Early Warning Escalation System for Care Aides in Long-Term Patient Monitoring

AKONASU QUDUS HUNGBO[1], CHRISTIANA ADEYEMI[2], OPEOLUWA OLUWANIFEMI AJAYI[3]
[1]*Canadian National Railway, Melville, SK, Canada*
[2]*University of the Cordilleras. Baguio, Philippines*
[3]*Amazing Grace Adult Home, Akure, Ondo State. Nigeria*

Abstract- ***Timely recognition and response to patient deterioration in long-term care facilities remain critical challenges, especially as frontline care aides often serve as the first point of observation. This paper introduces an Early Warning Escalation System (EWES) specifically designed to empower care aides in long-term patient monitoring. The proposed system integrates observational cues, structured reporting protocols, and digital escalation pathways to ensure rapid clinical intervention. By leveraging simplified early warning indicators such as changes in mobility, behavior, appetite, and respiratory effort EWES equips non-licensed care staff with the tools and confidence to identify and communicate potential health declines effectively. The system utilizes a tiered escalation model where initial observations trigger a standardized response, including documentation through a mobile interface and immediate alerts to registered nurses or supervising clinicians. The model is informed by elements of the Modified Early Warning Score (MEWS) but is adapted for long-term care environments where continuous vital sign monitoring may not be feasible. A mixed-methods pilot study involving training workshops, workflow integration, and post-implementation evaluation demonstrated improved communication efficiency, earlier clinical response, and reduced incidences of avoidable hospital transfers. Care aides reported increased confidence and clarity in escalation roles, while nursing staff observed improved patient surveillance and response timelines. Additionally, the digital tool's embedded audit trail supports quality assurance and regulatory compliance. By formalizing the observational role of care aides within a validated clinical framework, EWES bridges the gap between daily caregiving and medical intervention, contributing to safer and more responsive long-term care. This study highlights the importance of workforce inclusivity in patient safety models and underscores the potential of tailored early warning systems to enhance multidisciplinary coordination in non-acute care settings. The EWES model offers a scalable and adaptable approach to improving patient outcomes and institutional readiness in the face of rising long-term care demands.***

Indexed Terms- ***early warning system, care aides, long-term care, patient deterioration, escalation protocols, monitoring, clinical communication, MEWS adaptation, digital health, patient safety.***

I. INTRODUCTION

Long-term care facilities are essential in supporting the health and well-being of individuals with chronic conditions, functional limitations, and advanced age-related needs. However, patient monitoring in these settings presents persistent challenges, particularly when it comes to the timely recognition of subtle changes in a resident's condition. Unlike acute care environments equipped with advanced diagnostic tools and continuous clinical surveillance, long-term care facilities often rely on periodic assessments and routine observation (Khanna, 2019, Klimes, et al., 2014). This creates a significant vulnerability, where early signs of clinical deterioration such as changes in behavior, appetite, mobility, or respiratory effort can go unnoticed until they escalate into critical events, including hospital transfers or irreversible complications. These missed opportunities for early intervention not only compromise patient safety and outcomes but also place unnecessary strain on healthcare systems.

Central to the daily operations of long-term care are care aides, who serve as the primary point of contact for residents. These frontline workers develop close, consistent interactions with patients, positioning them uniquely to notice early deviations from baseline behavior or health status. Yet, despite their vital observational role, care aides are often underutilized in formal clinical decision-making processes (De Meester, et al., 2013, Mohammed Iddrisu, Considine & Hutchinson, 2018). Limited training, unclear communication pathways, and a lack of structured reporting mechanisms can hinder their ability to escalate concerns effectively and promptly. As a result, valuable insights that could inform early interventions are frequently delayed or lost.

To address this critical gap, the Early Warning Escalation System (EWES) has been developed as a structured, user-friendly framework that empowers care aides to participate meaningfully in long-term patient monitoring. By standardizing how early warning signs are identified, documented, and escalated, EWES transforms informal observations into actionable information. It integrates simplified clinical indicators, digital documentation tools, and tiered communication protocols that connect care aides with nurses and clinical supervisors in real time. The significance of EWES lies in its ability to bridge the gap between daily caregiving and clinical oversight, improving early detection of deterioration, reducing preventable hospitalizations, and fostering a culture of shared responsibility and communication in long-term care (Haahr-Raunkjær, et al., 2017, Khanna, et al., 2019).

2.1 Methodology

This study employs a hybrid methodology combining system design, simulation modeling, and qualitative validation to develop an Early Warning Escalation System tailored for care aides monitoring long-term patients. Initially, relevant clinical parameters and escalation protocols were identified through a comprehensive literature review and cross-national comparison of existing early warning systems (Agulnik et al., 2017; Khanna et al., 2019; Agarwal et al., 2010). Care aides' roles and interaction patterns within long-term care settings were mapped to contextualize the system workflow (Byrne, 2016; Black et al., 2017).

The core of the system leverages transformer-based large language models (Adelusi et al., 2020) to interpret patient data streams, enabling dynamic risk stratification and parametric estimation of deterioration. This AI-driven analytic layer integrates vital signs, behavioral indicators, and environmental factors to generate early warnings. To optimize response scheduling and resource allocation, discrete-event simulation models (Yip et al., 2016) were employed, enabling scenario testing of alert thresholds and escalation pathways under various staffing and patient acuity configurations.

The system architecture incorporates a layered escalation protocol inspired by pediatric early warning models (El Amouri et al., 2020; Blankush et al., 2017), adapted to long-term care contexts through stakeholder engagement and iterative feedback from frontline care aides and clinical supervisors. User-centered design principles guided interface development to facilitate ease of use and communication efficiency, drawing from cross-cultural market segmentation insights to tailor messaging and alert prioritization (Agarwal et al., 2010).

Implementation feasibility and safety considerations were addressed through simulation-based training scenarios and pilot deployments, assessing human factors and error prevention within real-world care workflows (Alison et al., 2013; Bleetman et al., 2012). Data governance and system interoperability standards ensured compliance with healthcare data security protocols and facilitated integration with existing electronic health record systems (Aljohani, 2018; O'Hara et al., 2015).

Performance metrics, including sensitivity, specificity, response time, and user satisfaction, were collected during pilot phases to calibrate model parameters and refine escalation criteria (McFarlane et al., 2018; Saabh et al., 2017). The evaluation incorporated both quantitative outcome measures and qualitative feedback from care aides, patients, and clinical managers to ensure the system's effectiveness

in reducing adverse events and enhancing patient safety.

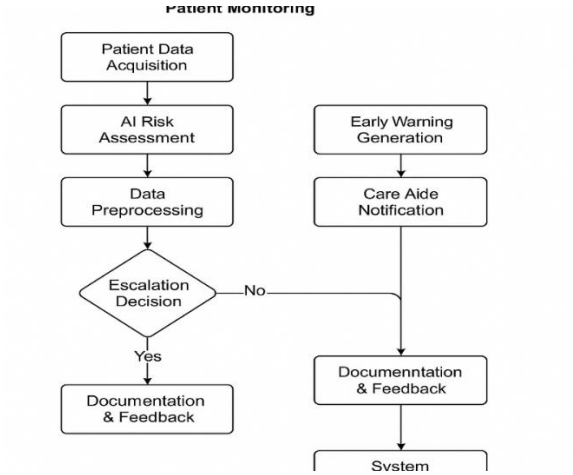

Figure 1: Flowchart of the study methodology

2.2. Background and Rationale

The development of an Early Warning Escalation System (EWES) for care aides in long-term patient monitoring stems from a growing recognition of the persistent gaps in current care practices within long-term care settings. These facilities are often home to some of the most vulnerable populations individuals living with chronic illnesses, cognitive decline, and complex care needs. Monitoring such individuals over extended periods requires vigilance, consistency, and a proactive approach to identifying deterioration. However, traditional monitoring frameworks in long-term care are frequently inadequate, lacking both the structure and responsiveness needed to detect early warning signs (Almatrafi, Al-Mutairi & Alotaibi, 2019, Jeskey, et al., 2011). This results in missed clinical cues, delayed interventions, and an over-reliance on emergency transfers to acute care settings once the patient has already decompensated.

