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Digital Empowerment: Reshaping the Future of Nursing Care and Education

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Abstract

The global healthcare landscape is entering the data-driven era of Industry 4.0, challenging nursing with profound structural transformations within increasingly complex clinical environments. The nursing profession in Taiwan is now confronting a "dual crisis" marked by a critical workforce shortage and unsustainable clinical workloads. This crisis permeates both clinical practice and nursing education, necessitating proactive and effective reform strategies. Digital technologies, including artificial intelligence (AI), AI-driven virtual avatars, digital twins, and virtual reality offer significant potential to augment clinical decision-making, enhance educational outcomes, and optimize patient self-management. Therefore, digital empowerment, more than simply the integration of technologies, represents a strategic pathway forward to reshaping nursing values and promoting professional dignity. Topol (2019) emphasized that alleviating clinical dilemmas is the primary aim of smart technology integration in the field of healthcare. By leveraging technology to solve practical issues, clinicians can reclaim time for direct patient care, facilitating humanistic, compassionate care and elevating the intrinsic value of nursing. In clinical practice, several healthcare institutions have already implemented virtual agents and remote monitoring systems to assist in clinical problem-solving, disease progression monitoring, and the provision of individualized health education and psychological support. Furthermore, digital twin technology is emerging as a cornerstone of this transformation. Integrating electronic health records with real-time data streams to create "virtual personas" is allowing nurses to detect subtle physiological changes prior to the onset of clinical deterioration, achieving precision care and optimizing healthcare operations. Carroll and Garcia-Dia (2025) argued that digital twins are not only predictive tools but also catalysts for redefining care delivery processes. In the realm of nursing education, academic institutions are actively developing digital curricula that incorporate metaverse elements such as virtual reality and augmented reality to bolster student engagement and learning efficacy. AI virtual humans and immersive virtual reality are at the forefront of pioneering new pedagogical models designed to enable students to cultivate core competencies within engaging and targeted learning environments. Using no-code platforms, educators are increasingly able to independently develop simulation scenarios that incorporate interactive voice response capabilities. These virtual environments allow students to practice nurse-patient communication and clinical decision-making in low-stakes, repeatable settings that effectively mitigate the "reality shock" traditionally experienced during the transition from academic to actual clinical environments. Ultimately, the goal of digital empowerment is to support professional judgment and return time to nursing professionals, ensuring the core of nursing remains centered on care and compassion, aspects that technology remains largely unable to handle. We hope this column will inspire readers to reflect on how technology can be harnessed to construct a sustainable and professionally valuable future for nursing amidst the smart healthcare wave.

Keywords: *digital empowerment, nursing workforce shortage, digital twins, AI simulation*

INTRODUCTION

Stroke is a leading cause of death and disability in the UK, with approximately 100,000 cases annually [1]. A substantial proportion of stroke survivors experience long- term physical, cognitive, emotional or behavioural deficits [2]. Although the term ‘chal- lenging behaviour ’ is not used explicitly in the stroke literature, a range of behavioural presentations are described that can challenge care delivery, including anger, aggression, irritability and agitation [3]. Confusion is also commonly documented after stroke and can present significant challenges for care [4]. Challenging behaviours in healthcare settings vary in intensity, frequency, and duration. They are recognised as a source of safety risks and care disruption, and they place emotional and physical demands on staff while also affecting patient experience [5,6]. An organisational imperative therefore exists in under- standing challenging behaviours post-stroke, in mitigating their deleterious effects and maintaining ‘safety for all’.

Long recognised as significant post-stroke sequelae [7], challenging behaviours may appear at any stage of recovery and are often missed, particularly when communication or cognitive difficulties limit assessment [8,9]. Their presence, particularly agitation and aggression, can interfere with rehabilitation and day-to-day ward routines, impacting the delivery of care and overall recovery [10]. Nursing staff, at the forefront of managing challenging behaviour, frequently report heightened stress and increased emotional burden when managing such behaviours in neurorehabilitation settings [11,12]. Significant patient distress [13] and increased healthcare utilisation [14] have also been reported following stroke in relation to neuropsychiatric complications. These observations contribute to rec- ommendations for strengthening general psychological support within stroke services [15] and highlight wider service impacts [16]. They also highlight the need for a comprehensive understanding of challenging behaviour following stroke.

