Executive Summary of DNP Project

Indicators of Transport Nurses Safety Competency

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**Problem Statement and Significance**

Transport nursing involves the provision of care to critically ill or injured patients by airplane (fixed-wing), helicopter or by ground ambulance. Air medical transport (AMT) is the use of an airplane or helicopter to transfer patients from the scene of an accident or rural hospital to specialized health care facilities. The transport team consists of two health care providers and a pilot or ambulance driver. In the US, most clinical transport providers are registered nurse/paramedic teams (Alfes, 2020). Although patient safety is a universal concern for all nurses, safety concerns extend beyond the patient in transport nursing. Safety is one of the top priorities in transport nursing because of the unpredictable nature of moving critically ill or injured patients by air or ground (York Clark et al., 2017). For instance, all transport team members, including the nurse, are at risk for injury or death if safety protocols are compromised (Blumen, 2009). From 1991 to 2008, air medical transport programs in the United States reported an alarming number of crew member fatalities from crashes, exceeding fatalities sustained during that period in any other type of aviation (Blumen, 2009). Over 90% of crashes were attributed to human factors such as complacency in not following safety protocols (Blumen, 2009). Since that time, the number of air medical and critical care ground incidents have decreased due to safety interventions developed to formalize a top-down organization-wide approach to managing safety risk and assuring the effectiveness of risk controls (Federal Aviation Administration, 2020).

A nurse who holds one or more specialty-nursing certifications in transport, such as the Certified Flight Registered Nurse (CFRN) and the Certified Transport Registered Nurse (CTRN), offered by the Board for Certification of Emergency Nurses (BCEN) is commonly assumed to have greater clinical and transport safety knowledge and competency than a nurse who holds no such certifications (BCEN, 2021 & Schroeter, 2015). Although these certifications require nurses to be familiar with safety standards, it is unclear if transport nurses consistently translate/apply safety knowledge into behaviors post certification examination. There are no safety universal assessment requirements post certification. Despite the standard practice of viewing certification status as an indicator of safety competency, there is little quantitative information to determine the relationship between the two.

In the current project, our purpose was to determine the relationship between certification status and the transport nurse’s self-rated safety competency. The specific aims were as follows.

Aim 1. Compare safety competency scores between transport nurses with any specialty nursing certification and transport nurses holding no specialty nursing certification.

* 1. *Hypothesis: Certified transport nurses (i.e., having at least one specialty nursing certification) will have higher safety competency scores in comparison with noncertified transport nurses (i.e., not having any specialty certification).*

Aim 2. Compare safety competency scores between nurses holding a transport-specific nursing certification (CFRN or CTRN) and Nurses holding a non-transport-specific nursing specialty certification.

*Hypothesis: Transport-specific certified transport nurses (i.e., having a CFRN and/or CTRN) will have higher safety competency scores in comparison with non-transport-specific certified transport nurses (i.e., having a certificate that is not a CFRN and/or CTRN).*

Aim 3. Determine the relationship between nursing certification status and transport safety competency scores.

* 1. *Hypothesis: There will be a significant and positive relationship between certification status and safety competency scores.*

**Methodology**

This was a cross-sectional project using an online survey. The survey included demographic questions (e.g., age, biological sex, ethnicity, certification type, years in transport, current transport engagement, and academic preparation) and an assessment tool for safety competency. We measured safety competency with an adapted version of the 22-item Critical Care Nursing Competence Questionnaire for Patient Safety (C3Q-Safety) Scale (Okumura et al., 2019). To adapt the C3Q-Safety Scale for transport nursing, we first reviewed the 22 items and matched them with the Air & Surface Transport Nurses Association (ASTNA) safety standards. Then, five transport nursing experts reviewed the 22 items for face validity and relevance to ASTNA safety standards. The scale was further revised based on feedback from the subject matter experts. The C3Q-Safety scale assesses four safety factors: decision making, collaboration, nursing intervention, and principles of nursing care. The original C3Q-Safety scale has a Cronbach’s alpha ranging from 0.73 to 0.83 (Okumura et al., 2019). The adapted C3Q-Safety scale (A-C3Q-Safety Scale) had a Cronbach’s alpha of 0.80. Members of the Air and Surface Transport Nurses Association (ASTNA) representing 2200 transport nurses were invited to participate. These transport nurses could be active or non-active practitioners of transport nursing, practicing ground or air (i.e., fixed-wing airplane or rotorcraft such as a helicopter) transport nursing, and have a range of nursing licenses from registered nurses to advance practice nurses. A series of 3 recruitment emails were sent to all members over a 3-week period by the ASTNA Executive Director. The email included a link to the Qualtrix survey. The project was reviewed and approved by the Purdue Institutional Review Board (IRB number 2020-1507.). T-tests were used to compare C3Q-Safety scores between those who were certified versus not, and multiple linear regression testing to determine factors associated with C3Q-Safety scores. Only those with complete C3Q-safety scale and nursing certification results were included in the analysis (n=302).