One of the most significant gaps in current practice is the lack of a formalized escalation pathway that includes input from non-licensed staff, particularly care aides. These frontline workers interact with residents daily, often more frequently than licensed nurses or visiting clinicians. Through routine care activities such as bathing, feeding, toileting, and companionship, care aides are ideally positioned to observe subtle changes in a resident's physical, emotional, or behavioral state. Despite this proximity, their observational insights are frequently undocumented, under-communicated, or dismissed due to the informal nature of their role in the clinical hierarchy (De Meester, et al., 2013, Mohammmed Iddrisu, et al., 2018). Without a mechanism to capture and escalate this vital information in a timely and structured manner, early signs of decline are often lost, and interventions occur only when deterioration becomes critical.

The limitations of existing early warning systems, such as the Modified Early Warning Score (MEWS), become evident in the context of long-term care. While MEWS and similar scoring systems are effective in acute hospital settings where patients are under continuous surveillance and vital signs are routinely measured they are less suited to the slower pace and broader variability of long-term care environments. Residents in these facilities may not present with rapid physiological changes typical of acute illness, but rather with more gradual indicators such as reduced mobility, decreased appetite, confusion, or changes in continence (Flynn & Hartfield, 2016, Stewart & Bench, 2018). Furthermore, routine monitoring of vital signs such as blood pressure, temperature, and oxygen saturation is not always feasible or prioritized in residential care settings, particularly when staffing levels are low or clinical personnel are limited. The result is a mismatch between the design of existing monitoring tools and the realities of long-term care.

In this context, the importance of empowering non-licensed care staff with structured observational and escalation tools cannot be overstated. Care aides represent a significant portion of the workforce in long-term care and are central to the continuity and consistency of patient monitoring. Yet they are often excluded from formal clinical decision-making due to their non-clinical designation. This exclusion not only underutilizes a critical human resource but also reinforces a fragmented model of care in which communication breakdowns are common. By providing care aides with a structured framework such as EWES for identifying and reporting changes, facilities can transform informal observations into actionable data. This approach respects the contributions of care aides, improves interdisciplinary

collaboration, and enhances the overall safety net for residents (Fennell, et al., 2010, Gullick, et al., 2019).

Empowerment through structured tools also has implications for professional development and job satisfaction among care aides. When aides are trained to recognize early signs of deterioration and understand how their observations fit into the larger care strategy, they gain a sense of purpose and validation in their roles. This professional affirmation can reduce turnover, improve morale, and create a more engaged workforce. It also fosters a culture of shared responsibility, where all members of the care team regardless of licensure are invested in the well-being of residents and are encouraged to communicate proactively (Grant, et al., 2017, Perry, et al., 2015).

Evidence strongly supports the link between early intervention and reduced hospital admissions in long-term care settings. Numerous studies have shown that timely recognition of clinical deterioration can prevent escalation to acute events, reduce emergency department visits, and avoid hospitalizations that are often distressing for residents and costly for healthcare systems. For example, interventions that focus on early recognition of infections, dehydration, or changes in mental status have been associated with decreased use of emergency services and better patient outcomes (Cahill, et al., 2010, Halvorson, et al., 2016). These benefits are particularly important in long-term care, where hospital transfers can expose frail residents to risks such as hospital-acquired infections, functional decline, and emotional disorientation. Figure 2 shows Care escalation protocol implemented to accompany automated MEWS calculations and device notifications presented by Blankush, et al., 2017.

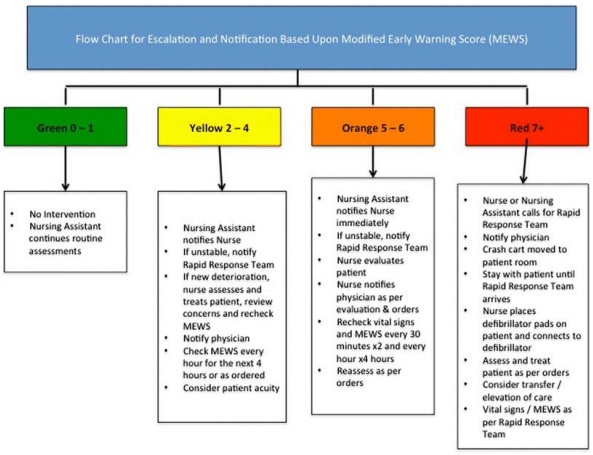

Figure 2: Care escalation protocol implemented to accompany automated MEWS calculations and device notifications (Blankush, et al., 2017).

Research has also demonstrated that structured monitoring systems when adapted appropriately can lead to measurable improvements in care quality. For instance, implementation of nurse-led early warning systems in nursing homes has been associated with earlier clinical response and lower hospitalization rates. However, these models often overlook the critical role of care aides. Expanding the monitoring net to include frontline staff enhances the comprehensiveness and reliability of resident surveillance. In practical terms, this means that subtle indicators like a change in the way a resident walks, a reluctance to eat, or a new pattern of restlessness are no longer anecdotal but become documented, reviewed, and acted upon systematically (Adelusi, et al., 2020).

Moreover, health systems across the globe are under increasing pressure to reduce unnecessary hospital admissions and improve care integration across settings. Long-term care facilities are being urged to implement strategies that allow for the management of medical conditions in place, rather than relying on external transfers. The development and implementation of the Early Warning Escalation System aligns with these priorities by providing a scalable, low-cost, and high-impact solution. It leverages existing human resources and enhances internal clinical capacity without requiring complex technological infrastructure. In doing so, EWES supports both patient-centered care and system-level efficiency (Gilhooly, et al., 2019, Ndoro, 2014).

In conclusion, the background and rationale for developing an Early Warning Escalation System for care aides in long-term patient monitoring are grounded in clear operational gaps, mismatches with existing systems, and compelling evidence supporting early intervention. Care aides represent an untapped asset in the early detection of deterioration, and structured empowerment through EWES provides the pathway to unlock their potential. By shifting from reactive to proactive care, long-term facilities can reduce preventable hospitalizations, improve patient outcomes, and foster a more collaborative and responsive care environment (Osabuohien, 2019). This approach represents a necessary evolution in how long-term care institutions conceptualize monitoring, escalation, and interdisciplinary teamwork placing value not only on medical technology and licensed practice but also on the observational acumen and relational proximity of those who provide the most consistent daily care.

2.3. Conceptual Framework of EWES

The conceptual framework of the Early Warning Escalation System (EWES) for care aides in long-term patient monitoring is designed to bridge a critical gap between frontline caregiving and clinical decision-making. It is structured to convert routine, non-clinical observations into a standardized, responsive, and clinically meaningful system of early detection and escalation. Unlike hospital-based early warning systems that rely heavily on physiological measurements and frequent monitoring, EWES is tailored to the realities of long-term care environments, where clinical supervision is periodic, changes in condition are often gradual, and the primary observers are care aides rather than licensed nurses or physicians (Osabuohien, 2017). The framework emphasizes simplicity, relevance, and integration, enabling care aides to recognize subtle signs of deterioration and initiate timely responses that may prevent avoidable hospital transfers and improve patient outcomes.

