# Chapter 29. Turbulence

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## Background

The health care environment was once regarded as safe and secure[1] for patients and staff. Turmoil and change have pervaded the U.S. health care system since the 1980s, contributing to a state of chaos and instability.[1] Today's health care work environment can therefore be characterized as turbulent—it is in a state of unrest, disturbance, agitation, or commotion.[2]

There are many sources of turbulence in 21st century health care. They can be grouped into five categories:

- Hectic conditions in hospitals;
- The rapid growth of large health care corporations, which has altered organizational structures and dynamics;
- Constantly changing health policies, such as those related to insurance—what is covered, what is paid for out-of-pocket, how Medicare Part D really works;
- World events that have placed new demands on health care workers, such as concerns related to bioterrorism; and
- An aging population that is seeking care for chronic conditions from a health care system designed for acute care.

Although turbulence from all of these categories works to create challenges for health care workers, it is turbulence on hospital units that has the most immediate effect on the nurses' work environment. Staff nurses are striving to meet complex patient needs that require rapid decisionmaking, despite there being fewer resources and more interruptions and distractions.

The focus of this review is predominantly on studies that explored turbulence at the level of the patient care unit. Although publications were located that addressed turbulence in health care, no systematic conceptualizations were found delineating or describing the features of turbulence. Moreover, there were indications of slippage between the terms *turbulence* and *uncertainty*. Nevertheless, *turbulence* seems to capture key components of the dynamic and complex work environment that add to the challenge of providing quality care and keeping patients safe.

## Research Evidence

Perhaps because turbulence remains to be clarified conceptually, a number of studies relied on qualitative methods. Although these investigations do not meet the criteria for inclusion according to most evidence hierarchies, they provide a rich description of turbulence. The 11 qualitative studies that were identified through database searches examined the work environment from the perspective of various health care personnel—Registered Nurses (RNs),[3–11] physicians,[12] and physical therapists.[13]

Although these studies varied in the rigor of their analytic approaches, five themes appeared across them. In general, turbulence was viewed as a *loss of control*[6, 11, 13] due to simultaneous demands; new, difficult, or unfamiliar work; heavy patient loads; and excessive responsibility.[6] Staff experienced the loss of control as a sense of chaos that infiltrated both their professional

and personal lives.[13] As the environment became more turbulent, *noise* escalated.[3, 6] *Problems with equipment and supplies* (e.g., malfunctioning, missing, calling for cumbersome processes to acquire) were also addressed as elements of turbulence.[3, 5, 11] Aspects of *workload*, particularly variability associated with patient turnover—due to admissions, discharges, and transfers—were mentioned as well.[4, 7, 11, 13]

## Turbulence and Communication: The Qualitative Evidence

The dominant discovery from qualitative investigations concerned how turbulence altered various aspects of *communication*, leading to breakdowns, distractions, interruptions, loss of information during handoffs,[3-6, 8-10] and impaired decisionmaking.[3, 4, 10, 12] Although these studies did not always explore patient outcomes, they offer initial evidence to suggest that turbulence may upset certain aspects of communication, thereby compromising patient safety.

Findings from three qualitative investigations can be used to illustrate how turbulence might contribute to heavy communication loads and interruptions. In the first study,[5] eight experienced acute care nurses were observed and interviewed. The investigators in this study coined the term "stacking" to characterize a care management strategy in which nurses kept track of patient care that remained to be done. Evidence of cognitive stacking was also found in the second study,[10] where both ethnography and human factors engineering techniques were used to analyze the work of seven RNs on medical and surgical units. Based on 43 hours of observation, the investigators found that, on average, nurses had a cognitive load of 11 activities; the maximum load averaged 16. These numbers become highly meaningful when viewed in relation to a classic paper from psychology that identified seven, plus or minus two, informational concepts as the limit for information processing.[14] The cognitive stacking experienced by these medical-surgical nurses often exceeded seven.

In the third study,[9] communication related to nurse call systems was studied in two hospitals. Data were gathered from 41 nurses through observations and focus groups. The call systems were viewed by RNs as a source of unnecessary interruptions: 70 percent of the patient calls in one hospital and 80 percent in the other were for issues that did not require the skills of an RN. Interruptions were also common in the previously mentioned study of medical-surgical RNs, comprising an average of 7 percent of their work time.[10] Forty-seven percent of the interruptions happened during patient-related interventions, with 22 percent of these occurring in the medication room during medication preparation.

