

Physical assault among nursing staff employed in acute care

R.L. Rodríguez-Acosta^{a,b}, D.J. Myers^{b,*}, D.B. Richardson^a, H.J. Lipscomb^b, J.C. Chen^a and J.M. Dement^b

^a*Department of Epidemiology, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA*

^b*Department of Community and Family Medicine, Division of Occupational and Environmental Medicine, Duke University Medical Center, Durham, NC, USA*

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Abstract. Hospital workers are known to be at risk of physical assault. The objective of this study is to characterize injuries resulting from physical assault among hospital nursing staff and to identify associated risk factors. Workers' compensation reports linked to human resources data were used to identify a cohort of aides and nurses employed in acute care units at a major healthcare system from 1997 to 2004 and their reported physical assault events. Poisson regression methods were used to estimate rates and rate ratios (RR) by occupation, gender, race, age, tenure, and hospital unit. During the study period 220 assaults were reported; the overall incidence rate was 1.65 (95% CI: 1.45–1.89) per 100 full-time-equivalent employees (FTEs). Assault risk was higher among those with shorter tenure (< 5 years vs. 15 or more) (RR=1.35, 95% CI: 0.83–2.19) and younger workers (under age 30 vs. 50 or older) (RR=1.30, 95%CI: 0.78–2.19), and lower among Black workers (vs. non-Blacks) (RR=0.63, 95% CI: 0.45–0.90). Incidence rates were highest in Psychiatry (12.65, 95% CI: 8.90–17.99), Neurology (4.43, 95% CI: 3.17–6.20) and Rehabilitation (3.63, 95% CI: 1.51–8.71) units. Interventions targeting Psychiatry, Neurology, and Rehabilitation units, and younger and newly hired staff are warranted. More detailed data are needed to develop targeted interventions.

Keywords: Physical assault, acute care, nurses, nurse aides, poisson regression, surveillance, cohort studies, workers' compensation

1. Introduction

An increased risk of physical assaults has been documented among healthcare workers [10,12,17,18]. According to the US Bureau of Labor Statistics, the rate of assault in the hospital industry in 2005 was 8.0 per 10,000 full-time-workers, three times the rate (2.4 per 10,000 full-time-workers) for all private sector industries [23]. Although anyone working in a hospital may become a victim of violence, nurses and aides are at

higher risk [5,9,10,17,18]. The majority of non-fatal violence-related workplace injuries occur in settings where the victim and the attacker are in a custodial or client/patient-caregiver relationship [19], the context routinely faced by nursing staff.

Hospital nursing staff members provide much of the direct care to patients, often in close contact. In the process of care-giving, patients may feel that they have little control over, or understanding of, the medical procedures that are being done and that their normal routines are disrupted. Events such as denial of services, involuntary admission, or when healthcare workers try to limit behaviors may also trigger violence in the hospital setting [17]. In such settings patients or family members occasionally strike out at the nursing staff with consequences that may negatively impact the em-

*Address for correspondence: Douglas J. Myers, ScD, MA, Assistant Professor, Occupational and Environmental Medicine, Department of Community and Family Medicine, Duke University, Durham, NC 27705, USA. Tel.: +1 (919) 684 8404; E-mail: douglas.myers@duke.edu.

employees' physical, emotional and psychological wellbeing [8]. Victims of workplace violence may experience a variety of consequences in addition to their physical injuries including psychological trauma, changes in relationships with coworkers and family, feelings of incompetence, guilt, powerlessness and fear of criticism by supervisors or managers [18].

We draw upon data for a large cohort of nurses and aides employed in a university-based healthcare system to explore risk factors for assault. Worker's compensation data were linked with employment records so that associations between assaults and individual and employment characteristics could be explored.

2. Methods

2.1. Study design

A retrospective cohort study of all nurse aides and nurses employed in acute care units at two Duke University Health System hospitals was conducted. This dynamic cohort included all aides and nurses employed at any point in time during the study period.