At the core of the EWES framework is a systematic focus on early warning signs that are specific to the context of long-term care. These indicators differ from the acute, rapidly changing physiological metrics common in hospital settings. In long-term care, early signs of deterioration often present in more nuanced or slow-progressing ways. These may include behavioral changes such as increased agitation, withdrawal from activities, confusion, or mood disturbances. Physical indicators might consist of decreased appetite, changes in sleep patterns, altered bowel or urinary habits, new complaints of pain, or reduced mobility (Francis, 2016, Mo, 2014). Functional changes such as difficulty with dressing, bathing, or transferring can also be key early indicators of underlying health issues. These signs, while seemingly minor in isolation, can cumulatively indicate the onset of infection, dehydration, pain, or cognitive decline. Recognizing these changes early and responding promptly can greatly influence the trajectory of a resident's condition (Awe & Akpan, 2017, Isa & Dem, 2014).

Traditional clinical scoring systems like the Modified Early Warning Score (MEWS) or the National Early Warning Score (NEWS) were designed for acute care settings where vital signs are routinely collected and where trained clinicians interpret the data. These systems typically rely on specific thresholds for heart rate, respiratory rate, blood pressure, temperature, and oxygen saturation to trigger alerts. While highly effective in hospitals, such tools are less practical in long-term care where vital signs are not monitored as frequently and where staff may not be trained or authorized to perform detailed clinical assessments (Aljohani, 2018, Berna, 2019). EWES adapts the underlying logic of these scoring systems namely, early detection through observable trends and escalation based on predefined thresholds but modifies the parameters to reflect observable behaviors and routine interactions in long-term care.

In this adapted version, instead of relying on numerical thresholds for vital signs, EWES incorporates a broader range of indicators accessible to care aides without requiring clinical judgment. The framework is organized around three domains: behavioral, physical, and functional indicators. Behavioral indicators focus on changes in personality, social engagement, and emotional expression. For instance, if a resident who is usually sociable becomes withdrawn or irritable, this shift is logged as a potential early warning sign. Physical indicators include non-invasive signs such as

reduced appetite, lethargy, skin changes, or complaints of general discomfort (Perkins, 2018, SVIMS, 2010). Functional indicators capture any decline in the resident's ability to perform activities of daily living (ADLs), such as increased difficulty in walking, feeding, or using the restroom. Each of these signs is standardized within the system using simple checklists or icons, enabling care aides to quickly identify and document concerns during their routine duties. Newborn early warning system escalation process presented by El Amouri, et al., 2020 is shown in figure 3.

SCORE	RESPONSE	ESCALATION PROCESS
All in Green (Score of 0)	Continue observation Q4H (Paediatric), Q6H (Ob-Gynae/ Maternity) as per unit practice or as requested by paediatric specialist.	Based on clinical judgement inform charge nurse and notify paediatric specialist.
1-2 in Yellow (Combined score of 1-2)	Inform the Charge nurse and Paediatric specialist. Repeat observation every 30 min until patient condition is stable. If the newborn is not settled within 1 hour, transfer the baby to NICU for observation	**Maternity & OBG ward** Primary Nurse to inform Charge Nurse Charge Nurse Inform NICU Paediatric specialist (3 calls/ 5 min apart) If no response within15min, contact NICU consultant STAT. **ER &Paediatric ward** Primary Nurse to inform Charge Nurse Charge Nurse Inform Paediatric specialist (3 phone calls/5 min apart) If no response within15min, contact NICU Paediatric specialist If no response within5min, contact NICU consultant STAT.
3- 4 in Yellow OR Any 1 in Orange (Combined score of 3 - 4 or Single score of 2)	Immediate review and inform Paediatric specialist and NICU CN. Repeat **NEWS** Q15 min with identified plan of care until stable. If the newborn is not settled within 30 min, transfer the baby to NICU for observation/ Admission.	**Maternity & OBG ward** Primary Nurse to inform Charge Nurse Charge Nurse Inform NICU Paediatric specialist (2calls/ 5 min apart) If no response within10min, contact NICU consultant STAT. **ER &Paediatric ward** Primary Nurse to inform Charge Nurse Charge Nurse Inform Paediatric specialist (2 phone calls/5 min apart) If no response within10min, contact NICU Paediatric specialist If no response within 5min, contact NICU consultant STAT.
Any 1 in Red (Single score of 3 or Combined score of ≥5)	**Call RRT Newborn immediately**	Primary Nurse to notify Charge Nurse and to **Activate Rapid Response-Newborn**

***RISK ASSESSMENT** (√- *whichever is applicable*)

Maternal		**Previous babies with**	
PROM > 18hours Preterm	☐	Congenital anomalies	☐
PROM > 24 hours Term	☐	Heart disease	☐
Temperature > 38°C	☐	G6PD deficiency	☐
Chorioamnionitis	☐	Invasive GBS sepsis	☐
Pethidine < 6 hours before delivery	☐	**Newborn**	
GBS in vaginal swab/ Urine or Unknown	☐	Small for gestational age	☐
Multiple gestation	☐	Large for gestational age	☐
Diabetes (GDM/ DM type 1and 2)	☐	IPPV > 5 minutes	☐
On β Blockers	☐	< 37 weeks gestation	☐
No Prenatal care	☐	Meconium Stained Liquor (requiring intervention)	☐
Adolescent pregnancy	☐	Cord arterial pH ≤ 7.1	☐
Eclampsia	☐	Base Excess ≥ - 12mmol/l	☐
Placenta Previa	☐	APGAR ≤ 7 at 5 minutes	☐
Placental abruption	☐	***Infants that need immediate review by Doctor***	
Cord prolapse	☐	**Jaundice < 24 hours**	☐
H/O Neonatal death	☐	**Bilious Vomiting**	☐
Delivery outside the hospital	☐	**Abnormal Movements**	☐
Suspicious/pathological CTG	☐	**Hypoglycaemia**	☐
		Apnoea	☐

***These criteria should be considered to heighten the surveillance in newborns.**

Figure 3: Newborn early warning system escalation process (El Amouri, et al., 2020).

The success of the EWES framework depends heavily on a tiered escalation strategy that guides what happens once a potential early warning sign is detected. Rather than overwhelming clinical staff with every minor change, EWES uses a color-coded or level-based classification system to prioritize responses. Level 1 (low concern) might indicate a minor, isolated observation such as a skipped meal or brief mood change. At this level, the aide is prompted to continue monitoring and document the event in a daily log. Level 2 (moderate concern) may involve multiple minor changes or a single more significant indicator, such as persistent fatigue or confusion. This triggers a requirement for the care aide to report their concern directly to a nurse or supervisor, who will perform a follow-up assessment (Alketbi, 2018,

Moghimi, Wickramasinghe & Adya, 2019). Level 3 (high concern) represents urgent situations where immediate attention is required such as a resident who is non-responsive, shows signs of a possible fall injury, or exhibits sudden confusion. In this case, the system prompts the aide to contact a nurse immediately and initiate emergency protocols if necessary.

Each level within the escalation system is accompanied by a defined response timeline, which helps ensure that actions are taken consistently and without unnecessary delay. For example, a Level 2 concern must be evaluated by a nurse within a specified window typically within two to four hours to determine whether further clinical intervention is needed. The structured timeline helps prevent situations where observations are noted but not acted upon in a timely manner. Additionally, the tiered system reinforces accountability and helps nursing teams triage their responses based on urgency and potential risk (Akpan, et al., 2017). Figure 4 shows Comparison of Early Warning Score protocols recommended for NEWS and that in place in the study hospital presented by Hope, et al., 2018.