## Turbulence and Medication Errors

The likely connection between turbulence and medication errors was also found in interview data from eight novice RNs who recounted their experiences with near-miss ($n$ = 2 cases) or adverse events ($n$ = 6 cases).[4] All six adverse events and one of the near misses were related to medication administration. Factors in the environment that may have contributed to these errors included a sense of time pressure, inadequate handoffs, impaired decisionmaking, or awkward workflow patterns—all of which could pertain to turbulence.

The quantitative studies can be categorized according to three ideas: medication errors, patient turnover, and communication. Medication errors were explored in three studies that examined features of turbulence.[15-17] In one study,[15] the investigators discovered that the work environment was more likely to be hectic and staff were more likely to be distracted in the 30

minutes preceding medical errors, 91 percent of which related to medication administration. In another study,[16] two protocols were designed to reduce distractions during medication administration. Although there were fewer distractions with one protocol (64 distractions) than the other (180 distractions), both protocols were effective in minimizing disruptions as compared to the control group (484 distractions). The differences among the three groups were statistically significant ($P = .0001$). Interruptions were the most common source of distractions across all three groups. Finally, in an intervention study designed to reduce patient transfers between coronary care and step-down units,[17] the medication errors index was reduced by 70 percent. Transfers were characterized as a "hiccup" in care delivery that could allow error to be introduced. Moreover, transfers take time that could be better spent in caring for patients (see Table 1).

## Patient Turnover

The second grouping of quantitative studies considered census and staffing variability or patient turnover related to admissions, discharges, and transfers, as well as observation patients.[17-23] The census variability from patient turnover demonstrates the need to replace midnight census as an indicator of patient volume; it also contributes to turbulence in the environment. The previously mentioned intervention study,[17] for example, reduced patient turnover from transfers by 90 percent through using acuity-adaptable rooms for coronary patients.

The importance of patient turnover is further illustrated in work by Houser,[24] who used structural equation modeling to assess features of the complex work environment on patient outcomes. Although workload, measured by length of stay and midnight census, demonstrated a negative relationship with patient outcomes, it was not a statistically significant predictor of outcomes. Adding patient turnover to the workload measure may have yielded different findings.

Patient turnover was used in combination with other variables in an additional two studies. The first[19] illustrates the slippage between turbulence and uncertainty. The investigators measured objective uncertainty—at times referred to as environmental turbulence—using patient turnover divided by midnight census. Although objective uncertainty was predictive of emotional exhaustion ($P < 0.01$) among staff nurses, the relationship was negative. The investigators suggest this unexpected finding may reflect that patient census variability possibly mediates the emotional effects of environmental turbulence because of the relief offered by occasional decreases in patient turnover.

In the second study,[21] path analysis was used to test a model to predict environmental and personal characteristics affecting nurse performance. Similar to objective uncertainty, the measure of turbulence included patient turnover. Although turbulence did not demonstrate direct effects on nursing performance, it did have a direct negative relationship with interpersonal relations and communication skills that was statistically significant ($p \leq 0.01$). These findings begin to illustrate that more turbulent environments may exert undesirable effects on communication with patients, families, and other staff.

## Turbulence and Communication: The Quantitative Evidence

Turbulence and communication were explored in other studies as well. Communication mechanisms were examined at one academic health science center based on three types of unit level practice environments—complex, unpredictable and rapidly changing, or stable.[25] Patient

care communication mechanisms used by the RNs were similar regardless of the degree of stability in the practice environment. The investigators suggested that quality could be better sustained if nurses learned to adjust their communication according to demands in the practice setting.

Communication was quantified and described in two studies. In observing eight emergency department (ED) nurses and physicians for about 20 hours across all shifts, 831 distinct communication events were identified.[26] On average, each of the eight clinicians spent 89 percent of their time communicating; they experienced 42 communication events per hour. Interruptions characterized one-third of the communication events, with each clinician experiencing an average of 15 interruptions per hour.

In the second study,[27] communication patterns were evaluated between the operating room (OR) charge nurses and other OR staff members at four hospitals—two university and two community. The OR suites ranged in size from 4 to 18 rooms. Observations and a data collection tool were completed on 17 nonconsecutive days, for a total of 2,074 communication episodes observed over about 100 hours. Communication episodes per hour ranged from 32 to 74, with more communication episodes associated with the larger OR suites. Charge nurses most often communicated with OR nurses (39 percent). The most common purpose of communication related to equipment coordination. Most communication occurred face-to-face (69 percent), with only 7 percent of the exchanges occurring via intercom. The duration of the communication ranged from 10 seconds to 10 minutes, with a mean of 40 seconds and a median of 20 seconds. Despite the overall brevity of most communication, the investigators did not assess interruptions.

