Pediatric nurses' fatigue descriptions in occupational injury reports: A descriptive qualitative study[1]

Beverly M. Hittle[a,*], Elizabeth G. Keller[a], Rebecca C. Lee[a] and Nancy M. Daraiseh[b,c]

[a]College of Nursing, University of Cincinnati, Cincinnati, OH, USA
[b]Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA
[c]Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Abstract.

BACKGROUND: Despite the high risks associated with occupational fatigue in healthcare, few organizations require nurses to screen and report fatigue symptoms. As a result, little is known about if and how nurses would report fatigue while on the job.

OBJECTIVE: To determine if hospital-based pediatric nurses reported fatigue as part of an active injury reporting method.

METHODS: This secondary analysis of qualitative data used a descriptive design with content analysis. Data from the parent study were collected at a U.S. pediatric hospital where nurses verbally reported on-shift injuries or near misses and pre- and post-shift health status via a digital voice recorder. Researchers used content analysis to independently code data for nurses' references to fatigue. Codes were then analyzed for patterns and themes.

RESULTS: Approximately 30% ($n = 104$) of participants reported fatigue-related content. Emergent themes were Work Stressors, Individual Risk Factors, Fatigue Descriptors, Adverse Outcomes from Fatigue, Fatigue Buffers, Descriptors for Buffered Fatigue, and Favorable Outcomes from Buffered Fatigue. Fatigue descriptions align with prior literature, demonstrating the accuracy of the voice recorder data collection method. In addition, nurses expressed uncertainty about the appropriateness of reporting fatigue symptoms.

CONCLUSION: Findings from this study support pediatric nurses will report fatigue, when provided an opportunity. Additional efforts are needed to better understand effective ways to improve fatigue reporting among nurses, including harnessing current technology for real-time reporting and how to change the culture around fatigue reporting.

Keywords: Fatigue, occupational health, occupational injuries, organizational culture, safety management, risk assessment

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[1]References: We have had to use more than the stated number of references due to this being a secondary analysis of qualitative data. Therefore, references to the parent study needed to be included, along with references for the background information, study design, and two conceptual models to inform this unique study.

*Address for correspondence: Beverly M. Hittle, University of Cincinnati, College of Nursing, 223 Procter Hall, 3110 Vine Street, Cincinnati, OH 45221-0038, USA. Tel.: +1 513 558 5500; E-mail: Beverly.Hittle@UC.edu.

1. Introduction

Compared to other high-risk industries, healthcare has one of the highest incidence rates of occupational injuries and illness with rates in the U.S. per 100 workers reported at 4.3 for healthcare, 3.3 for manufacturing, and 4.6 for transportation [1]. A contributor to injury among nurses [2], other healthcare workers [3], and patients [4] is occupational fatigue. Occupational fatigue is a subjective human experi-

ence and has been described as a physical and/or mental depletion of energy resulting from a lack of sleep and/or high demands at work. [5–8] Among nurses in the hospital setting, it can arise from multiple occupational sources to which nurses are regularly exposed, such as long work hours (i.e., 12-hour shifts) [9, 10], quick returns (<11 hours between shifts) [11], working night shift [10], and the heavy physical activity and mental workloads associated with providing patient care [7, 12]. In addition, the pediatric acute care setting poses a unique work environment, which may exacerbate nurse fatigue. Specifically, pediatric healthcare providers experience high stress levels from working with a sick and vulnerable patient and family population [13]. Since children need extra time to prepare for the care they are receiving, nurses can experience added stress and heavier workloads as they try to accommodate for this extra time [14]. Despite the multiple organizational factors associated with nurse occupational fatigue and subsequent risks posed to worker and patient safety, fatigue is rarely recognized as a reportable occupational hazard in healthcare.

2. Background

While leaders in the industry have acknowledged occupational fatigue among nurses is a safety threat to patients and the healthcare workforce, the management of fatigue in healthcare settings is fraught with obstacles [15, 16]. Experts in the field of occupational fatigue recommend implementing fatigue risk management systems [17, 18]. A fatigue risk management system is a multi-layered safety approach, and should be a shared-responsibility between the worker and employer: (a) employers give workers adequate time off to sleep; (b) workers take the time to sleep; (c) employers and employees use detection/monitoring systems for reporting and mitigating fatigue-related behavioral symptoms; and (d) employers regularly evaluate the fatigue risk management system and reported errors and incidents for root causes of fatigue [17]. Unfortunately in healthcare, implementing early controls for managing occupational fatigue risks, such as providing enough time off for sleep, is not always possible due to worker shortages and/or surges in public need for healthcare. As a result, nurses and other healthcare providers may need to work long hours for multiple days to meet public health needs, placing them at continued risk for fatigue related injuries and accidents [19].

Specific obstacles also exist in reporting fatigue-related behavioral symptoms in healthcare safety programs. Barriers range from the difficulties of measuring the multidimensional, subjective, and temporal symptoms of fatigue [7, 15], determining the most efficient reporting process [7], and a lack of non-punitive reporting systems [17, 20] which may reduce worker willingness to report [21]. Even with a non-punitive reporting system in place, nurses and other healthcare workers are reluctant to report events that may indicate culpability [22]. Additionally, nurses often perceive fatigue as an inevitable part of working in healthcare [22, 23], and work recovery as a nurses' responsibility to occur outside of the hospital [22, 24]. Evidence suggests rather than reporting fatiguing work conditions (i.e., long work hours, rotating shifts) as safety hazards, nurses feel reasonable solutions would be to leave their jobs and/or profession [25], increasing organizational costs due to nurse turnover [26]. Such beliefs can present major barriers to reporting fatigue as a workplace hazard. Consequently, there is not a clear determination on how or if nurses would report fatigue and associated factors while at work.