A study exploring anger, hostility and aggression in acute stroke found 35% of patients presenting with anger [17]. The study highlighted that anger was probably caused by the stroke lesion which interfered with emotional control and noted that many patients were not aware of this presentation. Where post-stroke mania is present, agitation may be particularly prominent, with a systematic review reporting agitation in approximately 63% of the 74 reported cases [18]. Post-stroke anger (PSA) and aggression are among the most commonly reported behavioural symptoms, with prevalence estimates ranging from 11 to 35% in the acute phase and from 19 to 32% in the subacute phase [9]. There is a lack of consensus regarding the precipitating factors of PSA. Recent reports suggest a correlation with damage to brain regions responsible for emotional regulation [19]. Other studies suggest psychosocial stressors, such as frustration with functional limitations, as important contributing factors to post-stroke emotional and behavioural difficulties [20,21].

Previously, Kim [22] described ‘anger proneness’, a difficulty in regulating post-stroke aggression, and identified it, along with emotional incontinence, as factors negatively influencing functional outcomes and increasing carer burden. While the impact of this seems to be less severe than other emotional disturbances (e.g., post-stroke depression), it can be distressing and embarrassing for patients, decrease their quality of life [10] and negatively influence functional outcomes [22]. Despite their prevalence and impact, these behaviours remain insufficiently characterised in the literature, particularly as to how stroke services document and manage these behaviours in practice.

This study aimed to explore the presentation of challenging behaviour following acute stroke in relation to demographic and clinical characteristics, and to describe its documentation in relation to care and discharge.

MATERIALS AND METHODS

Study Design

A retrospective chart review was conducted to explore the presentation, assessment, and management of challenging behaviour in patients admitted with acute stroke. The study is reported in

accordance with the SQUIRE 2.0 (Standards for Quality Improvement Reporting Excellence) guidelines [23] and is available in the Supplementary Materials.

Context and Setting

The study was undertaken at two stroke units within the Lancashire Teaching Hos- pitals NHS Foundation Trust. These units provide acute stroke care and rehabilitation services, with multidisciplinary staffing including stroke physicians, nurses, occupational therapists, physiotherapists, and speech and language therapists. The study was under- taken as part of a 12-month academically supervised research internship, which included supervisor allocation, project scoping, data collection and analysis, report writing, and poster presentation. The research intern was a senior occupational therapist experienced in clinical practice. All patients consecutively admitted to the stroke units between March and April 2022 were included.

Data Collection

Electronic records were reviewed by a member of the study team (Principal Occupa- tional Therapist). A data collection tool was developed to capture data across four domains: demographics (e.g., age, gender, pre-admission living arrangements); clinical history (e.g., stroke type, pre-existing confusion or psychiatric history, NIHSS score); documented impact on care (e.g., own care, other patients, additional staffing, management); and discharge and follow-up outcomes (e.g., discharge destination, delays, and post-discharge care). Chal- lenging behaviour was identified during chart review based on documented behavioural descriptions (e.g., anger, aggression, irritability, agitation, and confusion). The tool also captured the use of formal assessment tools recorded (e.g., delirium and cognitive screening instruments, behaviour charts, psychological assessments, capacity assessment Deprivation of Liberty Safeguards, or enhanced care risk assessments).

Data Analysis

Descriptive statistics were used to summarise data for all patients and for subgroups based on the documented presence or absence of challenging behaviour. Frequencies, percentages, means, medians, and ranges were calculated where relevant. Subgroups are presented based on the documented presence or absence of challenging behaviour, across demographic, clinical, and discharge-related variables. For each variable, reporting was based on clinical record documentation. Where information was missing, this is reflected in table denominators.

Ethical Considerations

This project was registered and approved as a clinical audit within the NHS Trust. Under NHS governance procedures, NHS Research Ethics Committee review is not required for registered clinical audits. Analysis and publication of anonymised audit data are permitted. Patient records were anonymised prior to analysis, and no direct patient contact occurred.

RESULTS

This study examined 48 patients following a stroke, with challenging behaviour documented in 13 patients during their stay (see Table 1). Ages were comparable in both groups, and women were more represented among those with challenging behaviour (8/13). Around half of those who developed challenging behaviour had been living independently (7/13), with nearly a third in residential or nursing care (4/13). Most patients who developed challenging behaviour had experienced an ischaemic stroke (11/13), with only two cases following intracerebral haemorrhage. Patients with challenging behaviour were also more often categorised as having moderate stroke

severity on admission (6/13), and median length of stay was longer for those with challenging behaviour (19 days) compared to those without (7 days).