**Results**

The survey had a 20% response rate (432 out of 2200 nurses). The analysis was completed on 302 participants with complete data. Participants were 54.3% female, 94.7% White, 50% bachelors prepared, 92.7% certified (76% with a transport nursing–specific certification), and on average 48 years of age (range: 24–71, SD: 10.57). Twenty-two participants, or 7.3%, had no certification. Participants had a mean of 14 years of experience (range: 0-48, SD: 10.99). Hypotheses 1 and 2 were not supported: T-tests indicated no significant difference in safety scores for those who were certified versus not certified or for those certified in transport nursing versus not certified in transport nursing. Hypothesis 3 was supported: multiple linear regression analysis revealed a statistically significant negative association between years of transport nursing experience and safety scores (β = -0.150, p = 0.037), even after adjusting for total years in transport, certification status, biological sex, and current activity as a transport nurse. For each additional year of transport experience, safety competency scores decreased by 0.15. The relationship between certification status and safety scores was not statistically significant.

**Discussion**

The study examined the relationship between certification status and self-reported safety competency scores. We hypothesized that nurses with certification and nurses with specific transport certification would have higher safety scores than those not certified. Surprisingly, there was no relationship found between safety scores and certification status. However, we did find a statistically significant decrease in safety scores in nurses with more years of transport experience. Decreasing A-C3Q-Safety scores by transport nurses with more experience may imply changes in those nurses’ perception of acceptable safe practices. These findings link to the concept of “normalization of deviance” or “practical drift,” which is frequently discussed in the safety literature (Prielipp et al., 2010; Price & Williams, 2018). Practical drift from established safety protocols or other nursing protocols is common, despite tenure, academic preparation, and specialty certification (Browne, 2019). In aviation, when a pilot is training to fly using instruments, there is a classroom learning component and a practical component monitored by a training pilot (Mize, 2019). Once certified in instrument flying, the pilot must be reassessed for compliance and competency by a training pilot at regular intervals to maintain certification. This model is not employed in transport nursing; once trained and certified, a transport nurse is assumed to hold a steady or increasing level of safety competency (Weiner, 1981). The results from this study may indicate that further examination of nursing safety training and competency assessment is needed.

In the context of transport nursing safety, deviations from safety standards may be accepted and may result in serious safety errors or fatalities (Banja, 2010). An example of safety practical drift in transport nursing is deviation from the safety standard of securing medical equipment (e.g., cardiac monitor, oxygen cylinder) prior to vehicular movement. The nonadherent behavior may be rationalized for reasons such as better workflow, time efficiency, or more effective care delivery. Colleagues who observe such deviance may believe the practice is acceptable and adopt the nonadherent behavior themselves. This normalization of deviance may lead to the deviant behavior becoming the new practice norm and drive practical drift (Harvey & Sotardi, 2017). In the setting of a potentially survivable crash, the unsecured equipment may become projectiles that cause serious or even fatal injuries to the patient or the transport team, including the nurse. Addressing practical drift to ensure that safety standards are upheld is critical to the safety of patients, nurses, and the entire transport team.