Fatigue reporting is not unique in facing barriers. Healthcare injury surveillance systems have long been plagued with not effectively capturing the full scope of injuries and incidents in the adult and pediatric acute care setting [27, 28]. Influential characteristics on reporting include the ease of making a report, time constraints, comprehensive training on how/when to use the system and the presence of subsequent follow-up [27]. A recent intervention at a pediatric hospital using an active reporting system (where workers were asked to narratively report injuries) demonstrated increased reporting of physical and psychological injury or near-misses compared to passive injury surveillance [28]. While healthcare worker reports were physical and psychological in nature, it is unknown whether this successful reporting method also was effective at capturing reports of occupational fatigue among pediatric nurses.

3. The study

3.1. Research questions

The purpose of this study was to answer the following research questions: (1) Do pediatric nurses report fatigue through an active reporting system using a digital voice recorder (DVR); (2) What do pediatric
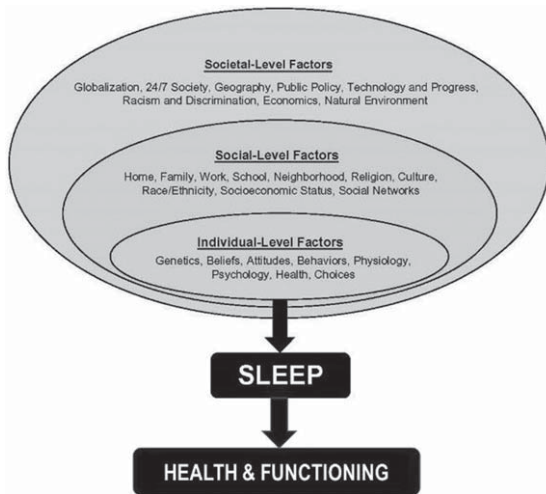
Fig. 1. Socioecological Model of Sleep (Original Copyright 2019. Used with permission).

Fig. 2. Neuman Sytems Model (Original Copyright 2019. Used with permission).

nurses describe as contributing to fatigue during their report; and (3) What work-associated outcomes do pediatric nurses attribute to fatigue?

4. Methodology

4.1. Study design

The researchers employed a descriptive design with content analysis to complete a secondary analysis using qualitative data from the original parent study [28].

4.2. Guiding conceptual models

Two conceptual models guided this study: The Social Ecological Model of Sleep Health [29] and Neuman Systems Model [30].

The Social Ecological Model of Sleep Health (Fig. 1) [29] considers how individual sleep is impacted not only at the person level, but through environmental influences, such as family, work, and society. The model is depicted with nesting circles, where the Individual-Level Factors (i.e., genetics, attitudes) are in the center circle, Social-Level Factors (i.e., family, work) are in the next level circle, and Societal-Level Factors (i.e., public policy, 24/7 society) are the final, outer circle, demonstrating a holistic view of the influences on sleep.

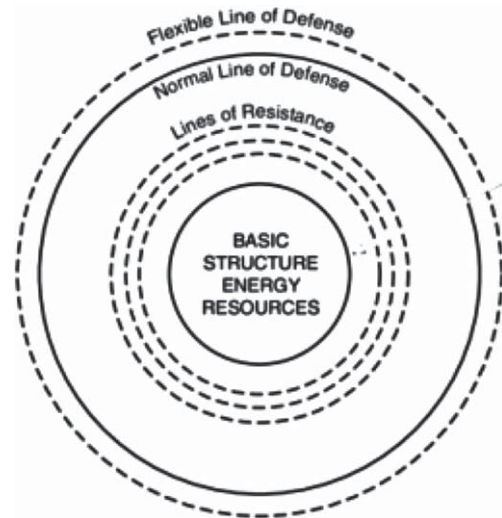Neuman Systems Model (Fig. 2) [30] is a conceptual model that can be applied to the individual,

family, or community level health systems. The model proports that a stable system (the Central Core) is one with optimal health and is made up of five interacting variables: physiology, psychology, sociocultural, developmental, and spiritual. Variances within the health system is caused by intra-, inter-, and extra-personal environmental stressors. The system is dynamic and constantly interacting with the environmental stressors. System stability is maintained through layered lines of defense (Flexible Line of Defense, Normal Line of Defense, Lines of Resistance) surrounding the system Central Core and protecting/responding to stressors.

Researchers in this study used The Social Ecological Model of Sleep Health and Neumann Systems Model to guide study methods and the development of a coding framework, facilitating deductive coding of a pre-existing data set. Knowledge of Social Ecological Model of Sleep Health factors informed the researchers identification of similar words or statements by participants representing those factors. In addition, Neumann Systems Model also allowed researchers to categorize various factors related to sleep as either supporting or weakening an individual nurse's defenses.

4.3. Study setting

Data were collected in 2013–2015 at a large urban pediatric teaching hospital.