2.2. Data sources

Data for these analyses came from the Duke Health and Safety Surveillance System (DHSSS), a comprehensive system for health, injury and hazard surveillance for employees from Duke University and Health System in Durham, North Carolina. The DHSSS links de-identified data from Human Resources, employee health benefits, occupational medicine, and workers' compensation on an individual basis [3].

The study cohort included all nurse aides and nurses employed in acute care units at two hospitals, a large tertiary medical care center and a large community hospital, both of which belong to Duke University Health System. Data for the medical center were available for 1997 to 2004, while data for the community hospital were available from 2000 to 2004. We defined acute care units as all inpatient clinical care units as well as the emergency room and post anesthesia care units.

2.3. Physical assaults

Assaults were identified by using text data from the incident reports provided by the injured employees and/or their manager. Keywords used to identify assault events were selected after reviewing work-

related violence literature [10–12,17] and include characteristics of patients (e.g., combative, agitated), actions taken by staff members (e.g., restraining, struggled) and actions taken by patients towards the staff (e.g., scratch, kick, bite). Although the classification of events as assaults was guided by the definition used by NIOSH [17], which includes intentional aggressive behavior towards persons at work, we did not require documentation of intent.

2.4. Risk factors

By linking data from human resources with workers' compensation records we were able to examine the distribution and risk of reported assault by job, gender, race, tenure and hospital unit. Units were classified according to their medical specialty and patient acuity, as emergency department, intensive and critical care (except neurology), neurology, orthopedics, step-down or intermediate care, psychiatry and rehabilitation. Obstetrics, gynecology, neonatal, and pediatric units were classified as women's and pediatrics. The remaining units were classified as other medical-surgical units and included perianesthesia/anesthesia care, telemetry, adult medicine, plastics, urology and ear/nose/throat units, medical surgical services, nephrology, chemical dependency center, oncology and bone marrow units. An additional category consisted of "float pool" workers who were not permanently assigned to a particular unit but were frequently "floated" or assigned to various hospital units as needed.

2.5. Statistical methods

Poisson regression methods for ungrouped data [14] were used to estimate crude rates and rate ratios (RR) and adjusted rate ratios in multivariate models using SAS software [20]. We evaluated rates of physical assault by occupation, gender, race, age group, tenure and unit of employment. Rate denominators were expressed as full-time-equivalents (FTEs) because these take into account hours worked per week and the duration of employment by follow-up year. Rates for the most common events leading to injuries (scratches and bites) and body parts (upper extremities and head) were also calculated separately.

To examine a possible under-reporting effect, we produced rate ratios (RR) stratified by outcome severity. It was assumed that more severe assaults (requiring medical treatment, time off work or remuneration) were more likely to be reported than less severe assaults.

Table 1
Characteristics of Assault Injuries Among Nursing Staff Employed at Duke University Health System by Cause, Body Site and Nature of Injury, Duke University Health System North Carolina 1997–2004

	n	%
Cause of Injury		
Struck By/Against	158	71.82
Human Bite	24	10.91
Exertion	20	9.09
Other	18	18.18
Body Site		
Head/Face	60	27.27
Arm	60	27.27
Hand/Finger	39	17.73
Back	16	7.27
Chest	15	6.82
Abdomen	12	5.45
Neck	9	4.09
Unspecified	8	3.64
Leg	1	0.45
Nature		
Pain/Inflammation	72	32.73
Contusion	39	17.73
Abrasion (Scratch)	32	14.55
Bood and Body Fluids Exposure	22	10.00
No Injury/Illness	19	8.64
Sprain/Strain	18	8.18
Puncture	9	4.09
Laceration	5	2.27
Crush/Trauma Injury	1	0.45
Eye Inflammation	1	0.45
Fracture	1	0.45
Miscellaneous	1	0.45

Under-reporting was considered a possible explanation when stratified results showed protective rate ratios further from one for less severe injuries and closer to or greater than one for more severe injuries.