The findings from this collection of qualitative and quantitative investigations have strong implications for practice (see Table 1). Turbulence can be said to emanate from two major sources—workload and communication. Reducing workload and improving communication, with particular attention to minimizing interruptions, could have dramatic effects on stabilizing the practice setting.

**Table 1: Summary of Research Evidence Related to Turbulence—Key Findings Center on Communication and Workload Issues**

| | |
|---|---|
| Communication | • Breakdowns<br>• Distractions<br>• Interruptions<br>• Inadequate handoffs (e.g., loss of information)<br>• Impaired decisionmaking<br>• Overload of information (cognitive stacking)<br>• Noise<br>• Interpersonal relations |
| Workload | • Excessive responsibility<br>• Heavy patient loads<br>• Patient turnover (admissions, discharges, transfers)<br>• Simultaneous demands<br>• New, difficult, unfamiliar work<br>• Time pressure<br>• Equipment and supply issues |

# Evidence-Based Practice Implications

Common sense suggests that turbulence could interfere with care delivery in several ways. However, the practice implications related to turbulence are only beginning to surface. There is a paucity of studies examining turbulence, fewer still that include patient outcomes, and only three that met criteria for inclusion in the evidence table (see Evidence Table). Even these studies must be considered with caution. None of the studies, for example, was designed to allow causality to be inferred.[17]

However, messages that can be used in practice can be constructed by combining the findings from studies in the evidence table with those using qualitative methods and the quantitative investigations that did not focus on patient outcomes. First, it appears that mitigating turbulence has a positive return in regard to patient safety. In particular, efforts to reduce environmental turbulence may be a major remedy for reducing medication errors. Second, intriguing and potentially fruitful areas for future exploration include cognitive stacking and cognitive shifts, interruptions and other distractions such as noise, and the overall effect of turbulence on communication in general. Finally, features of workload, such as patient turnover and time pressure, are also important avenues for future investigations. Data indicate that each of these elements is connected to patient safety in important ways.

## Needed: A Conceptual Framework

Turbulence is an emerging concept that appears to have important ramifications for patient safety. Empirical work is limited, however, by the absence of a model that specifies the components of turbulence. Developing and testing a theoretical model of turbulence would therefore make an important contribution to guiding future research. Exploring similarities and differences between turbulence and uncertainty would also advance conceptual and theoretical clarity. Additional qualitative work may be required to achieve this goal.

Although common sense suggests that chaos is not compatible with patient safety, the understanding based on research findings is limited. Findings from a few studies are beginning to indicate there is a connection between environmental turbulence and medication errors.[4, 10, 15-17] The relationship of turbulence to other clinical outcomes and patient safety indicators remains to be illuminated. More rigorous designs would facilitate a better understanding of the effects of turbulence on patient outcomes. Instrument development would also make a contribution, if a psychometrically sound measure of turbulence could be developed once there is greater conceptual clarity.

Concurrently, although some individuals may regard intervention studies as a bit premature, evidence is accumulating in support of the belief that features of workload and communication have undesirable effects on patient safety. A challenge to researchers, therefore, is to design easy-to-introduce ways to reduce environmental turbulence. Questions and avenues of pursuit might include establishing a metric of a safe patient load, developing an intervention to mitigate the undesirable effects of patient turnover, introducing ways to minimize interruptions, developing processes and procedures to improve handoffs, and determining how to reduce cognitive overload.

Additional possibilities include working with architects and engineers to construct patient care units for the future. These units would take into consideration the needs of both patients and

staff. The overall goal would be to reduce turbulence for the purpose of creating a safer, more secure environment for both patients and staff.

Lastly, there is currently a gap in examining turbulence in long-term care, outpatient settings, and the home. Along with advancing the understanding of turbulence in each of these care settings, it would be useful to explore turbulence across the care continuum as it applies to patient safety and quality care.

## Conclusion

Turbulence is a concept that appropriately characterizes contemporary conditions surrounding nurses' work. Because this concept is more recent in its application to health care, the literature about it in relation to quality care and patient safety is sparser. Nevertheless, as indicated in Table 1, ideas related to turbulence cluster nicely within two themes—communication and workload. Focusing efforts on improving communication and managing workload could offer much needed help to the practicing nurse who is often found working in a highly turbulent environment.