4.4. Recruitment in the parent study

The study population from the parent study included registered nurses, mental health specialists, and patient care assistants working on behavioral health or medical/surgical units. Participants were recruited via flyers posted in the hospital, e-invitations sent to work emails, personal invitation, and project presentations at unit meetings. Once consent was obtained, study participants ($N = 607$) were asked to record non-sequential narrative reports of workplace injuries or near misses on a DVR during a 2-week period [28] resulting in 927 reports. Participants were given instructions on how to use the DVR along with a laminated card listing examples of injuries and near misses. Participants were not limited on the length of their recordings. The audio recordings were transcribed and reviewed by the parent study research team and uploaded into NVivo software system.

4.5. Inclusion/exclusion criteria

For the current study, the sample was restricted to only registered nurses from the medical/surgical units ($n = 351$) as reporting differences have been noted among participant staff positions and unit type [28].

4.6. Data collection and analysis

Transcripts from the parent study were prepared in order to allow for qualitative coding of data. Specifically, the original data had to first be filtered to exclude cases where no events or description were reported. The team also formed a preliminary coding scheme for use when analyzing the data. A coding scheme developed based on existing literature and conceptual models prior to examining the data is referred to as a priori codes. The research team created a priori codes by reviewing the conceptual models and published literature for definitions of fatigue to act as guidance and understanding of language surrounding fatigue. Fatigue literature was then compiled from healthcare literature on patient fatigue [32–35], and occupational fatigue [5–7, 36, 37]. For example, in the patient literature, fatigue was defined by Ream and Richardson [35] as "a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion creating an unrelenting overall condition which interferes with individuals' ability to function to their normal capacity." An example of a fatigue definition from occupational health is from Phillips [36] who stated:

> Fatigue is a suboptimal psychophysiological condition caused by exertion. The degree and dimensional character of the condition depends on the form, dynamics and context of exertion. The context of exertion is described by the value and meaning of performance to the individual; rest and sleep history; circadian effects; psychosocial factors spanning work and home life; individual traits; diet; health, fitness and other individual states; and environmental conditions. The fatigue condition results in changes in strategies or resource use such that original levels of mental processing or physical activity are maintained or reduced.

The research team also collected words in the literature that were used interchangeably with fatigue including weakness [35], sleepiness, drowsiness, tiredness, and exhaustion [37].

From June through September 2022, two researchers (occupational sleep and fatigue scientist and occupational health doctoral student) used the initial coding schema to independently review transcripts in NVivo, to identify data passages that fit with the a priori characterizations of fatigue. Researchers met every two weeks to discuss and compare findings. Any disputes that were not resolved were reviewed with other members of the research team (qualitative scientist and occupational health engineering and systems scientist). This was an iterative process to categorize transcripts referencing fatigue and the antithesis of fatigue.

Once identified, fatigue-related data were reviewed again so researchers could designate meaning units within the text, using the participants' words. Researchers came together to confirm identified meaning units. Continuing with the iterative process, the meaning units and surrounding text were then reviewed to give more context, allowing the researchers to assign codes to each passage. When initial independent coding was completed, the two researchers met to discuss and define the codes and units of text classified as significant in relation to the research questions. After reaching consensus on code assignments, the researchers analyzed these codes, grouping them into categories to reflect themes. Using the Social Ecological Model of Sleep Health and Neuman Systems Model as guides, the team used an iterative process to formulate a concep-

tual model to depict how the identified themes were related.

4.7. Ethical considerations

Institutional Review Board approval was obtained for this study from University of Cincinnati and Cincinnati Children's Hospital Medical Center. All data were stripped of identifiers prior to the study team gaining access to the data. Data were only available to the research team, and stored on password protected, institution supported laptops. Participants remained anonymous to this study team, not allowing for follow-up questions. Therefore, this study used a descriptive design [31] with content analysis. A member of the parent team was a part of the current study team and available to answer questions.

4.8. Rigor and reflexivity

To enhance study trustworthiness, methodological decisions and memos on data analyses were documented for auditing purposes [38]. Analyses confirmability was established by first using *in vivo* coding of meaningful units, then by having exemplars of the coding direct from the data. While researchers were unable to confirm findings with study participants, other procedures found in the literature [39, 40], were used to enhance finding validation, including consensus among study team members, tie-breakers where consensus was not able to be established, and having study results reviewed by the researcher from the parent study. In vivo coding was employed to keep the analysis close to the data, particularly as the data collection method resulted in shorter responses with no opportunity for follow-up questions to allow participants to elaborate. The Standards for Reporting Qualitative Research were used to report this study methods and findings [41].

5. Findings

5.1. Characteristics of participants

In the subset data of registered nurses working in medical-surgical acute pediatric care ($n = 351$), 125 narrative reports were recorded by 104 (29.6%) study participants and coded as fatigue-related. An intercoder reliability (ICR) score was calculated by dividing the number of coding agreements between the two reviewers by the total number of data pieces coded. The intercoder reliability score for initial coding was 92%. Findings support that nurses will report fatigue in an active reporting system via DVR. Several themes emerged from the data giving context to how nurses describe and experience fatigue. These themes include Work Stressors, Individual Risk Factors for Fatigue, Fatigue Descriptors, Adverse Outcomes, Fatigue Buffers, Descriptors for Buffered Fatigue, And Favorable Outcomes (Table 1). Drawing from the conceptual models guiding this study, a new conceptual model (Fig. 3) was created based on these analytic themes.