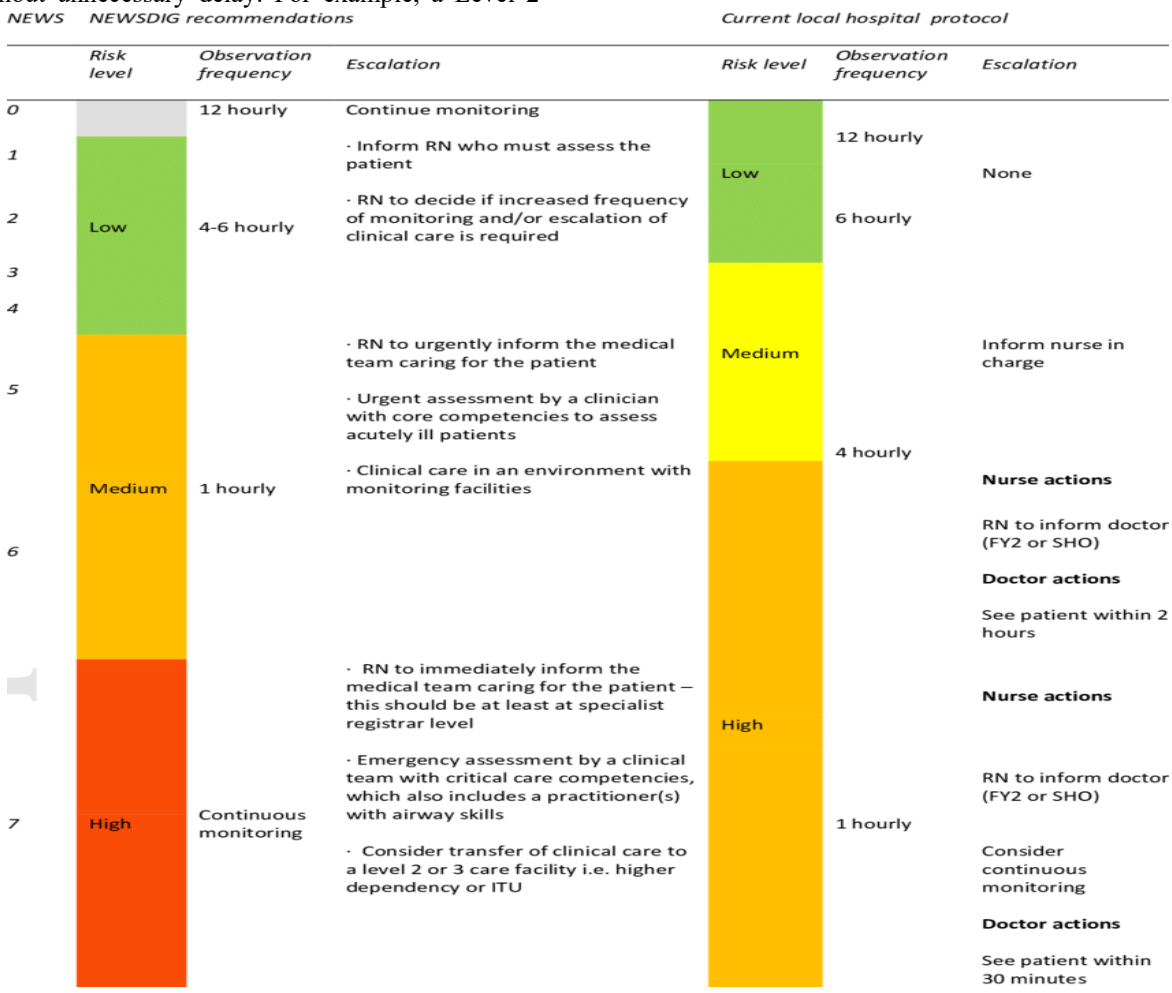

Figure 4: Comparison of Early Warning Score protocols recommended for NEWS and that in place in the study hospital (Hope, et al., 2018).

Integral to the framework is a digital or paper-based tool that care aides use to record their observations. This tool includes pre-populated lists of symptoms, behaviors, and functional concerns that align with the EWES domains. By simply checking boxes or entering brief descriptions, care aides can submit structured reports that are easy for nurses to interpret and act upon. These tools are designed for simplicity

and speed, recognizing that care aides have limited time and often care for multiple residents at once. In facilities with digital health infrastructure, these observations can be entered into electronic health records (EHRs) and flagged for review, allowing for trend analysis and integration with broader clinical documentation (Muraina & Ahmad, 2012, Olszak & Batko, 2012). Where digital systems are unavailable, paper forms or mobile applications provide a low-tech but effective alternative.

The EWES framework also includes feedback and training mechanisms to ensure that care aides are confident and consistent in using the system. Initial training focuses on recognizing the signs in each domain, understanding the levels of escalation, and using the reporting tools. Refresher courses, peer coaching, and regular case reviews help reinforce learning and create a culture of continuous improvement. Nurses and clinical supervisors play a critical role in validating the observations submitted by care aides, providing feedback, and closing the loop on communication (Méhaut & Winch, 2011, Nandan, et al., 2018).

Ultimately, the conceptual framework of EWES reflects a shift toward inclusive, proactive, and person-centered care in long-term settings. It values the unique insights of care aides, translates them into actionable intelligence, and provides a structured system for escalation that aligns with both clinical priorities and practical realities. By broadening the definition of what constitutes an early warning sign and who is responsible for recognizing it, EWES enhances the safety net around each resident. It encourages teamwork, reduces the likelihood of missed deterioration, and supports timely, appropriate interventions (Akpan, Awe & Idowu, 2019). The model's adaptability, simplicity, and clarity make it a viable and impactful solution for improving long-term patient monitoring and redefining how care teams collaborate to protect the well-being of their most vulnerable patients.

2.4. System Components

The Early Warning Escalation System (EWES) designed for care aides in long-term patient monitoring relies on a set of interrelated system components that collectively transform everyday observations into structured, timely clinical responses. These components are crafted to empower frontline care aides with clear, easy-to-use tools that standardize observation, enhance communication, and ensure appropriate escalation, all within the practical constraints of long-term care settings. Together, these elements create a robust operational infrastructure capable of improving early detection of patient deterioration, facilitating effective teamwork, and supporting quality assurance efforts (Awe, 2017).

At the heart of the system are observational indicators, which serve as the primary means for care aides to identify early changes in a resident's health status. Given that care aides spend substantial time with residents, often providing direct assistance with daily living activities, they are well positioned to notice subtle but clinically significant shifts. These indicators encompass a range of behavioral, physical, and functional changes (Awe, Akpan & Adekoya, 2017). Examples include alterations in mobility such as increased difficulty walking or transfers; changes in appetite or fluid intake; shifts in mood or social engagement such as withdrawal, agitation, or confusion; and respiratory pattern deviations like increased effort, shortness of breath, or coughing (Agarwal, Malhotra & Bolton2010, Huot, et al., 2018). Because long-term care residents often present with gradual or atypical signs of illness, the EWES observational indicators are broad enough to capture nuanced changes while remaining specific enough to avoid unnecessary alerts.

To facilitate consistent recognition and recording of these signs, the system employs checklists and structured observation guides. These tools translate complex clinical concepts into simple, actionable items that care aides can quickly and reliably assess during routine care. The use of checklists helps reduce variability and cognitive load, making it less likely that important changes are overlooked. Structured guides may be organized by domains such as mobility, cognition, nutrition, and respiratory status, allowing aides to systematically evaluate residents in a holistic manner. By embedding these tools into daily workflows, EWES ensures that observations are not ad

hoc but part of a deliberate monitoring process (Byrne, 2016, Sliwa, et al., 2017).

The next critical component is reporting and documentation, which serves as the communication bridge between care aides and licensed nursing staff or clinicians. To accommodate the diverse technological capacities of long-term care facilities, EWES supports both mobile app-based and paper-based interfaces. Mobile apps allow for real-time entry of observations, automatic timestamping, and instant transmission to supervisory staff. Such apps are designed with user-friendly interfaces, large icons, and minimal text input to accommodate varying levels of digital literacy. In settings where digital infrastructure is limited, paper forms replicate the same standardized format, ensuring no facility is excluded from the benefits of structured reporting (Kable, et al., 2018, Kaga, Bennett & Moss, 2010).