Only 3 of the 13 patients in whom challenging behaviour was documented had a recorded history of confusion or challenging behaviour before their stroke. Dementia was documented in three patients, and previous stroke in only one patient. Most had other pre-existing health conditions (12/13). Clinical factors were noted in 9 of the 13 patients at the time their behaviour was observed, most commonly inattention/neglect (n = 5) and infection (n = 4), and several patients had other acute contributing factors such as frailty, communication problems, or impulsivity (n = 5). See Table 2 for history and clinical factors.

When challenging behaviour was documented, challenges to care delivery were docu- mented in almost half (n = 6) of these patients, predominantly through refusal of treatment (n = 4). Challenging behaviour occasionally disrupted the care of other patients (n = 2) and additional professional input was required for over half of the patients with challenging behaviour (n = 7), including nursing staff, and specialist clinical and multidisciplinary teams. Management strategies were documented for all patients with challenging be- haviour and included a range of clinical, safeguarding, and supportive approaches, most commonly one-to-one care, and deprivation of liberty standards (both n = 6). See Table 3 for documented impact on care and management.

Post-discharge destinations for patients in whom challenging behaviour was docu- mented were varied (See Table 4). Of the 11 with recorded outcomes, 6 returned to their own homes independently or with family assistance, with 4 being discharged to a nursing home. Discharge was delayed for 4 of the 13 patients in whom challenging behaviour was documented, due to the need for either an increased package of care (n = 2) or a specialist discharge destination (n = 2).

Documentation of behavioural presentation showed that challenging behaviour was most often described as confusion or agitation, and reports were usually made by nursing or therapy staff. Where follow-up assessments were recorded, these commonly related to capacity, deprivation of liberty, or risk assessments, while formal cognitive screening was only recorded for one patient.

DISCUSSION

This study examined challenging behaviour following acute stroke in relation to pa- tient characteristics, management, and impact on care. Challenging behaviour was recorded in just over a quarter of patients admitted with stroke, with caution that this reflects clinical documentation and perception rather than prevalence per se. Those in whom challenging behaviour was documented were typically older adults, more often women, admitted with moderate strokes and a range of co-existing health conditions. Consequently, challeng- ing behaviours in stroke were documented alongside clinical complexity rather than a distinct or predictable patient profile. Inattention/neglect and infection were commonly recorded clinical factors documented alongside challenging behaviour. When documented, challenges to care delivery were documented in around half of patients, most notably treat- ment refusal and the need for additional nursing or multidisciplinary input. Admissions were also longer for these patients, occurring in the context of management and discharge planning complexity. Management approaches varied and challenging behaviour was occa- sionally documented alongside discharge delays for specialist care planning or placement arrangements. This variability suggests that the role of early specialist multidisciplinary involvement in managing care complexity could be explored in future research. Behaviours were most often recorded by nursing staff and categorised predominantly as confusion or agitation. Despite this, formal cognitive screening was infrequently documented, but it was unclear whether this reflected actual assessment or merely documentation practices. Understanding staff use and documentation of structured screening and assessment tools would help clarify this finding.

The profile of patients with documented challenging behaviour in this study (i.e., older adults, mostly women, with moderate stroke severity and multiple comorbidities) both contrasts with and complements previous research. Earlier studies have linked post-stroke aggression to younger age, a

history of depression, speech difficulties, and poor cognitive or motor function [24–27]. In contrast, Lau et al. [10] found no association between post-stroke anger and age or gender. However, in line with current findings, previous health conditions, such as diabetes, concurrent depression, and stroke severity have been linked to post-stroke aggression and agitation [10,20]. Alignment with some studies and divergence from others may reflect the fact that the literature is yet to converge on a consistent understanding of post-stroke challenging behaviour, including how behaviours are defined and labelled.

Inattention, neglect, and infection were commonly documented among patients with challenging behaviour in this study. Santos et al. [17] noted neglect among patients with intense anger, while Choi-Kwon and Kim [3] described post-stroke anger as a manifesta- tion of delirium, involving disturbances in attention and cognition. Infection may also contribute to behavioural disturbance by precipitating delirium, a link supported in stroke populations [28] and more broadly in older adults [29]. These findings are consistent with our study, where confusion and agitation were frequently documented. However, formal cognitive or delirium assessments were rarely recorded, limiting insight into behavioural assessment practices. In the absence of formal screening to identify potential cognitive or physiological contributors, pathways to specialist input are less clear, increasing reliance on non-specialist management within routine care.