Limited socio-demographic data were collected (Table 2). Of the 104 nurses reporting fatigue, most self-identified as female (92, 88.5%) and White (93, 89.4%) with an average age of 29.7 years (8.0 SD). Self-reported years working in their current position was 2.6 years (11.4 SD) and average hours worked per week was 34.9 (3.7 SD).

5.2. Themes

5.2.1. Work stressors

Nurses provided accounts of the pediatric work environment and associated stressors leading up to fatigue. Example from a nurse report [Participant 72]: "I just got done with my shift. It was really long and I'm really tired. My patient peed on me. I'm exhausted and I am sad that I am at work so late." These stressors included subthemes of patient assignments, physical and mental demands of providing nursing care, and schedule characteristics.

Patient assignment stressors could be caring for high acuity patients, juggling multiple tasks, and managing violent episodes from children with behavioral needs. Physical demands of the workday were described by participants as "busy" moving from room to room, inability to sit down for a break, needing to make repetitive awkward positions when caring for the pediatric population (i.e., stooping), and trying to maneuver around a crowded patient room where caregivers are staying. Mental demands of the workday included the emotional toll of caring for sick children and the mental fatigue from managing multiple demands. Scheduling characteristics included long shifts, overtime hours, multiple consecutive shifts, rotating shifts, and shift timing (i.e., night shift). Work Stressors serve as an overarching theme of fatigue that is consistently present in nurses' accounts.

Table 1
Nurse Fatigue Themes, Subthemes, and Data Examples

Theme	Subthemes	Example from Data
Work Stressors	Patient Assignment	*Participant 76:* Okay, it is the end of my shift. It is about 8 : 00 on Tuesday, February eleventh, and it's been a long and tedious shift dealing with patients with increasing pain, patients who desat and need increased oxygen, and a patient who refuses to let us get anymore labs with peripheral IV sticks. I didn't get much time to sit down.
		Participant 67: Alright end of shift. I know this probably does not fall under the privial of what the study is doing, but this was the most mentally exhausting day ever. I had a crazy assignment and I get to have them back again tomorrow and the day after that.
	Physical Demands	*Participant 18:* Feeling tired. Little achy and sore, especially from holding her down. We were probably holding her down in her room for 45-minutes. So, it gets a little exhausting.
		Participant 97: It is 4 : 40 in the morning. Just an observation that when I have children in infant cribs or crib climbers that I'm hunching over and my back does become fatigued and sore.
	Mental Demands	*Participant 43:* The end of an 8-hour shift, and I feel very tired. I'm mentally more exhausted, probably still left over from the last night being really busy yesterday.
		Participant 63: I am about to start my third shift in a row. Um I am really tired. Last night I ended up finding out that one of my patients had passed away, so I was a little upset last night and just did not sleep well
	Scheduling Characteristics	*Participant 96:* It is day three of three for me. So, day three of three is always really hard, you're already super exhausted- especially for a day shift. This is my first week back on days. I flex, and so last week I was on nights and this week I'm on days, so it's 6 : 27 and I'm on my way to work. I'm feeling okay, a little bit tired. And just ready for the day to be over already.
		Participant 72: I am going in for uh my day shift. Um 7 to 7. This is my third day in a row, so I actually exhausted right now. Um I think today is going to be a res-really busy day.
Individual Risk Factors	Poor Sleep	*Participant 72:* I'm about to go into work. I didn't sleep very well last night so I'm really exhausted.
		Participant 43: I'm kind of tired because I didn't get to sleep until like midnight.
	Managing Needs of Personal Life	*Participant 6:* Let's see, how do I feel today? Really, really tired. I had a really busy day yesterday for some personal matters- speeding ticket, car towed away, expired tags- so that was very stressful. I feel like I slept well, but I woke up tired, so I don't know. Anyway, so physically I mean, there's no aches or pains. I'm just tired . . .
		Participant 54: I'm about to start an 8-hour shift. I haven't been here in a few days, and I did have class this evening before I came into work, so I'm a little bit tired. I didn't sleep as much as I like to before starting a shift, but other than feeling a little bit tired, I don't have anything hurting currently.
	Pre-existing Physical Conditions	*Participant 19:* I forgot to record yesterday because I was sick. I got sinuses, headache, I'm exhausted, but no safety events occurred throughout the shift;
		Participant 13: I'm getting ready to work a 12-hour shift. I'm having a little bit of back pain, did a lot of stuff yesterday so I'm sore and didn't sleep well last night.
Fatigue Descriptors[a]	Fatigue	*Participant 97:* 12/20, the end of an AM shift. Started the shift feeling good; a little fatigued, but no injuries.
		Participant 88: Start of shift. No pain or discomfort, just fatigued.
	Drained	*Participant 82:*...the backgrounds that these kids have are devastating, are just devastating and your heart just bleeds for 'em. So yeah, physically I'm fine, a li- I'm a little sad tonight, I'm a little distressed, but I also recognize where I'm at in-in the work week, I am one day away from the end of my l- my long stretch, in my long stretch I work se- six out of seven days, and it's not unusual for me to be a little, you know, starting to be a little bit drained by that time..