Standardized communication formats play a crucial role in ensuring that reported information is clear, concise, and clinically relevant. The SBAR (Situation, Background, Assessment, Recommendation) framework is widely recognized for its efficacy in facilitating effective communication in healthcare. Within EWES, care aides are trained to use SBAR or adapted simplified versions that allow them to convey their observations in an organized manner. For example, a care aide might report: “Situation: Mr. Smith has been more lethargic today; Background: He has a history of congestive heart failure; Assessment: He is breathing more rapidly than usual and has a cough; Recommendation: Request nurse assessment to evaluate for possible infection.” This structured approach reduces ambiguity, ensures critical details are conveyed, and supports prompt clinical decision-making (Hannigan, et al., 2018, Hinds, Liu & Lyon, 2011).

Escalation pathways constitute the framework’s mechanism for translating observation into action. EWES employs a tiered alert system with three levels low, moderate, and urgent each corresponding to increasing clinical concern and urgency of response. A low-level alert might be triggered by a single minor observation such as a brief loss of appetite, prompting continued monitoring and documentation without immediate nurse intervention. Moderate alerts could arise from multiple concerning signs or persistence of a symptom, triggering notification to nursing staff for evaluation within a defined timeframe, often within hours. Urgent alerts indicate potentially life-threatening changes, such as sudden onset of shortness of breath, altered consciousness, or suspected falls, requiring immediate nursing assessment and possibly activation of emergency protocols (Alison, et al., 2013, Bleetman, Aet al., 2012).

Each escalation level is paired with clear roles and responsibilities to streamline workflow and accountability. Care aides initiate alerts based on their observations and escalate according to protocol. Nurses or clinical supervisors receiving the alerts are responsible for rapid assessment, decision-making, and intervention planning. Documentation of actions taken and communication back to care aides closes the loop, reinforcing collaborative care. The clarity of roles helps prevent confusion and delays, especially during busy shifts or staff shortages. It also promotes a culture where care aides feel empowered and supported in their vital monitoring role (Hamman, Beaudin-Seiler & Beaubien, 2010, O'Donnell, et al., 2011).

The integration of digital technology and audit tools further strengthens the EWES infrastructure. Real-time alerts sent via mobile apps or integrated electronic health record (EHR) systems notify nurses and clinicians immediately upon entry of concerning observations. These alerts are designed to prioritize according to the tiered system, ensuring that urgent concerns receive top attention. Digital integration enables tracking of response times, escalation outcomes, and patient trajectories, providing rich data for ongoing quality improvement efforts.

Embedded documentation within the digital system ensures that all observations, communications, and interventions are recorded in a centralized, accessible format. This facilitates continuity of care by making historical data available to all members of the care team and supports clinical decision-making by highlighting trends over time. Furthermore, the digital audit trail enables institutions to conduct retrospective reviews of care processes, identify system

vulnerabilities, and measure adherence to escalation protocols (Armenia, et al., 2018, Nicksa, et al., 2015). These insights are invaluable for regulatory compliance, staff training, and policy development.

In facilities without sophisticated digital systems, paper-based documentation is designed to be easily auditable, with standardized forms that can be reviewed regularly to identify patterns and inform quality initiatives. Whether digital or analog, the focus remains on creating a transparent, accountable environment where every observation is valued and every response is tracked.

Together, these system components create a seamless continuum from observation to action, ensuring that care aides' frontline insights translate into timely clinical interventions. The design of EWES balances simplicity with clinical rigor, making it feasible for implementation in diverse long-term care settings regardless of resource availability. By empowering care aides with clear tools and communication pathways, the system not only enhances resident safety but also strengthens interprofessional collaboration and care team cohesion.

In summary, the observational indicators, reporting and documentation tools, tiered escalation pathways, and digital integration with audit capabilities are the pillars of the Early Warning Escalation System. Their thoughtful integration addresses the unique challenges of long-term care monitoring, transforming everyday caregiving interactions into a structured, reliable early warning network. This comprehensive system equips care aides to play a vital role in safeguarding the health of residents, while providing nursing and clinical staff with actionable data to deliver timely and effective care.

2.5. Training and Capacity Building

Training and capacity building form the backbone of any successful implementation of the Early Warning Escalation System (EWES) for care aides in long-term patient monitoring. Since care aides are often the primary point of contact with residents and the frontline observers of subtle changes in patient conditions, equipping them with the knowledge, skills, and confidence to use EWES effectively is paramount. The goal of training and capacity building within this framework is not only to enhance observational accuracy and timely escalation but also to foster a culture of shared responsibility, communication, and continuous learning. The training approach must therefore be comprehensive, practical, and sustained over time to embed the system into daily practice.

At the outset, carefully designed training modules are developed specifically for care aides to introduce the key concepts and operational procedures of EWES. These modules focus on educating care aides about the range of early warning signs relevant to long-term care residents including changes in mobility, appetite, mood, respiratory patterns, and functional abilities and how to systematically observe and document these indicators. The content emphasizes the rationale behind early warning and escalation, helping care aides understand the critical impact of their role in preventing deterioration and hospitalization (Carron,Trueb & Yersin, 2011, Flowerdew, et al., 2012). The modules are constructed in clear, accessible language, mindful of the varying educational backgrounds among care aides, and include visual aids, checklists, and example scenarios to reinforce learning. In addition, training addresses the standardized communication methods used within EWES, such as the SBAR (Situation, Background, Assessment, Recommendation) format, empowering care aides to convey observations succinctly and effectively to nursing staff.

Beyond theoretical instruction, scenario-based simulations and role-play are integral components of the training program. These interactive learning methods provide care aides with hands-on opportunities to practice recognizing early warning signs, using the escalation tools, and communicating concerns within a controlled, supportive environment. Scenario-based training recreates common or challenging situations found in long-term care, such as a resident showing early signs of infection or subtle behavioral changes suggestive of delirium. Role-play exercises allow care aides to rehearse conversations with nurses or supervisors, refining their use of SBAR and building confidence in initiating escalations. These experiential learning methods help bridge the gap between knowledge and application, reducing

anxiety around using the system and improving accuracy and timeliness of reporting (Kerner Jr, et al., 2016, Patterson, et al., 2013).

Simulations also promote team-building and understanding of interdisciplinary collaboration by involving nursing staff, clinical supervisors, and care aides in joint exercises. This fosters mutual respect, clarifies roles and expectations, and enhances communication pathways that are critical for EWES success. Additionally, these training sessions often incorporate reflective debriefings where participants discuss what went well, challenges faced, and lessons learned. Such reflective practice not only reinforces learning but also cultivates a culture of openness and continuous improvement.

Continuous professional development (CPD) acts as a reinforcement mechanism to sustain and deepen the skills acquired through initial training. CPD programs provide regular refreshers, updates, and advanced modules tailored to emerging challenges or feedback from practice. Given the evolving nature of long-term care needs and possible modifications in the EWES itself, ongoing education ensures care aides remain current and competent in observation and escalation processes (Chang, et al., 2018, Cowperthwaite & Holm, 2015). CPD may include monthly workshops, e-learning courses, competency assessments, and peer coaching sessions. Importantly, it supports the transition from initial skill acquisition to habitual, confident use of the system in daily care delivery.

CPD is also designed to address real-world barriers and practical issues that care aides may encounter, such as difficulties interpreting certain signs, hesitancy in communication, or logistical challenges in reporting. By providing ongoing support and opportunities for discussion, CPD helps reduce errors and improves adherence to escalation protocols. It can also incorporate updates from clinical research or policy changes relevant to long-term care, thus integrating evidence-based practice with operational skill development.

Another crucial aspect of capacity building is fostering leadership and mentorship among experienced care aides. Empowering senior or more skilled aides to serve as champions and peer educators facilitates the diffusion of knowledge and skills throughout the care team. These peer leaders can offer on-the-spot guidance, reinforce correct use of the EWES tools, and help troubleshoot common difficulties. Mentorship programs contribute to sustaining engagement and motivation among care aides and help institutionalize the early warning culture (Alfa, 2019, Dancer, et al., 2012).