3. Results

A search of workers' compensation claims filed from 1997 to 2004 led to the identification of 1266 potential violence-related events. Review of the event description confirmed a total of 220 violence-related injuries among 197 nurse aides and nurses. These represent 7% of all injury events recorded in workers' compensation data during the study period. Fifty-two violence-related events (24%) were reported by nurse aides and 168 events (76%) were reported by nurses.

Fifty percent of the assaults resulted in injuries requiring medical treatment beyond first aid, time off or financial compensation, while 19 (8.6%) did not result in any injury. The majority of the reported injuries

(86.4%) resulted from direct patient contact. Common patient behaviors that led to intentional injuries were: hitting/kicking (25.0%), biting (13.6%), scratching (11.4%) and grabbing (10.0%). Struck by or against was the leading cause of assault accounting for 71.8% of all reports; events included in this category involved scratching, kicking, spitting, hitting, throwing objects, pushing, punching, digging nails on skin, and grabbing body parts. The second leading cause of injury was biting (10.9%), primarily affecting the arm/hand/finger areas (54.2%). Over-exertion injuries, primarily as a result of working with combative, resistant or agitated patients, accounted for 9.1% of the assaults. The body parts primarily affected were the upper extremities (45.0%) and the head/face (27.3%). One third (32.7%) of the violence-related injury were coded as resulting in pain/inflammation, followed by contusions (17.7%), and abrasions/scratches (14.5%) (Table 1).

The overall reported assault rate among nursing staff was 1.65 per 100 FTEs (95% CI: 1.45–1.89). Nurse aides had a greater risk of physical assault than nurses (RR=1.51, 95% CI: 1.10–2.06) (Table 2). While the number of assaults was greater among women than among men, their risk was lower (RR=0.70, 95% CI: 0.48–1.03). Black nurses and aides (RR=0.95, 95% CI: 0.70–1.28) had a non-significant decrease in risk of injury compared to non-Black workers (the majority of whom were white). The risk of intentional injury decreased with age and job tenure; workers under age 30 had the greatest risk of reported assault compared to those 50 or older (RR=1.15, 95% CI: 0.76–1.73) and workers employed less than five years had a greater assault risk (RR=1.40, 95% CI: 0.94–2.06) relative to those employed for over 15 years. Compared to nursing personnel employed in women's and pediatric care those employed in psychiatry had the highest risk of physical assault (RR=18.31, 95% CI: 10.52–31.86) followed by those employed in neurology (RR=6.41, 95% CI: 3.72–11.05) and long-term rehabilitation (RR=5.25, 95% CI: 1.98–13.91).

After adjusting for gender, race, age group, unit of employment and tenure of employment at DUHS, nurse aides' rate of intentional injury was almost 40% higher than the rate among nurses (adjusted RR=1.38, 95% CI: 0.96–1.98). Fully adjusted models stratified by race showed that the effect of job was stronger among whites. White aides had higher risk of assault compared to White nurses (adjusted RR=1.60, 95% CI: 0.99–2.59). There was little difference in risk between nurses and nurse aides among Blacks (adjusted RR=1.10, 95% CI: 0.63–1.90) (data not shown). An

Table 2

Assault Injury Unadjusted Rates*, Rate Ratios (RR), Adjusted Rate Ratios (RR) and 95% Confidence Intervals (95% CI) by Occupation, Demographic and Employment Characteristics, Duke University Health System, North Carolina 1997–2004