**Systems Implications**

Practical drift in an individual nurse’s practice is a significant systemic safety concern. Although hospitals and transport programs have policies in place to prevent safety errors (i.e., requiring completion of checklists to ensure equipment is functional and critical items are available), the presence of policies do not eliminate errors in human behavior or practical drift (Helmreich, 2000). In other words, although nurses may have knowledge and awareness of safety policies, their safety behaviors may still deviate from policies in practice. An example of practical drift with checklists could be not checking all the equipment on the crash cart but signing off on the checklist. The nurse may rationalize this as acceptable presuming that the crash cart has not been used and assumes all is intact. This deviant behavior may occur once with no consequence, and become the new normal (Wright et al, 2021). This deviant safety behavior is an indication that the system does not effectively identify, address, and deter deviation from psychomotor skills of safety standards (Boyson, 2013). In systems with no checks and balances for deviation, the safety net established by well-defined, evidence-based policies and procedures (e.g., checklists) is weakened. For systems to optimize safety, transport nurses must be empowered to proactively monitor adherence. The system must foster a safety culture that encourages reports on deviant behaviors and does not punish those who report deviations. Systems that focus on the management of human behavior by holding transport nurses and other team members accountable will identify practical drift earlier and mitigate errors and their potentially devastating consequences. For example, if a new transport nurse witnesses a colleague not securing a monitor when loading a patient into an aircraft, this safety practice deviation may take three paths. In the first, the new nurse adopts the process of not securing the monitor and eventually there is an event in which the monitor becomes a projectile and vehicle occupants are injured. In the second path, the nurse reports the issue and is reprimanded and ridiculed for raising a “trivial” issue. In the third path, the new nurse reports the issue, and the behavior is discussed as a systems issue, and the safety practice is reinforced systemwide and adjusted. By having a system that encourages a safety culture, transport nurses will feel comfortable reporting deviations and feel assured that reporting such actions will be valued and result in safer transport missions. One way to create a safety culture that mitigates practical drift may be by creating a leadership hierarchy structure to support and maintain the checks and balances necessary to monitor and intervene when there are deviations. The leadership team must ensure that effective monitoring can be accomplished, and that requirements and actions are in place to remedy safety deviations.

**Policy Implications**

The lack of difference in safety competency scores between those who were certified versus not certified may indicate that current nursing certification testing does not imply future safety competency or behaviors. Having a certification, even a specialty transport certification, may not adequately mitigate practical drift in safety. The policy implication is that although certification may represent competency at the time of certification, periodic safety training and assessment should be required to ensure that safety standards are upheld. For instance, a system that includes regular safety gap analysis with simulation-based scenarios that evaluate practice requirements may increase safety proficiency for the clinician (Gaba, 2007). Transport programs may be improved by instituting a safety training and operations policy for all transport nurses that requires: (1) post mission debriefing for all missions to identify deviance from standards such as safety violations, and (2) monthly monitoring of a high-risk activity (i.e., such as loading a patient with airway and IV lines in place) to assess for safety risks and near misses. Monitoring may include observation of patient care tasks, measurement of end-tidal carbon dioxide to assure airway security, and assessment of body mechanics for the transport nurse and other crew.

Additionally, as discussed in the systems implications, all transport programs may benefit from a safety policy that ensures nonpunitive reporting of deviations from established safety procedures (Marx, 2001). For example, a policy could detail examples of deviations to report, the person(s) to whom the deviance should be reported, how to report the deviance, and the process to expect following the report. Policies may reduce practical drift in safety and lower the chances of hazardous care provision and unsafe practices being instilled in transport nurses (Browne, 2019). Established policies would require periodic review to refine safety practices and incorporate recent learning.

**Economic Implications**

Our finding of reduced self-assessed safety competency scoring among experienced transport nurses is concerning, due to the potential for practical drift to cause errors that result in medical, resource, and/or personnel losses. For instance, the Institute of Medicine “To Err is Human” report estimated 98,000 people die in hospitals due to medical errors each year (Institute of Medicine, 2000). The economic cost of these errors is estimated to be nearly 20 billion dollars per year (Rodziwewicz et al., 2020). While many studies have examined medical error costs, no studies are available to determine the cost of medical errors in transport nursing. However, given the presence of practical drift and the possibility of medical errors in all clinical venues, we assume the economic impact of practical drift from safety standards in transport nursing may be significant. What is clear, are the costs from vehicle crashes due to safety deviations. These costs may include debilitating injury of loss of life for the nurse, other team members, the patient, or civilians at the crash site; litigation of causation of the accident; immediate health care costs for those injured; and crisis intervention or mental health recovery costs for the surviving transport nurse and team members and their families. More specifically, if a nurse dies because of a safety-related incident or accident or decides to leave transport nursing due to an incident or accident, the loss is compounded by the cost of hiring and training a replacement transport nurse (Brooks, 2017). The replacement of experienced transport nurses is expensive. Evidence reveals that the cost of replacing a general medical surgical nurse ranges between $10,100 and $64,000 (Park et al., 2016). Transport nurse training and orientation is more protracted and specialized; therefore, the cost may be significantly greater than what is noted in the literature (York Clark et al., 2017). Since 90% of air medical crashes are related to human error (Blumen, 2009) and practical drift is in large part due to human error, one can conclude that allowing practical drift to continue may result in high economic costs inclusive of expenses related to resources, people, and time.