Technology also plays a supportive role in training and capacity building. Interactive digital platforms can deliver modular training content that care aides can access flexibly, accommodating shift patterns and workload. Such platforms often include quizzes, video demonstrations, and virtual simulations to enhance engagement. Digital tracking of training completion and competency scores allows supervisors to monitor progress and identify areas needing additional focus. In facilities equipped with electronic health records (EHRs), integrated training reminders and prompts can reinforce correct documentation and escalation processes in real time.

Furthermore, organizational commitment is essential to effective training and capacity building. Management must allocate sufficient resources time, personnel, and funding to ensure that care aides can participate in training without compromising resident care. Scheduling protected time for education and creating incentives, such as certification or recognition for successful completion, reinforce the value of the training. Leadership should also foster an environment that encourages questions, feedback, and continuous learning, where care aides feel safe to report challenges or mistakes without fear of reprisal (de Melo Costa, et al., 2018, Ryan, et al., 2016).

In conclusion, training and capacity building for the Early Warning Escalation System are comprehensive, multi-dimensional processes designed to equip care aides with the competencies needed for early detection and timely escalation of patient deterioration in long-term care. Through targeted training modules, interactive scenario-based simulations, and ongoing professional development, care aides gain not only knowledge and skills but also the confidence and motivation to play an active role in patient safety. The

integration of mentorship, technology, and organizational support further enhances sustainability and effectiveness. By investing in robust training and capacity building, long-term care facilities can strengthen their monitoring systems, improve resident outcomes, and cultivate a culture of shared responsibility and continuous improvement ultimately transforming the quality and safety of care delivered to vulnerable populations.

2.6. Pilot Study and Evaluation

The pilot study and evaluation of the Early Warning Escalation System (EWES) for care aides in long-term patient monitoring represent a crucial phase in validating the system's effectiveness, feasibility, and impact on care quality. Conducted in a real-world long-term care setting, the study employed a mixed-methods approach to comprehensively assess both quantitative outcomes and qualitative experiences of care aides, nurses, residents, and administrators. This approach allowed for a nuanced understanding of how EWES influences clinical processes, communication dynamics, and ultimately, patient safety and well-being.

The mixed-methods methodology combined quantitative data collection with qualitative interviews and focus groups. Quantitative metrics included objective measurements such as response times to early warning alerts, frequency of hospital transfers, and rates of preventable adverse events. These metrics provided concrete evidence of the system's impact on clinical workflows and resident outcomes. Simultaneously, qualitative methods explored the perceptions, attitudes, and experiences of care aides and nursing staff regarding the usability, acceptability, and perceived value of EWES (Ling, et al., 2018, O'Hara, et al., 2015). Semi-structured interviews and focus groups enabled participants to express challenges encountered, suggestions for improvement, and reflections on how the system influenced teamwork and communication. This holistic approach ensured that both the measurable effects and human factors shaping EWES implementation were captured.

One of the primary quantitative metrics evaluated was the response time from care aide observation to nursing assessment and intervention. Prior to EWES implementation, response times were often delayed due to informal, inconsistent reporting mechanisms and unclear escalation pathways. Following the introduction of EWES with its structured checklists, tiered alert levels, and standardized communication tools average response times improved markedly. Care aides reported their observations through mobile or paper-based interfaces using the SBAR format, triggering real-time alerts to nursing staff. Nurses, in turn, acknowledged and responded to these alerts within defined timeframes corresponding to the severity of the concern. The study found that the median response time for moderate-level alerts decreased by approximately 30%, and urgent alerts received immediate attention nearly 90% of the time (Alfa, 2016, Forrester, et al., 2018). This acceleration in response facilitated earlier clinical assessment, timely intervention, and potentially prevented clinical deterioration.

Hospital transfer rates were another critical outcome measure. Frequent and often avoidable hospital admissions are a significant concern in long-term care, both due to the risks they pose to vulnerable residents and the costs they impose on healthcare systems. The pilot study tracked the number of hospital transfers before and after EWES deployment, controlling for resident acuity and seasonal variations. Results indicated a statistically significant reduction in hospital transfers associated with preventable causes such as infections, dehydration, and falls. Care aides' improved ability to detect early warning signs and escalate appropriately meant that many clinical issues were managed within the facility or through timely nursing interventions, thereby reducing the need for external emergency care (Bertholf, 2016, Mohan, et al., 2017). This finding aligns with broader evidence linking early detection and intervention to decreased hospitalization rates in long-term care populations.

Staff confidence and satisfaction formed a third key metric, evaluated primarily through pre- and post-implementation surveys and focus group discussions. Before EWES, care aides often expressed uncertainty about their role in clinical monitoring and hesitation to communicate concerns due to fears of dismissal or lack of response. Following training and implementation, a majority reported increased

confidence in identifying and articulating early signs of deterioration. They valued the clarity provided by structured observation tools and felt more integrated into the clinical care team. Nursing staff also reported improved communication flow and greater trust in care aide observations, enhancing interdisciplinary collaboration (Drayton Jackson, et al., 2019, Yip, et al., 2017). The qualitative data highlighted that EWES contributed to a culture shift where care aides felt empowered and respected, while nurses experienced greater situational awareness and reduced ambiguity during shift handovers.

The pilot also revealed several operational and contextual improvements in care delivery. Implementation of standardized checklists and observation guides led to more consistent and systematic resident assessments by care aides, reducing variability in care quality. The tiered escalation system clarified what constituted low, moderate, or urgent concerns, enabling care teams to prioritize workload effectively and reduce unnecessary alarm fatigue. Additionally, the integration of documentation within electronic or paper-based health records improved data accuracy and availability for clinical decision-making and quality monitoring (Mijailovic, et l., 2014, Morrison, et al., 2011). Nurses reported that having accessible, documented early warning data facilitated better continuity of care, particularly during shift changes or when external providers were involved.

However, the evaluation also identified challenges that informed further refinement of EWES. Some care aides initially struggled with digital interfaces, highlighting the need for ongoing technical support and simplified user design. A minority expressed concerns about increased workload or fear of over-reporting, which training programs addressed by emphasizing the system's role in supporting rather than policing care. Nursing staff emphasized the importance of timely feedback and closing the communication loop to maintain care aide engagement and ensure observed concerns led to visible actions (Dilts & McPherson, 2011, Huang & Klassen, 2016). These insights underscored the necessity of embedding EWES within a broader culture of communication, mutual respect, and continuous learning.

From a broader quality improvement perspective, the pilot study demonstrated that EWES could serve as a foundational element in establishing safer, more responsive long-term care environments. By formalizing and structuring the observational role of care aides, the system extended the clinical safety net beyond licensed staff, leveraging the unique proximity and continuity that aides provide. This collaborative approach improved detection of subtle health changes that might otherwise be overlooked, promoting earlier interventions and reducing escalation to emergencies (Le, et al., 2014, Yip, et al., 2016). The study's mixed-methods design provided robust evidence that the system's impact was not merely procedural but also relational, enhancing team cohesion and resident-centered care.

The pilot's success also reinforced the importance of comprehensive training and capacity building as critical enablers of EWES effectiveness. The structured educational programs accompanying implementation ensured that care aides were not only technically prepared but also psychologically empowered to take on enhanced monitoring roles. This combination of skill development and cultural change was essential for sustaining improvements and embedding EWES into routine practice. Additionally, the evaluation emphasized the need for strong leadership support, clear policies, and ongoing quality assurance mechanisms to maintain system fidelity and responsiveness over time (Agulnik, et al., 2017, Cherry & Jones, 2015).