		Injuries	FTEs	Unadjusted Rate	95% CI	Unadjusted RR	95% CI	Fully Adjusted RR	95% CI	Adjusted RR (no race)	95% CI
Occupation	Nurse Aide	52	2264.77	2.30	1.75–3.01	1.51	1.10–2.06	1.38	0.96–1.98	1.11	0.80–1.54
	Nurse	168	11025.46	1.52	1.31–1.77	1.00		1.00		1.00	
Gender	Female	189	11914.18	1.59	1.38–1.83	0.70	0.48–1.03	1.01	0.69–1.50	1.00	0.67–1.47
	Male	31	1376.04	2.25	1.58–3.20	1.00		1.00		1.00	
Race	Black	59	3704.10	1.59	1.23–2.06	0.95	0.70–1.28	0.63	0.45–0.90		
	Non-Black	161	9586.12	1.68	1.44–1.96	1.00		1.00			
Age Group	≤ 29	66	3522.97	1.87	1.47–2.38	1.15	0.76–1.73	1.30	0.78–2.19	1.38	0.82–2.33
	30–39	69	4171.21	1.65	1.31–2.09	1.01	0.67–1.52	1.23	0.76–1.99	1.26	0.78–2.05
	40–49	51	3517.45	1.45	1.10–1.91	0.89	0.57–1.37	1.07	0.68–1.68	1.08	0.68–1.70
	50 +	34	2078.44	1.64	1.17–2.29	1.00		1.00		1.00	
Tenure	< 5	118	6313.13	1.87	1.56–2.24	1.40	0.94–2.06	1.35	0.83–2.19	1.42	0.88–2.31
	5– <10	48	2794.58	1.72	1.29–2.28	1.28	0.82–2.01	1.31	0.80–2.15	1.37	0.83–2.26
	10– <15	22	1793.45	1.23	0.81–1.86	0.92	0.53–1.58	0.94	0.53–1.64	0.99	0.57–1.74
	≥ 15	32	2389.06	1.34	0.95–1.89	1.00		1.00		1.00	
Hospital Unit	Emergency Department	13	1007.42	1.29	0.75–2.22	1.87	0.93–3.73	1.81	0.90–3.65	1.86	0.93–3.75
	Float Pool	12	1008.10	1.19	0.68–2.10	1.72	0.85–3.50	1.81	0.89–3.68	1.74	0.86–3.55
	Intensive Care/ Critical Care	30	1895.98	1.58	1.11–2.26	2.29	1.31–4.00	2.29	1.30–4.01	2.30	1.31–4.03
	Neurology	34	766.96	4.43	3.17–6.20	6.41	3.72–11.05	6.46	3.74–11.18	6.23	3.61–10.78
	Orthopedics	7	341.18	2.05	0.98–4.30	2.97	1.26–6.98	3.32	1.40–7.86	3.13	1.32–7.40
	Other Medical	67	4849.19	1.38	1.09–1.76	2.00	1.22–3.26	2.13	1.30–3.49	2.03	1.24–3.32
	Psychiatry	31	244.97	12.65	8.90–17.99	18.31	10.52–31.86	24.44	13.48–44.31	21.92	12.15–39.55
	Rehabilitation	5	137.90	3.63	1.51–8.71	5.25	1.98–13.91	6.50	2.41–17.52	5.92	2.20–15.95
	Women's/ Pediatrics [^]	21	3038.52	0.69	0.45–1.06	1.00		1.00		1.00	

*per 100 FTEs.

[^]Obstetrics, gynecology, labor, delivery, postpartum, neonatal, and pediatric units.

interaction term for race and job (representing Black aides) was not significant in the fully adjusted model (adjusted RR=0.71, 95% CI: 0.36–1.43) and produced no changes in the rate ratios for any other covariates (other than the main effects of race and job). Therefore only the model including job and race as indicator variables is presented here.

Differences in injury rates by gender observed in the crude analyses did not persist when adjusting for occupation, age, tenure, race and unit (Adjusted RR=1.01, 95% CI: 0.69–1.50). In contrast, there remains evidence of variation in intentional injury rates by hospital unit ($p \leq 0.0001$) and tenure of employment (test for trend, $p = 0.07$). The relative risk of intentional injury in the psychiatry unit (relative to women's and pediatric units) increased in magnitude upon adjustment for the other covariates (Adjusted RR=24.44, 95% CI: 13.48–44.31). After adjustment, we continued to observe a decreasing risk in assault risk with increasing age (Table 2).