Documented challenges to care included treatment refusal, increased multidisciplinary input, and longer admissions, reflecting tangible service pressures during acute stroke care. Consequently, processes that support timely identification and escalation of care could be explored in future research. This reflects earlier work from Remer-Osborn [30], who described behavioural disturbances as contributing to caregiver distress and com- munication breakdown. While caregiver experience was beyond the scope of this audit, its prominence in the literature highlights the importance of future work that considers emotional wellbeing and organisational support mechanisms among stroke caregivers. The absence of standardised tools for assessing post-stroke behavioural symptoms, as noted by Choi-Kwon and Kim [3], and the under-recognition of these behaviours in stroke care, suggest the value in exploring improved screening and management protocols. This need is also supported by van Heugten and Wilson [21] and the National Clinical Guideline for Stroke [31], which advocate for early identification and tailored neuropsychological support to improve rehabilitation outcomes. In summary, the literature and current findings suggest that challenges in care delivery documented in relation to challenging behaviour may be well recognised but remain difficult to address consistently.

These findings offer insight into how challenging behaviour is recognised, docu- mented, and managed within routine stroke services, informing consideration of broader implications for service delivery and future research.

Implications and future directions

This study provides a descriptive snapshot of challenging behaviour presentation and management within a single NHS Trust. While the findings cannot be generalised beyond this setting, they identify patterns that could be explored further locally and nationally. Challenging behaviours in clinically complex situations, as reflected in documentation alongside moderate stroke severity, comorbidities, and additional care needs observed here, may benefit from multidisciplinary and multi-specialty assessment to ensure medical and behavioural contributors are appropriately addressed. The infrequent documentation of formal cognitive or delirium screening found in this study suggests inconsistency in recorded behavioural assessment practices. However, this may not reflect actual clinical practice, highlighting scope in exploring screening and its documentation to support clinical response further. If similar patterns are found in larger studies, wider specialty-specific protocols could be explored in a national context. The predominance of ‘confusion’ and ‘agitation’ as descriptors found here highlights the challenge of defining and categorising behavioural change after stroke. This has implications for care, as distinguishing cognitive states from behaviours informs

appropriate assessment and response. Further work could explore how challenging behaviour is operationalised in stroke care to support recognition, documentation, and management. The observed difference in length of stay indicates an area for further investigation in larger cohorts, with statistical testing to characterise these patterns, and to establish whether similar patterns exist in other settings. These descriptive findings provide a preliminary basis for larger-scale, multi-site research that may inform practice recommendations.

Strengths and limitations

Consecutive stroke admissions during the study period were reviewed, reducing the risk of selection bias. The inclusion of two units representing different points in the stroke pathway provided some contextual breadth in how behaviours were recorded and managed. The study also establishes a foundation for future, larger-scale evaluation of be- havioural presentation and management across stroke services. The study was conducted within a defined time period associated with a research internship, which limited the duration of data collection to that period. Consequently, findings may not reflect patterns across different time periods. Within this time-limited scope, the data extraction tool was not pilot tested, and data extraction consistency was not formally assessed. As the study was retrospective, it relied entirely on existing clinical notes. The information available depended on what had been recorded at the time, which may have reflected clinician variability, and interpretation by a single reviewer may have introduced subjectivity. Simi- larly, with the retrospective design, we were unable to clarify ambiguities in the clinical record or determine whether the clinical notes fully reflected actual care and management. Challenging behaviour was not defined using a standardised operational definition, and identification relied on terminology used in routine clinical documentation. Accordingly, misclassification related to documentation is a potential source of bias in this study. Fi- nally, the small sample from a single organisation and geographical area may not reflect settings elsewhere.

CONCLUSIONS

Challenging behaviour was documented in just over a quarter of stroke admissions, most often described as confusion or agitation, and was commonly documented along- side inattention or infection. When documented, it was done so alongside challenges in care delivery, sometimes through treatment refusal, and often alongside additional multidisciplinary input. Length of stay was longer for these patients, and discharge was sometimes delayed. Formal cognitive or delirium screening was rarely recorded. These findings provide a descriptive account of the way challenging behaviour was documented in stroke care at a local level. They provide baseline descriptive data to support a broader national exploration of how such behaviours are recognised, understood, and managed in clinical practice.

Conflicts of Interest: The authors declare no conflicts of interest.

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