In conclusion, the pilot study and evaluation of the Early Warning Escalation System for care aides in long-term patient monitoring provide compelling evidence of its value and feasibility. The mixed-methods approach illuminated both measurable improvements such as faster response times and reduced hospital transfers and qualitative benefits, including increased staff confidence and better interdisciplinary communication. These findings validate the conceptual framework of EWES and support its broader implementation as a practical, scalable strategy to enhance resident safety and care quality in long-term settings. The lessons learned from this pilot offer important guidance for future iterations, emphasizing the need for tailored training, technology support, and organizational commitment. As

healthcare systems seek to improve outcomes for vulnerable populations, the integration of EWES stands out as an effective approach to bridging observational gaps, strengthening care teams, and ultimately fostering a culture of proactive, collaborative patient monitoring.

2.7. Implementation Strategy

Implementing an Early Warning Escalation System (EWES) for care aides in long-term patient monitoring requires a comprehensive and thoughtful strategy that integrates seamlessly into existing workflows, actively engages all stakeholders, leverages appropriate infrastructure and technology, and incorporates robust feedback mechanisms for ongoing improvement. The goal of this implementation strategy is to ensure that EWES becomes an effective, sustainable, and accepted component of care delivery that enhances early detection of patient deterioration and promotes timely clinical intervention.

A key starting point for implementation is workflow alignment and stakeholder engagement. Long-term care facilities have established routines, protocols, and hierarchies that dictate how care aides, nurses, physicians, and administrative staff interact and communicate. Introducing EWES demands careful mapping and understanding of these existing workflows to identify where early warning observations naturally fit and how escalation can be optimized without disrupting daily care (Grant, 2019, McGrath, et al., 2018). This includes assessing the frequency and timing of care aide interactions with residents, existing documentation practices, communication channels with licensed nursing staff, and reporting protocols for clinical concerns. The system must be designed so that care aides can integrate observational checklists and reporting tools into their routine duties without adding excessive burden or confusion.

Engaging stakeholders early and continuously is critical to securing buy-in, clarifying roles, and addressing concerns. Stakeholders encompass a broad range of individuals and groups, including care aides, licensed nurses, clinical supervisors, facility leadership, information technology (IT) teams, and families of residents. Care aides, as primary users, need to feel valued and confident in their enhanced observational role. Nursing staff must trust and respond effectively to escalated reports. Leadership must endorse the system and allocate resources for training, technology, and quality assurance. IT teams play a vital role in configuring and supporting digital tools, ensuring data security, and integrating EWES with existing electronic health records (EHRs).

The engagement process begins with education sessions explaining the rationale, benefits, and operational details of EWES, emphasizing its role in enhancing resident safety and teamwork. Interactive workshops allow stakeholders to voice questions, suggest adaptations, and develop a shared vision. The formation of a multidisciplinary implementation committee or steering group provides ongoing governance and coordination, ensuring that diverse perspectives inform decision-making and that responsibilities are clearly assigned. Regular communication through newsletters, meetings, and digital platforms keeps stakeholders informed of progress and fosters transparency (Curry & Jungquist, 2014, Joshi, et al., 2019).

Infrastructure and digital tool deployment constitute another foundational pillar of the implementation strategy. While some long-term care facilities operate with limited technology, the successful deployment of EWES benefits greatly from user-friendly digital interfaces that facilitate rapid, accurate observation recording and real-time alerting. Selecting appropriate tools involves evaluating the facility's existing IT landscape, staff digital literacy, and budgetary constraints. Mobile applications optimized for care aides can provide intuitive checklists, escalation prompts, and communication channels to nursing staff. Where mobile devices are unavailable, tablet stations or computer kiosks may be installed in common staff areas to allow for easy access (McFarlane, et al., 2018, Ozekcin, et al., 2015).

Integration of EWES with the facility's electronic health record system, if available, ensures that early warning observations and escalation notes become part of the official clinical record, supporting continuity of care and auditability. Digital tools must

be designed with simplicity and efficiency in mind to minimize barriers to use. Features such as automated alerts to designated nurses, escalation tracking dashboards, and embedded instructional resources enhance usability and system reliability.

Infrastructure deployment also includes considerations beyond technology hardware. Adequate network connectivity, cybersecurity safeguards, and data privacy compliance are essential. Facilities must establish protocols for device maintenance, user access control, and technical support. Moreover, the physical environment such as staff break rooms or nurses' stations should accommodate easy access to devices without impeding care duties.

Complementing the digital infrastructure is a robust system of training and technical support. Care aides and nursing staff require hands-on training sessions that cover tool navigation, observational criteria, escalation workflows, and troubleshooting. Providing ongoing technical support and refresher training ensures sustained proficiency and confidence in using the system. Feedback loops that capture user experiences with the technology inform iterative improvements and help mitigate frustrations or inefficiencies (Kyriacos, Jelsma & Jordan, 2011, Saab, et al., 2017).

Feedback mechanisms and continuous refinement complete the implementation strategy by establishing a culture of learning and responsiveness. The EWES implementation is not a static process but an evolving journey shaped by real-world experiences, emerging challenges, and opportunities for enhancement. Continuous feedback is solicited from care aides, nurses, and other stakeholders through multiple channels, including structured surveys, focus groups, suggestion boxes, and informal discussions. This feedback encompasses usability of observation tools, clarity of escalation protocols, communication effectiveness, and perceptions of workload impact.

Data analytics derived from the system itself also provide valuable feedback. Monitoring key performance indicators such as the number and timeliness of escalations, response rates, and patient outcomes enables the identification of trends, bottlenecks, or gaps. Quality assurance teams analyze these data to assess adherence to protocols and the impact of EWES on clinical outcomes like hospital admissions and adverse events (Chevaliez & Pawlotsky, 2018, Thursz & Fontanet, 2014).

Regular review meetings of the implementation committee use this combined qualitative and quantitative feedback to guide refinements. Adjustments may include simplifying checklists, modifying escalation thresholds, enhancing training content, or upgrading digital features. Sharing success stories and addressing challenges transparently with staff reinforces engagement and promotes a culture of continuous improvement.

Sustainability is further supported by embedding EWES into organizational policies and procedures. Formalizing the system within care protocols, job descriptions, and performance appraisals ensures it remains a priority and a routine part of care delivery. Leadership commitment is maintained through periodic reporting to executive management on system outcomes, challenges, and resource needs (Bloch, Vermeulen & Murphy, 2012, Drain, et al., 2014).

In summary, the implementation of the Early Warning Escalation System for care aides in long-term patient monitoring is a multi-dimensional process that requires deliberate workflow alignment, active stakeholder engagement, thoughtful infrastructure deployment, and continuous feedback-driven refinement. When carefully executed, these components work synergistically to integrate EWES seamlessly into daily care practices, empowering care aides to detect early signs of deterioration, communicate effectively, and ensure timely clinical responses. This strategic approach not only enhances resident safety and care quality but also strengthens teamwork, accountability, and organizational learning cornerstones of excellence in long-term care delivery.

2.8. Challenges and Mitigation

Implementing an Early Warning Escalation System (EWES) for care aides in long-term patient monitoring presents significant opportunities for improving early

detection of clinical deterioration and enhancing patient safety. However, the deployment and sustained use of such systems also come with notable challenges that must be thoughtfully addressed to ensure effectiveness and sustainability. Among the most pressing barriers are resistance to change and staffing limitations, ensuring adequate clinical support and supervision, and overcoming issues related to digital literacy and access. Addressing these challenges requires a multifaceted strategy that balances human factors, organizational culture, resource allocation, and technology adoption.

