean overall documentation quality score was 3.72 (SD = 0.61) on a 5-point scale, reflecting moderate-to-high documentation performance.

Table 7. Documentation Performance by Domain

Domain	Mean Score	SD	Interpretation
Frailty Risk Identification	3.54	0.68	Moderate
Clinical Monitoring and Reassessment	3.61	0.64	Moderate–High
Care Coordination and Continuity Planning	4.01	0.59	High

As shown in table 7, care coordination and continuity planning achieved the highest mean score (4.01), suggesting stronger documentation practices in interdisciplinary communication and discharge planning. In contrast, Frailty Risk Identification received comparatively lower scores, indicating gaps in systematic recording of multidimensional frailty indicators such as cognitive decline and social vulnerability. Further analysis demonstrated that higher documentation scores were significantly associated with reduced 30-day readmission risk among audited cases ($\beta = –0.32$, $p < 0.01$). Records with comprehensive frailty monitoring documentation were 21% less likely to be associated with documented adverse clinical outcomes during hospitalization.

Empirical application within Uzsoki Street Hospital confirmed that while interdisciplinary care coordination documentation is relatively strong, frailty risk identification remains inconsistently recorded. Overall, these findings support the psychometric robustness and practical applicability of the IEPN-FMI instrument for systematic frailty risk monitoring and care coordination evaluation in aging populations.

This study aimed to develop and psychometrically validate an Integrated Electronic Progress Note–Based Instrument for Frailty Risk Monitoring and Care Coordination in aging populations. The findings demonstrate that the instrument possesses strong content validity (S-CVI = 0.93), high internal consistency (CR > 0.90), adequate convergent validity (AVE > 0.50), satisfactory discriminant validity (HTMT < 0.90), and substantial explanatory power ($R^2 = 0.68$). Moreover, empirical application within Uzsoki Street Hospital revealed meaningful variation in documentation performance across domains, with care coordination scoring highest and frailty risk identification remaining comparatively weaker. These results collectively affirm the

robustness and practical utility of the instrument while simultaneously highlighting structural gaps in frailty-related documentation within integrated electronic systems.

From a health information management perspective, the findings address a critical gap in prior research. Previous studies Olufisayo et al. [50] on electronic nursing documentation and integrated progress notes have largely concentrated on usability, workflow efficiency, and general completeness indicators. While these contributions are valuable, they insufficiently capture multidimensional constructs such as frailty vulnerability and interdisciplinary coordination quality [35], [51]. Existing frailty tools primarily function as clinical screening instruments and are not designed to evaluate how systematically frailty-related information is documented within electronic progress notes. Consequently, health systems lack validated measurement tools that bridge clinical frailty assessment with documentation quality assurance. This study responds directly to that gap by operationalizing frailty risk monitoring as a measurable documentation construct embedded within electronic health records, thereby extending the scope of health informatics evaluation beyond surface-level completeness metrics.

The structural model findings further reinforce the strategic importance of documentation integration [52], [53]. Care Coordination and Continuity Planning demonstrated the strongest effect on overall documentation quality ($\beta = 0.41$), underscoring the centrality of interdisciplinary communication in geriatric care. This aligns with health management theories emphasizing continuity of care as a determinant of system performance, especially in aging populations characterized by multimorbidity and functional decline [54], [55]. However, the comparatively lower mean score in Frailty Risk Identification (3.54) reveals a systemic weakness in the systematic recording of multidimensional vulnerability indicators. This particularly concerning given the established association between frailty and adverse outcomes such as readmissions, prolonged hospitalization, and mortality. In this study, higher documentation quality was significantly associated with reduced 30-day readmission risk ($\beta = –0.32$), suggesting that documentation performance is not merely administrative but clinically consequential.

The novelty of this research lies in its integration of three previously disconnected domains: frailty risk constructs, electronic progress note evaluation, and psychometrically validated measurement modeling. Unlike prior studies that treat documentation as a binary variable (complete/incomplete), the present instrument conceptualizes documentation as a multidimensional, performance-based construct grounded in health information governance principles [56], [57]. The use of PLS-SEM to validate structural relationships among frailty monitoring, clinical reassessment, and care coordination further advances methodological rigor in health information management research. By demonstrating strong predictive relevance ($Q^2 = 0.49$), the study establishes the instrument not only as a descriptive audit tool but also as a predictive quality management framework capable of informing data-driven decision-making.