## Search Strategy

Literature for this review was identified with the help of a reference librarian. Both MEDLINE® and CINAHL® databases were searched from 1995 to 2005 with the goal of being as inclusive as possible. The search terms were slightly different for each database because of differences in MeSH® headings. The terms included: turbulence, work interruptions, attention/or distractions, uncertainty, variability, unpredictability, workload or work overload, loss of control, and work environment. Citations were limited to research reports published in the English language.

The MEDLINE search identified 158 possible citations and the CINAHL search identified 1,324 possible citations. The abstracts for each of the 1,482 studies were reviewed. Based upon information in the abstracts, all but 119 publications were eliminated from consideration. Reasons for excluding papers were that they were not related to nurses in particular, health care staff in general, quality, or patient safety. For example, some studies identified initially pertained to memory assessments, environmental factors related to racial disparities, statistical tests, and studies of particular patient populations. The remaining 119 articles were reviewed in their entirety, 94 of which were eliminated from further consideration because they were not pertinent to turbulence per se (i.e., they were related to other concepts such as stress or leadership), or because they were simply short reports lacking in details.

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## Evidence Table

| Source | Safety Issue Related to Clinical Practice | Design Type | Study Design, Study Outcome Measure(s) | Study Setting & Study Population | Study Intervention | Key Finding(s) |
|---|---|---|---|---|---|---|
| Grayson 2005[15] | Work conditions | Case control | Patient outcomes (Level 4), medical errors (medication and procedural) (Level 1) | 11 acute care hospitals, 112 of 300 nursing personnel (RNs, licensed practice nurses, nursing assistants, patient care technicians) involved in a recent medical error that resulted in minimal or no harm to the patient. | None per se: working conditions were described at 3 points in time and attributes of the work environment were explored to determine the prevalence of potential triggers for errors. | Preliminary results for the first 112 interviews indicate: 91% of the errors related to medication administration. Participants were more likely to report a hectic working environment in the 30 minutes prior to making an error compared to the rest of the shift (OR = 2.6; 95% CI = 1.3-5.4) and more likely to feel distracted (OR = 4.1; 95% CI—1.9-10). |
| Hendrich 2004[17] | Patient transfers | Pretest, post-test | Design: Level 3, Patient outcomes, sentinel events (medication errors and falls) (Level 1), patient satisfaction and financial outcomes | Two, 28 bed floors in an acute care hospital, Patient transfers. | Acuity-adaptable rooms to provide progressive and critical care in the same setting. | During the two years before the change, the coronary care and step-down units averaged more than 200 intra-unit transfers each month; after the acuity-adaptable rooms were introduced, transfers were reduced by 90%, the medication error index was reduced by 70%, the fall index was reduced from an annual rate of about 6 to 2, and patient dissatisfaction declined. |

| Source | Safety Issue Related to Clinical Practice | Design Type | Study Design, Study Outcome Measure(s) | Study Setting & Study Population | Study Intervention | Key Finding(s) |
|---|---|---|---|---|---|---|
| Pape 2003[16] | Distractions | Non-randomized trial | Design: Quasi-experimental. The dependent variable was the number of distractions experienced by the nurse | A medical-surgical unit with an average patient census of 30, in a 520-bed acute care hospital, Nurses ($n$ = 24)—46% ($n$ = 11) licensed practical nurses, 17% ($n$ = 4) of the RNs had BSNs | Two protocols were tested. Both provided the nurses checklists to guide their medication procedures. In addition, for the focused protocol, staff members were asked not to interrupt the nurse during medication administration. For the Medsafe protocol, in addition to the checklist and staff instructions, the nurses wore a special vest when administering medications. The control group received their medications under usual conditions. Each group (control, focused, Medsafe) was tested for 8 cycles yielding 24 high-volume medication cycles (the unit of analysis started with the beginning of medication administration and ended when the administered medications were documented). | The control group experienced 484 distractions ($M$ = 60.5, $SD$ 12.9), there were 180 distractions with the focused protocol ($M$ = 22.5; $SD$ = 8.5), and 64 distractions with the Medsafe protocol ($M$ = 8, $SD$ = 4.5). Statistically significant differences were found between the control group and each of the protocols ($p$ = 0.001) and between the two protocols ($p$ = 0.014) indicating that fewer distractions occurred when protocols were used as compared to the control group although the fewest distractions occurred with the Medsafe protocol. Across all groups, the most common distraction was interruptions by personnel ($n$ = 267, $M$ = 11.13), followed by hearing conversations by others ($n$ = 215, $M$ = 8.96). Loud noise was a less frequent distraction ($n$ = 34, $M$ = 1.42). |