	Exhausted	*Participant 13:* This is Wednesday, November nineteenth. This is three in a row for me, I'm exhausted and my back is very sore. I'm at 8-hours today, thanks.
		Participant 17: It's the end of my shift. I'm not having any pain, just really exhausted. I had a really long day, but no near misses. I'm feeling okay, and no pain or discomfort.
	Tired	*Participant 3:* It is Saturday at ten till eight. I am finishing my shift. A little stressful day on the floor but doing okay. Feeling fine- little tired.
		Participant 5: End of my shift. Very tired, just a long day. Um but no other complaints.
Adverse Outcomes from Fatigue	Mental	*Participant 76:* Okay, it is the end of my shift . . . I didn't get much time to sit down . . . I'm just kind of at that point where your head feels light, and kind of foggy. That it's hard to focus on anything right now, and I notice that I'm mixing up a lot of my words when I'm talking to others. I don't think honestly that it would affect small things in my nursing care, but if I were like this regularly or for a longer period of time, it would probably affect my critical thinking, ability to look at the bigger picture. Otherwise, I'm just very ready to go home and sit down.
		Participant 72: I'm leaving my evening shift exhausted and tired. Was the busiest day and I don't ever want to come back.
	Physical	*Participant 85:* I was really sore getting off work this morning, and I just had a really busy night and I got about a ten-minute lunch break and that's pretty much the only time I sat down the entire 12-hours. So my legs and my feet were really, really sore. They felt like Jell-O walking out of the hospital.
		Participant 43: I am just really tired, it's- I've worked three days in a row now and my feet hurt and my lower back aches.
Fatigue Buffers	Caffeine Consumption	*Participant 104:* I finished my nightshift, and during the entire night I didn't experience any pain. I gained my energy after drinking some coffee, and luckily didn't have any incidences.
	Time off for Recovery	*Participant 74:* Um I'm about to start another day shift 7am to 7 : 30pm. Um feeling pretty good. Had a nice little few days off in a row, so I'm well rested.
		Participant 30: I'm getting ready to start my shift. Was off for the weekend so I'm well-rested and feeling great.
	Sufficient Sleep	*Participant 7:* I'm feeling good, slept well. No pain.
		Participant 69: start of my AM shift. I feel good this morning, got some good sleep. Stress levels are pretty low. Going to be here all day, it's my last shift, third shift in a row, so hope to have a good day.
Descriptors for Buffered Fatigue[b]	Rested	*Participant 80:* This is [Name] prior to my PM shift. I have no pain, no discomfort, no injuries at this time. Well rested, so hopefully it will be a good shift. Thanks.
		Participant 38: Got good rest last night, feeling good at the beginning of the shift. Felt good, no issues. Have a good assignment today so I don't foresee any problems.
	Refreshed	*Participant 90:* July 17, beginning of my shift, feeling very refreshed from sleeping, we'll see how tonight goes.
		Participant 52: I'm at the beginning of my shift and I feel refreshed.
	Energized	*Participant 92:* Starting shift. Experiencing no pain, feeling energized.
		Participant 104: It is seven o'clock. I am working a 12-hour shift today. I feel very energized at the moment; I feel great, and I look forward to a great shift.
Favorable Outcomes	Readiness to Work	*Participant 11:* I'm here till 7 in the morning. Let's hope it's a good night. Come in, got a lot of sleep today, feeling pretty good.
		Participant 49: I am feeling pretty good right now; well rested, relaxed, ready for a good day at work.
	General Positivity	*Participant 54:* I'm working an N(ight)-shift tonight. I am not experiencing any pain or discomfort. I got a good night's sleep- well, good day's sleep. I am in a good mood to be at work, and hopefully I will not have any injuries today.
		Participant 30: I'm getting ready to start my shift from three to eleven thirty. I'm feeling pretty good today; I'm well-rested. Hoping to have a good night tonight.

[a]The number of participants who used the *Fatigue Descriptors* identified in the table are as follows: fatigue ($n = 3$), drained ($n = 1$), exhausted ($n = 15$) and tired ($n = 85$). [b]The number of participants who used the *Descriptors for Buffered Fatigue* identified in the table are as follows: rested ($n = 11$), refreshed ($n = 3$), and energized ($n = 2$).
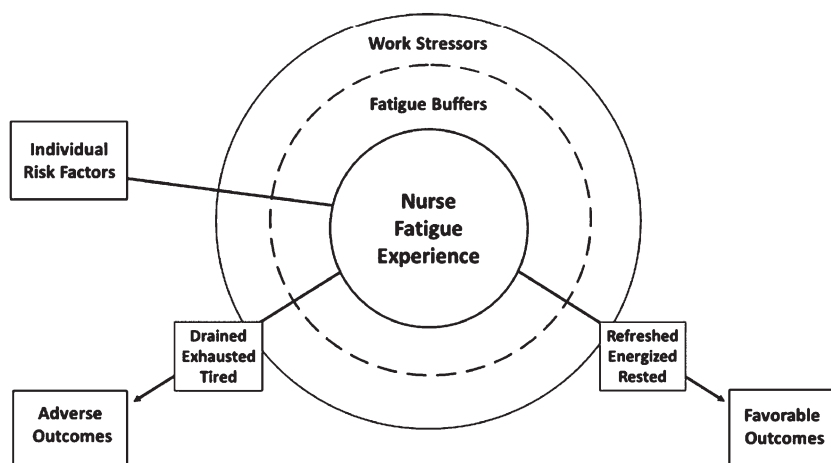
Fig. 3. Conceptual Model for Nurse Fatigue as Part of Injury Reporting.