The short-term implications of these findings are immediately actionable within hospital management systems. First, the validated instrument can serve as a standardized audit framework to evaluate frailty-related documentation performance across units. This supports internal quality assurance, targeted staff training, and refinement of electronic documentation templates. Second, identifying domain-specific weaknesses particularly in frailty risk identification enables managers to implement focused interventions, such as structured frailty checklists or automated prompts within electronic progress notes. Third, the demonstrated association between documentation quality and reduced readmission risk highlights the instrument's potential role in strengthening patient safety and reducing avoidable hospital utilization, which is directly aligned with performance-based reimbursement models.

The long-term implications extend to system-level transformation in aging care management. As health systems increasingly adopt value-based and outcome-oriented frameworks, reliable documentation metrics become essential for benchmarking, accreditation, and policy evaluation. A psychometrically sound frailty documentation instrument supports interoperability and standardization across institutions, facilitating comparative performance analysis and national-level quality reporting. Furthermore, embedding frailty monitoring indicators within electronic documentation infrastructures lays the groundwork for predictive analytics and artificial intelligence integration. Over time, structured documentation data can inform risk stratification algorithms, resource allocation models, and population health management strategies targeting vulnerable older adults [58].

Thus, this instrument contributes not only to micro-level clinical governance but also to macro-level health system sustainability [59], [60]. Documentation culture, digital infrastructure maturity, and interdisciplinary workflows can vary significantly across institutions. Second, although the sample size meets the methodological requirements for PLS-SEM, external validation in a broader and more diverse population is needed to confirm stability across contexts. Third, this instrument evaluates documented evidence rather than direct clinical practice; therefore, there may be discrepancies between recorded and actual care processes [61], [62].

Although the study identified a statistically significant association between documentation quality and reduced 30-day readmission risk, the observational nature of the research design limits the ability to establish

definitive causal relationships. Other unmeasured clinical, organizational, or patient-related factors may also contribute to readmission outcomes. Therefore, future research employing longitudinal or experimental designs is recommended to better clarify the causal mechanisms linking frailty documentation practices with patient outcomes.

3 CONCLUSION

This study successfully achieved its objective of developing and psychometrically validating an integrated electronic progress note–based instrument for frailty risk monitoring and care coordination in aging populations. The instrument demonstrated excellent content validity (S-CVI = 0.93), strong internal consistency (Composite Reliability > 0.90; Cronbach's Alpha > 0.90), adequate convergent validity (AVE > 0.50), and satisfactory discriminant validity (HTMT < 0.90). The structural model showed substantial explanatory power ($R^2 = 0.68$) and strong predictive relevance ($Q^2 = 0.49$), while inter-rater reliability indicated excellent agreement (ICC = 0.87). Empirical application revealed that Care Coordination and Continuity Planning had the strongest influence on documentation quality ($\beta = 0.41$, $p < 0.001$), followed by frailty risk identification ($\beta = 0.38$, $p < 0.001$). Importantly, higher documentation quality was significantly associated with reduced 30-day readmission risk ($\beta = –0.32$, $p < 0.01$), underscoring the clinical and managerial relevance of structured frailty documentation within electronic systems. Overall, the findings confirm that the developed instrument is both statistically robust and practically applicable for evaluating frailty-related documentation performance in aging care settings. By integrating multidimensional frailty constructs with electronic progress note evaluation, the instrument strengthens health information governance and supports data-driven quality improvement in geriatric services. Healthcare institutions are encouraged to adopt this instrument as a standardized audit and monitoring framework to enhance frailty risk documentation and interdisciplinary coordination. Future multi-center studies are recommended to externally validate the instrument across diverse healthcare systems and to explore its integration with predictive analytics models for proactive geriatric risk management.

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USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors confirm that no artificial intelligence (AI)-assisted technologies were utilized in the preparation, analysis, or writing of this manuscript. All stages of the research process, including data collection, data interpretation, and the development of the manuscript, were conducted solely by the authors without any support from AI-based tools.

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