**Practice Implications**

Our findings suggest that certification status and years of nursing experience may not be an adequate indicators of transport nursing safety competency. Exploring ways to identify deviant safety practices and understanding the impact of deviant behaviors through scenario-based simulation may help prevent practical drift. Simulation may be particularly useful because redundancy of actions is one of the most reliable strategies to reduce safety errors from human factors (Wetterneck et al, 2014). A simulation allows the transport nurse to stress the system and see the impact without the risks associated with actual intervention (Cant & Cooper, 2017). High-risk transport scenarios may be particularly useful. For instance, a high-risk scenario simulation may include role-playing the acceptance of a transport mission with unfavorable conditions (e.g., weather, location of patient). Each simulation should include a debriefing post simulation that involves all team members and the simulation leader to review the actions taken, areas of practical drift or deviation from standards, and identification of nonadherence to safety standards (Sofer, 2018). Additionally, monthly reviews of all mission debriefings and incident reports may reduce deviations in safety practices. These reviews may provide insight into the specific safety problems the transport team is facing and could be used to develop ongoing simulation scenarios to address the identified safety concerns.

An additional practice implication is that nurses may suffer from posttraumatic stress disorder after transport accidents or other incidents that occur during transport (Geronazzo-Alman et al., 2016). Transport nurses may benefit from an employee assistance program (EAP) after an incident or accident (Haagsma et al., 2012). Such an EAP could focus on coping strategies and therapeutic interventions, such as eye movement desensitization and reprocessing (EMDR) (Chen et al., 2015). The development of an effective practice strategy to support nurses following an incident or accident may help to reduce ineffective coping and harmful self-treatments, such as substance use, and decrease transport nurse turnover rates.

**Conclusion**

Our findings indicate a lack of relationship between nurse certification status and safety competency, and that more experienced transport nurses had lower safety competency scores. Practical drift—or the failure to follow established rules and regulations, which leads to deviations from policies and procedures—may explain why experienced nurses scored lower. When left unaccounted for, practical drift in safety may lead to patient harm, injury, or death. Transport nurses may not be aware of their practical drift and the risks associated with practical drift. Informed transport nurses and transport nursing leaders can prevent practical drift in safety by instituting practices such as simulation and monitoring to protect nurses, patients, and the transport team.

**References**

Alfes, C. M. (2020). Improving air medical transport training: A nurse leader perspective. *Nurse Leader*, *18*(1), 63–66. <https://doi.org/10.1016/j.mnl.2019.11.011>

Banja, J. (2010). The normalization of deviance in healthcare delivery. *Business Horizons*, *53*(2), 139–148. <https://doi.org/10.1016/j.bushor.2009.10.006>

Board for Certification of Emergency Nurses (BCEN) (2021). About the CFRN. Retrieved from: https://bcen.org/cfrn/about-the-exam/.

Blumen, I. (2009, February 3). An analysis of HEMS accidents and accident rates [PowerPoint slides]. <https://www.ntsb.gov/Pages/Search.aspx?k=An%20Analysis%20of%20HEMS%20Accidents%20and%20Accident%20rates>

Boysen, P. G., II. (2013). Just culture: A foundation for balanced accountability and patient safety. *The Ochsner Journal*, *13*(3), 400–406. PMCID: PMC3776518

Brooks, S. (2017). *Health care leaders’ strategies to improve nurse retention* (Publication No. 4425) [Doctoral dissertation, Walden University]. Walden Dissertations and Doctoral Studies. https://scholarworks.waldenu.edu/dissertations/4425

Browne, K. P. (2019). *Practice drift* (Publication No. 13806937) [Doctoral dissertation, Saint Peter’s University]. ProQuest Dissertations Publishing.

Cant, R. P., & Cooper, S. J. (2017). The value of simulation-based learning in pre-licensure nurse education: A state-of-the-art review and meta-analysis*. Nurse Education in Practice*, *27*, 45–62. <https://doi.org/10.1016/j.nepr.2017.08.012>

Chen, L., Zhang, G., Hu, M., & Liang, X. (2015). Eye movement desensitization and reprocessing versus cognitive-behavioral therapy for adult posttraumatic stress disorder: Systematic review and meta-analysis. *The Journal of Nervous and Mental Disease*, *203*(6), 443–451. <https://doi.org/10.1097/NMD.0000000000000306>

Federal Aviation Administration (2020) Regulation 8000.369 Safety Management Systems. https://www.faa.gov/regulations\_policies/orders\_notices/index.cfm/go/document.current/documentNumber/8000.369

Gaba, D. M. (2007). The future vision of simulation in healthcare. *Simulation in Healthcare*, *2*(2), 126–135. <https://doi.org/10.1097/01.SIH.0000258411.38212.3>