Table 2
Socio-demographic Data of RNs Reporting Fatigue (*n* = 104)

Variable Name	*N* (%)	Mean (S.D.)
Self-identified Gender[a]		
Female	92 (89)	
Male	8 (8)	
Self-identified Race[b]		
White	93 (89)	
Other Race or Multi-racial	5 (5)	
Age (years)[c]		29.7 (8.0)
Years in current position		3.6 (5.0)
Hours worked in an average week		34.9 (3.7)

[a]4 missing; [b]6 missing; [c]3 missing.

5.2.2. Individual risk factors for fatigue

Nurses identified Individual Risk Factors for Fatigue as directly contributing to their reports of fatigue. An example from the data [Participant 13]: "Kind of slept funny last night, the left side of my neck is a little sore, and my right hip is a little sore but not bad. I'm working a 12-hour shift today." Individual risk factors included subthemes of poor sleep, a need to manage their personal lives, and pre-existing physical conditions (including pain). For instance, nurses reported not getting enough sleep and feeling tired prior to the start of their shift. Nurses also reported care taking and other needs in their personal life not allowing for adequate recovery time. Pre-existing conditions reported in conjunction with fatigue included chronic injuries (e.g., back pain), and acute illnesses (e.g., cold symptoms, headaches).

5.2.3. Fatigue descriptors

Nurses used multiple words to describe their fatigue. A few participants used the word "fatigue"

(*n* = 3) or "drained" (*n* = 1) but most used "exhausted" (*n* = 15) or "tired" (*n* = 85). The descriptions of fatigue were brief as nurses mostly focused on reporting the precursors and outcomes to fatigue. When reporting fatigue, nurses often included qualifiers such as, "a little," "very," and "really," placing fatigue on a continuum. Example from the data [Participant 48]:

> I just finished my night shift and having a little bit of back pain- I'm very tired because I worked two in a row. But overall, I had a very busy night, but a good night. I had a very good compliment from one of my patient's families, so that makes me feel good as a nurse. I'm off till Tuesday, and I'm looking forward to the few days off.

Sometimes nurses would state they were not sure if talking about fatigue should be included in the study, or as one participant stated [Participant 32]:

> Okay, Saturday, March eighth. Here for a twelve-hour a.m. shift, this is my last shift with this thing.

Pretty tired. Got some pretty significant nausea going on, so that's exciting. And also I just want to say that through this study I've tried to air on the side of more information, a lot of the things I've said are things that typically I wouldn't think twice about. Really just don't want to come off as crazy or hypochondriac because that's not me.

5.2.4. Adverse outcomes from fatigue

Fatigue resulted in reports of mental and physical manifestations for nurses. Mental manifestations were described as emotional ("I'm a little sad tonight"), cognitive ("hard to focus"), and psychosocial ("I feel like I don't see [my kids]"). The mental manifestations were sometimes associated with discouragement with work, as one participant mentioned [Participant 72], "I'm leaving my evening shift exhausted and tired. Was the busiest day and I don't ever want to come back". Physical manifestations were descriptions of how the body felt after work, including sleepiness, exacerbated pain ("My lower back definitely hurts more than when I started"), and tired feet and legs ("Jell-O legs"). In particular, a participant described physical manifestations of fatigue as a full body tiredness [Participant 54]: "... overall I am very tired. My eyes are burning and my whole body just feels very, very tired ... "

5.2.5. Fatigue buffers

Despite workplace stressors, nurses described some factors which buffer them from fatigue. These protective factors included strategic use of caffeine consumption during shifts to counteract fatigue ("gain energy"), time off between shifts for recovery, and sufficient sleep ("good sleep"). Time off for recovery was typically acknowledged at the end of multiple shifts worked ("looking forward to the few days off,") or at the beginning of their first shift after a break from work ("Was off for the weekend so I'm well-rested,").

Adequate, or sufficient sleep was noted as a fatigue buffer in a participant example [Participant 65]:

Good morning. It's the beginning of my shift on November third, AM. I woke up great mood today, got that extra hour of sleep over the weekend. I have two patients. I'm not in charge of safety coach so I was pretty excited about that, and so far I haven't had any near misses or safety events.

5.2.6. Descriptors for buffered fatigue

When nurses described experiencing fatigue buffers, they used words such as, "rested" ($n = 11$), "refreshed" ($n = 3$), and "energized" ($n = 2$). These descriptors were used mainly at the beginning of the shift, except when caffeine was used. One participant reported at the start of their shift [Participant 104]: "I am working a 12-hour shift today. I feel very energized at the moment; I feel great, and I look forward to a great shift."

5.2.7. Favorable outcomes

When nurses were able to buffer fatigue, they reported more favorable outcomes, such as readiness to work and general positivity. Readiness to work included reports of feeling awake, prepared for the workday and anything that may occur during the shift. An example from the data [Participant 49]: "This is my first shift ... I am feeling pretty good right now; well rested, relaxed, ready for a good day at work." Positivity was noted in nurses reporting feeling in a good mood and hopeful for a good shift. An example [Participant 82]: "Feeling pretty good about the shift. I feel relatively rested and positive. A couple of kids had some trouble during the day, but I think we'll be able to fix that. So far so good."