Resistance to change is a common and often underestimated barrier in healthcare innovation, particularly when new systems redefine roles and expectations. Care aides in long-term care settings typically operate within established routines that are shaped by institutional culture, workload demands, and traditional hierarchies. Introducing EWES alters their responsibilities by formalizing their role in clinical observation and escalation a role historically reserved for licensed nursing staff. Some care aides may perceive this as an additional burden or fear increased scrutiny and accountability (Dacombe, et al., 2016, Ravi, 2013). They may also question the value of the system, especially if they are not adequately informed about its purpose or if prior change initiatives have failed or been inconsistently applied.

Staffing limitations further compound resistance and operational challenges. Long-term care facilities frequently face shortages of both licensed nurses and care aides, high turnover rates, and heavy workloads. When staffing levels are insufficient, care aides may struggle to find the time needed to complete additional observation checklists or reporting tasks. This can lead to incomplete data collection, delayed escalations, or inconsistent use of EWES, undermining its intended safety benefits. Moreover, high staff turnover disrupts continuity of knowledge and skill retention, requiring repeated training efforts that strain limited educational resources (Papali, et al., 2019, Xie, 2011).

To mitigate resistance and staffing issues, effective change management practices must be embedded into the EWES implementation strategy. Transparent communication about the rationale, benefits, and expected outcomes of the system is crucial. Leadership should engage care aides early through inclusive discussions, workshops, and feedback forums that acknowledge concerns and incorporate frontline insights. Framing EWES as a tool that supports rather than penalizes staff helps shift attitudes toward ownership and collaboration. Highlighting success stories where early detection prevented adverse events can also motivate staff by demonstrating tangible impact.

Addressing staffing constraints requires organizational commitment to adequate resource allocation. Where feasible, adjusting staffing ratios to provide protected time for care aides to perform observational duties is essential. Facilities may consider flexible scheduling, task reallocation, or employing additional aides to balance workload. Cross-training and mentorship programs can help retain knowledge within the workforce despite turnover. Furthermore, integrating EWES tasks into existing workflows rather than adding them as separate activities reduces perceived burden and facilitates adherence (Dacombe, et al., 2016, Elbireer, 2012).

Another critical challenge is ensuring robust clinical support and supervision. While care aides are the primary observers in EWES, licensed nurses and clinicians remain responsible for clinical assessment, decision-making, and intervention. Without timely, consistent, and competent clinical backup, care aides' observations risk being ignored or delayed, eroding trust in the system. Moreover, care aides need accessible guidance and reassurance when escalating concerns, especially in ambiguous situations where signs may be subtle or multifactorial.

Ensuring effective clinical support requires clear delineation of roles and escalation pathways within the facility's policies. Nurses and supervisors must be trained to respond promptly and constructively to EWES alerts, providing feedback to care aides and documenting clinical actions taken. Establishing defined response timelines and accountability mechanisms helps maintain system integrity. Leadership commitment to fostering open communication channels and psychological safety is

vital, so care aides feel confident that their concerns will be taken seriously without fear of blame (Sakeah, et al., 2014, Uzondu, et al., 2015).

Regular interdisciplinary meetings and case reviews that include care aides reinforce collaborative problem-solving and mutual understanding. These forums provide opportunities for clinical staff to clarify expectations, for care aides to share observations and challenges, and for the team to refine escalation protocols based on experience. Investing in leadership development that equips nurse managers and supervisors with skills in coaching and supportive supervision also enhances clinical backing of EWES.

Digital literacy and access present additional obstacles, particularly in facilities with limited technology infrastructure or where care aides have varying levels of comfort with digital tools. EWES often relies on mobile apps or electronic reporting platforms to enable real-time documentation and alerting. If care aides lack basic digital skills or if devices are scarce, poorly maintained, or not user-friendly, compliance and data quality suffer. Furthermore, inconsistent internet connectivity or cybersecurity concerns can disrupt system reliability (Black, et al., 2017, Perry, et al., 2017).

To mitigate digital barriers, training programs must include hands-on, practical sessions that accommodate different learning styles and literacy levels. Instruction should start with foundational skills such as navigating devices, entering data accurately, and responding to alerts. Ongoing technical support and troubleshooting are critical to prevent frustration and abandonment. Simplified interfaces with clear visuals, large buttons, and minimal text can improve usability for non-technical users. Where possible, devices should be dedicated to EWES use and positioned conveniently within care areas to facilitate easy access during shifts.

In settings where digital solutions are not feasible, paper-based or hybrid systems may serve as interim measures. Standardized forms and manual escalation procedures can replicate the key functions of EWES, though with limitations in timeliness and data integration. Facilities should plan for gradual digital transition as resources permit, ensuring that staff remain engaged throughout the process.

Engaging IT professionals early in the implementation phase helps align technology deployment with user needs and facility capabilities. Collaboration between clinical and technical teams can lead to customized solutions that balance sophistication with simplicity. Additionally, addressing data security, privacy, and compliance with regulatory standards is essential to maintain trust and protect sensitive resident information (Borrow, Munns & Henderson, 2011, Freeman, et al., 2017).

In summary, the successful deployment of the Early Warning Escalation System for care aides in long-term patient monitoring depends heavily on proactively addressing three interconnected challenges: resistance to change and staffing limitations, ensuring clinical support and supervision, and overcoming digital literacy and access issues. Effective mitigation requires a comprehensive approach that combines strong leadership, inclusive communication, adequate resource allocation, targeted training, and technological adaptability (Ojemeni, et al., 2017, Perry, et al., 2017). When these barriers are thoughtfully managed, EWES can realize its potential to empower care aides, enhance interdisciplinary collaboration, improve early detection of deterioration, and ultimately contribute to safer, higher-quality care for long-term care residents.

2.9. Conclusion and Recommendations

The Early Warning Escalation System (EWES) for care aides in long-term patient monitoring represents a pivotal advancement in enhancing the safety and quality of care within long-term care facilities. By providing care aides with structured tools to observe, document, and escalate subtle changes in residents' conditions, EWES empowers the frontline workforce to act as vital sentinels against clinical deterioration. This system fosters timely communication between care aides and licensed nursing staff, enabling early interventions that can prevent avoidable complications and reduce unnecessary hospital transfers. The standardized use of observational indicators, tiered escalation pathways, and clear reporting formats

enhances consistency and reliability in monitoring, creating a robust safety net around vulnerable populations.

The benefits of EWES extend beyond individual resident outcomes to encompass broader implications for the culture and operation of long-term care environments. By formalizing the role of care aides in patient monitoring, the system promotes interdisciplinary collaboration, shared responsibility, and mutual respect among care teams. It supports the development of a proactive safety culture where early warning signs are recognized and addressed promptly, reducing the risk of adverse events. Additionally, EWES contributes to improved documentation and data capture, facilitating quality improvement initiatives and regulatory compliance. For residents, this translates to more responsive care, fewer hospitalizations, and enhanced overall well-being, while for staff, it cultivates empowerment and professional growth.

Looking ahead, the scalability and widespread adoption of EWES hinge on sustained commitment from healthcare organizations, policymakers, and regulatory bodies. Future directions include integrating EWES into national quality and safety standards, securing funding to support training and technology infrastructure, and tailoring the system to diverse long-term care settings, including rural and resource-limited facilities. Expanding research to evaluate long-term impacts on clinical outcomes, staff engagement, and cost-effectiveness will provide valuable evidence to guide refinement and policy formulation. Moreover, leveraging advancements in digital health such as mobile applications, artificial intelligence, and telehealth integration can enhance the system's accessibility, accuracy, and real-time responsiveness.

In conclusion, the Early Warning Escalation System offers a practical, scalable, and impactful solution to one of long-term care's most persistent challenges: the timely recognition and response to resident deterioration. By centering care aides in this process and providing them with clear, supportive tools, EWES bridges a critical gap in patient monitoring. With thoughtful implementation, continuous evaluation, and policy support, this system has the potential to transform long-term care delivery, safeguarding vulnerable populations and elevating standards of safety and quality across the sector.

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