Adjusted models showed a significant decrease in risk of assault among Blacks (adjusted RR=0.63, 95% CI: 0.45–0.90). Fully adjusted models stratified by job title showed that the effect of race was stronger among aides (adjusted RR=0.53, 95% CI: 0.29–0.94) than among nurses (adjusted RR=0.72, 95% CI: 0.47–1.10) (data not shown). Under-reporting was investigated as a possible contributor to this observed decrease in risk of intentional injury among Blacks. When models were stratified by severity of the worker's compensation report, the results showed a larger difference for race (Blacks compared to other races) for less severe (adjusted RR=0.52, 95% CI: 0.31–0.90) than for more severe outcomes (adjusted RR=0.75, 95% CI: 0.47–1.20). Similar changes in adjusted rate ratios for race across severity levels were observed for both nurses and aides. However, the decrease in risk for Blacks was larger among aides than among nurses for each level of assault severity. For less severe assaults the adjusted rate ratio for Blacks vs. other races was 0.41 (95% CI:

0.15–1.11) for aides and 0.58 (95% CI: 0.31–1.07) for nurses. For more severe assaults the adjusted rate ratio for Blacks was 0.59 (95% CI: 0.29–1.19) for aides and 0.93 (95% CI: 0.51–1.67) for nurses (data not shown).

3.1. Analyses by cause of injury and body part affected

Nurse aides were only at a slightly higher risk of assaults resulting from being struck than nurses (unadjusted RR=1.14, 95% CI: 0.77–1.70) while their risk of sustaining an intentional injury due to a bite was substantially greater (unadjusted RR=2.43, 95% CI: 1.04–5.69). Risk of assaults due to being struck or bitten, both decreased with age and tenure and were lower among Black workers than among non-Blacks. Due to the small number of bites ($n = 24$), these findings are unadjusted (Table 3).

Nurse aides were also at greater risk of assaults involving both the upper extremities (adjusted RR=1.79, 95% CI: 0.7–3.00) and the head (adjusted RR=1.21, 95% CI: 0.58–2.55). The relative risk of assaults involving the upper extremities (adjusted RR=56.16, 95% CI: 19.80–159.32) and the head (unadjusted RR=15.95, 95% CI: 13.02–19.50) was substantially higher among those working in psychiatry than in any other area (Table 4).

4. Discussion

This study allowed the identification and examination of potential of risk factors for reported physical assault among nursing staff employed in acute care over an eight year period by linking workers' compensation and personnel records at a large health system. In this hospital setting, the majority of the perpetrators of assault on nursing staff were patients and the most striking findings were related to unit of employment. Nursing staff taking care of patients with mental illness, neurological diseases, and those undergoing longer-term rehabilitation were at particularly high risk of being physically assaulted. Although the DUHS has a standard policy, applicable to all of its components, for reporting workplace injuries it could be possible that the observed differences in risk by unit are due to differences in workers' compensation reporting by unit. However, several studies and reports have similarly identified staff employed on psychiatry, neurology, and long-term care settings [10,15–17,24] as being at high risk.

A noteworthy result of our study was the relatively low risk of assaults reported by emergency department nursing staff in contrast to other reports [15]. It is possible that nursing staff in the emergency department accept this risk as part of their job, therefore considering it not worth reporting [10]. However, we do not know of any reasons why nurses in this institution would be less likely to report than in other emergency departments where risk is higher. Another possible explanation for this finding could be that the policies and procedures addressing security and safety that are in place in the Duke emergency department, which include specific instructions on how to proceed in the event of violence and the obvious presence of security officers and metal detectors, may be effective in protecting these workers.