6. Discussion

This secondary analysis study was designed to investigate whether pediatric nurses would report fatigue and associated outcomes via DVR when using an active reporting system. While not prompted to talk about occupational fatigue, approximately 30% of nurses in this study did report on their fatigue status pre and/or post shift. Nurses reported not only their fatigue and related symptoms, but also contributing factors (individual and work-related) and adverse outcomes, such as physical and mental manifestations. In addition, nurses stated when they were not fatigued, describing what buffered fatigue symptoms and favorable outcomes such as a readiness to work and having a positive outlook on their day. As a result, this study highlights pediatric nurses will report on occupational fatigue, when given the opportunity. It also suggests what is reported is fairly accurate, since findings of this study align well with what is known about occupational fatigue symptoms, contributors and outcomes among nurses in adult [42, 43] and pediatric care settings [9, 44].

Workplace stress in the form of shift work characteristics (i.e., long shifts, overtime, night shift) and heavy workload were all factors reported by nurses in this study as contributing to occupational fatigue. Of note, the socio-demographic results indicate nurses are working less than 40-hours per week. This supports the qualitative findings that work hour stressors are related to working beyond scheduled work hours (i.e., staying late to finish work), as opposed to extensive cumulative weekly work hours. Shift work characteristics and heavy workloads have also been identified as major contributors to medication errors [4] and occupational injuries in healthcare and motor vehicle accidents from drowsy driving among nurses [45, 46]. The impact of patient care errors and occupational injuries from fatigue are significant. For example, medical errors can have devastating effects on both patients and healthcare workers [47]. Healthcare workers who commit errors can experience severe psychological impact, effecting their heath and ability to continue their work as healthcare providers [47, 48]. The negative downstream effects of occupational fatigue, such as worker injury, adverse health outcomes, and worker death, are financially costly to the economy [49]. Specific to the pediatric nurse population, acute fatigue has been associated with nurse absences, an added cost to healthcare facilities [44]. Despite considerable risks, this study demonstrated nurses recognized their fatigue symptoms at not just the end, but also the start of their shifts. Beginning work already fatigued could place nurses, their coworkers, and patients at higher risk for adverse outcomes.

Conversely, some nurses in this study reported the antithesis of fatigue, along with a positive psychological outlook and a readiness to work, even when the workload was anticipated to be high. Specifically, nurses reported work readiness when they felt they had quality sleep and/or adequate recovery time from work. Reducing nurse fatigue may lower the spillover effects of work, resulting in greater wellbeing, benefitting not only the nurse but help to stabilize the nursing workforce. In a study with 637 nurses, those with extreme fatigue had lower wellbeing scores, indicating symptoms of distress, lack of meaning in work, and dissatisfaction with work-life balance [50]. Nurses with lower wellbeing scores had a higher likelihood of intent to leave the bedside. Because of these downstream effects, acknowledging what helps nurses to feel refreshed is quite significant and should not be understated. Reducing nurse

fatigue and ensuring a readiness to work aligns with the goals of the Total Worker Health® approach to occupational health and safety. The National Institute for Occupational Safety and Health's (NIOSH) Total Worker Health® program urges employers to expand views of worker health and safety by incorporating policies, programs, and procedures to not only mitigate work-related hazards but also promote wellbeing [51]. Having nurses who feel refreshed and physically and mentally prepared to provide patient care could benefit society and the healthcare industry, mitigating potential adverse outcomes associated with lack of readiness to work [52].

If the associated societal costs of occupational fatigue among nurses is so significant, why does fatigue reporting and risk mitigation in healthcare continue to be elusive? Even though some nurses self-detected and reported feeling fatigued in this study, certain barriers persist. Specifically, some nurses were unsure whether fatigue was appropriate to share in the context of injury reporting, highlighting the continued stigma and cultural barriers to reporting fatigue symptoms in healthcare [22–25]. In the 2022 U.S. Agency for Healthcare Research and Quality Hospital Survey on Patient Safety Culture, almost half of pediatric healthcare workers perceived error and injury reporting as punitive [53] with similar results found among healthcare workers in adult setting [54] suggesting a wide-spread issue in the healthcare industry. To overcome these barriers, healthcare organizations would benefit from transforming error and injury reporting to non-punitive systems and foster an organizational culture emphasizing fatigue risk detection or screening as a standard shift practice to enact proactive fatigue countermeasures (e.g., caffeine, napping). Fatigue risk detection and screening has been effectively used in a variety of other high-risk industries [21]. Additionally, experts in the field have highlighted the need for healthcare leaders to drive a shift towards inclusion of occupational fatigue in patient and worker safety culture [43, 55].

Healthcare industries also may benefit from raising the significance of fatigue detection and reporting among nurses and other healthcare workers. This can be accomplished by providing training to managers and staff on the risks associated with fatigue and how to best mitigate risks. A review of fatigue risk mitigation training among shift workers demonstrated multiple benefits, including improved patient safety and worker health and safety across outcome mea-

sures of sleep, burnout and stress, and acute fatigue [56].