Geronazzo-Alman, L., Eisenberg, R., Shen, S., Duarte, C. S., Musa, G. J., Wicks, J., Fan, B., Doan, T., Guffanti, G., Bresnahan, M., & Hoven, C. W. (2016). Cumulative exposure to work-related traumatic events and current post-traumatic stress disorder in New York City’s first responders. *Comprehensive Psychiatry*, *74*, 134–143. <https://doi.org/10.1016/j.comppsych.2016.12.003>

Haagsma, J. A., Ringburg, A. N., van Lieshout, E. M., van Beeck, E. F., Patka, P., Schipper, I. B., & Polinder, S. (2012). Prevalence rate, predictors and long-term course of probable posttraumatic stress disorder after major trauma: A prospective cohort study. *BMC Psychiatry*, *12*, Article 236. <https://doi.org/10.1186/1471-244X-12-236>

Harvey, H. B., & Sotardi, S. T. (2017). Normalization of deviance and practical drift. *Journal of the American College of Radiology*, *14*(12), 1572–1573. <https://doi.org/10.1016/j.jacr.2017.08.003>

Helmreich, R. L. (2000). On error management: Lessons from aviation*. BMJ*, 320(7237), 781-785.

Institute of Medicine (US) Committee on Quality of Health Care in America, Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). *To Err is Human: Building a Safer Health System*. National Academies Press (US).

Marx, D. (2001). Patient safety and the “just culture”: A primer for health care executives. Trustees of Columbia University. <http://www.chpso.org/sites/main/files/file-attachments/marx_primer.pdf>

Mize, J. F. (2019). The roundabout way to disaster: Recognizing and responding to normalization of deviance. *Process Safety Progress*, *38*(2), Article e12014. <https://doi.org/10.1002/prs.12014>

Okumura, M., Ishigaki, T., Fujiwara, Y., & Mori, K. (2019). Development of an easy-to-use questionnaire assessing critical care nursing competence in Japan: A cross-sectional study. *PLoS ONE*, *14*(11), Article e0225668. <https://doi.org/10.1371/journal.pone.0225668>Park, S. H., Gass, S., & Boyle, D. K. (2016). Comparison of reasons for nurse turnover in Magnet® and non-Magnet hospitals. *The Journal of Nursing Administration*, *46*(5), 284–290. <https://doi.org/10.1097/nna.0000000000000344>

Price, M. R., & Williams, T. C. (2018). When doing wrong feels so right: Normalization of deviance. *Journal of Patient Safety*, *14*(1), 1–2. <https://doi.org/10.1097/pts.0000000000000157>

Prielipp, R. C., Magro, M., Morell, R. C., & Brull, S. J. (2010). The normalization of deviance: Do we (un)knowingly accept doing the wrong thing? *Anesthesia and Analgesia*, *110*(5), 1499–1502. <https://doi.org/10.1213/ane.0b013e3181d5adc5>

Rodziewicz, T. L., Houseman, B., & Hipskind, J. E. (2021). Medical error reduction and prevention. In *StatPearls* [Internet]. StatPearls Publishing. Retrieved March 23, 2021from <https://www.ncbi.nlm.nih.gov/books/NBK499956/>Schroeter, K. (2015). Value of certification. *Journal of Trauma Nursing*, *22*(2), 53–54. <https://doi.org/10.1097/JTN.0000000000000120>

Sofer, D. (2018). The value of simulation in nursing education. *The American Journal of Nursing*, *118*(4), 17–18. <https://doi.org/10.1097/01.naj.0000532063.79102.19>

Wetterneck, T., Kelly, M. M., Carayon, P., Sesto, M., Tevaarwerk, A., Chui, M., Stone, J., Hoonakker, P., Musa, A., Holman, G. T., & Beasley, J. (2014). Improving Quality and Safety through Human Factors Collaborations with Healthcare: The System Engineering Initiative for Patient Safety. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 58(1), 728–732. https://doi.org/10.1177/1541931214581169

Wiener, E. L. (1981). Complacency: Is the term useful for air safety? In *Proceedings of the 26th Corporate Aviation Safety Seminar*. Flight Safety Foundation.

Wright, M. I., Polivka, B., Odom-Forren, J, & Christian, B. J. (2021). Normalization of Deviance: Concept Analysis. Advances in Nursing Science.  doi: 10.1097/ANS.0000000000000356

York Clark, D., Stocking, J. C., Johnson, J., Treadwell, D., & Corbett, P. (Eds.). (2017). *Critical care transport core curriculum*. Air & Surface Transport Nurses Association.