For this study, qualitative data successfully captured reports of nurse occupational fatigue. Previous research indicated healthcare workers in the pediatric setting prefer reporting injuries through active systems via narrative recording devices, demonstrating a 40-fold increase of injury reporting [28]. While evidence suggests self-reporting fatigue may not always be an accurate measure due to associated impaired cognition [57, 58], the importance of capturing occupational fatigue through reporting and surveillance cannot be understated. Nurse leaders, managers, and nurses often recognize the problems surrounding fatigue, yet broader healthcare leadership may not [15, 16] and surveillance data could demonstrate the need for interventions. Furthermore, without occupational fatigue surveillance, the extent of the hazard risk, including how often and how many nurses are working while fatigued, may not be accurately captured. As a result, the true impact of fatigue risk mitigation interventions may not be recognized.

While this study confirms pediatric nurses will report fatigue and previous research supports an active reporting system increases injury and illness reporting [28], some approaches to fatigue risk management in healthcare have averted nurse reporting due to concerns of overburdening nurses [59]. Recently published study results [7] described success with a passive fatigue prediction model as a tool for managing occupational fatigue drawing in data already collected in some healthcare settings (e.g., patient acuity, admission/discharge counts) as opposed to relying on screening or fatigue detection measures. Similarly, Gander et al. [60] developed scheduling matrices effective at predicting nurse fatigue and risks for errors. While both studies demonstrated promising interventions in adult care settings, questions of the generalizability across hospitals and the pediatric setting remain. Considering the suggested multi-layered system approach to fatigue risk management [17], finding a way to integrate active nurse reporting with other fatigue prediction strategies may provide realistic options for a wider variety of healthcare settings. In addition, working towards a safer healthcare work environment should encompass efforts to assess and mollify the sources of heavy work demands that not only contribute to occupational fatigue but have been noted to restrict fatigue reporting [59].

6.1. Strengths and limitations

This study presented several limitations. First, some participant experiences of fatigue may not have been accounted for because the primary study did not specifically ask about occupational fatigue. Therefore, some nurses may not have voluntarily self-reported their fatigue as an occupational injury. However, the number of nurses who shared information about fatigue led to the understanding that nurses will describe and report this as an occupational injury even when unprompted. It must be acknowledged these findings may be reflective of the organizational culture for this facility and may not be generalizable to other healthcare organizations.

Next, due to the nature of the secondary analysis design, the researchers were unable to ask follow-up questions with participants to expand on responses and clarify ambiguities. However, the study team were able to validate findings with a researcher from the parent study [28] to add credibility to study results [40]. Third, the qualitative nature and volume of the data made it difficult to complete analysis in a timely manner. Yet, the process of analyzing data iteratively, discussing codes until agreement was met among research team members, and validation with a researcher from the parent study, allowed for the researchers to accomplish the study aims and derive meaning from this dataset while maintaining the complexity of this phenomenon.

Despite the limitations, there were certain strengths to this study. For instance, this study was able to utilize data that involved a narrative reporting device (the DVR), which is preferred by nurses and improves injury surveillance. Another strength is this study was able to provide a new way of understanding the existing dataset [61], allowing the researchers to learn about how pediatric nurses experience occupational fatigue.

6.2. Recommendations for further research

Results suggest the continued need for research and organizational action regarding occupational fatigue reporting to improve the pediatric healthcare landscape for nurses, their patients, and the coworkers in which they interact. Future efforts can be targeted to explore how to best utilize technologies like DVR to improve fatigue reporting in an efficient and manageable process for nurses. Improving fatigue reporting also can be accomplished by forming a non-punitive reporting culture, while incorporating

fatigue into reportable injury systems with standardized and periodic screening.

6.3. Implications for policy and practice

Study findings help to inform the practice of occupational fatigue screening and reporting in the healthcare industry. While there has been indication of barriers among nurses and other healthcare providers to performing fatigue screening and reporting, findings from this study supports nurses will report fatigue when given the opportunity. What could further encourage fatigue reporting practices in healthcare is organizational efforts to further shift the healthcare culture towards fatigue risk mitigation by implementing truly non-punitive reporting as part of a larger fatigue risk management system. Healthcare cannot always control the public's need for healthcare services. As such, nurses and other healthcare professionals may need to temporarily work longer hours during times of public health surges. Having fatigue reporting systems in place with appropriate risk-management measures can further protect healthcare workers and their patients from fatigue-related errors.

7. Conclusions

This secondary analysis of qualitative data using a descriptive design revealed that a sample of pediatric nurses recognized and reported occupational fatigue in an active injury reporting system. Moreover, the nurses were able to recognize pre-existing stressors coinciding with fatigue symptoms, outcomes of fatigue, and the buffers that may reduce negative effects of fatigue. Results underscore the need for additional research to be completed regarding the best way to report occupational fatigue among healthcare workers using technologies such as DVR, and how to mitigate consequences of fatigue. Organizations should also consider incorporating fatigue as a reportable injury, improving their workplace culture to destigmatize injury reporting, and enhancing the error assessment process.

Ethical approval (name of institute and number)

University of Cincinnati, #2020-0687 and Cincinnati Children's Hospital Institutional Review Board, #2020-0654.

Informed consent

N/A.

Conflict of interest

The authors declare that they have no conflict of interest.

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Author contribution

Beverly Hittle: conceptualization, data curation, formal analysis, methodology, investigation, visualization, writing-original draft Elizabeth Keller: data curation, formal analysis, methodology, investigation, visualization, writing-original draft Rebecca Lee: data curation, formal analysis, methodology, investigation, visualization, writing-original draft Nancy Daraiseh: conceptualization, formal analysis, methodology, validation, visualization, writing-original draft.

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