We also found younger workers and those with shorter tenure of employment to be at modestly greater risk of assault. With age and tenure employees may develop better coping mechanisms and/or experience to deal with violence at work; they may be more adaptable to patient behaviors, or develop an empathetic approach that protects them from assaults [8]. However, these findings could also reflect differences in job assignments based on age and tenure, and consequently work exposures, that we were unable to discern with the data available.

Given other studies of injuries and physical assaults among healthcare workers [5,8,13,24] aides were expected to have higher rates of assaults in this data set. The fully adjusted model that included race (Table 2) is the most consistent with past studies. Thus, we believe, this model best represents the effect of job title on the risk of work-related physical assault. Stratified results that showed an interaction between job and race further suggest that race must not be excluded from models of assault risk produced with these data.

It is unclear how race is operating in this population. In this study, Blacks were found to have lower rates of physical assault injuries than non-Blacks. While little is known about the effect of race on assault among healthcare workers, at least one study suggests that Black healthcare workers have higher rates of work-related injury [21]. Smaller differences between Blacks and non-Blacks for more severe outcomes than for less severe outcomes may suggest that Blacks are less likely to report minor assaults. Differences in workers' compensation reporting by race have not been previously demonstrated. However, Blacks are known to utilize health services in general less than Whites, even though for many health conditions they bear a disproportionate burden of disease, injury, death and disability [1,

Table 3
 Assault Injury Unadjusted Rates* and Rate Ratios (RR), Adjusted Rate Ratios (RR) and 95% Confidence Intervals (95% CI) for Most Common Causes of Injury by Occupation, Demographic and Employment Characteristics, Duke University Health System, North Carolina 1997–2004

	Struck by/Against (n = 158)												Human Bites (n = 24)				
	Injuries				Against				By				Bites				
	Injuries	Rate	95% CI	RR	Injuries	Rate	95% CI	RR	Injuries	Rate	95% CI	RR	Injuries	Rate	95% CI	RR	Adjusted RR [±]
Occupation	Nurse Aide	30	1.32	0.93–1.90	1.14	0.77–1.70	1.06	0.67–1.67	8	0.35	0.18–0.71	2.43	1.04–5.69	–	–	–	–
	Nurse	128	1.16	0.98–1.38	1.00	–	–	–	16	0.15	0.09–0.24	1.00	–	–	–	–	–
Gender	Female	137	1.15	0.97–1.36	0.75	0.48–1.19	1.06	0.66–1.7	18	0.15	0.10–0.24	0.35	0.14–0.87	–	–	–	–
	Male	21	1.53	1.00–2.34	1.00	–	–	–	6	0.44	0.20–0.97	1.00	–	–	–	–	–
Race	Black	39	1.00	0.74–1.34	0.78	0.55–1.10	0.63	0.42–0.96	6	0.16	0.07–0.36	0.86	0.34–2.17	–	–	–	–
	Non-Black	119	1.28	1.07–1.54	1.00	–	–	–	18	0.19	0.12–0.30	1.00	–	–	–	–	–
Age Group	≤ 29	49	1.39	1.05–1.84	1.16	0.71–1.87	1.41	0.76–2.63	9	0.26	0.13–0.49	1.77	1.48–2.11	–	–	–	–
	30–39	51	1.22	0.92–1.61	1.02	0.63–1.64	1.33	0.75–2.35	7	0.17	0.08–0.35	1.16	0.30–4.50	–	–	–	–
	40–49	33	0.94	0.67–1.32	0.78	0.46–1.31	0.97	0.56–1.67	5	0.14	0.06–0.34	0.98	0.24–4.12	–	–	–	–
	50 +	25	1.20	0.81–1.78	1.00	–	–	–	3	0.14	0.05–0.45	1.00	–	–	–	–	–
	≥ 5	85	1.35	1.09–1.67	1.29	0.82–2.01	1.2	0.68–2.13	15	0.24	0.14–0.39	2.84	0.65–12.41	–	–	–	–
Tenure	5–<10	31	1.11	0.78–1.53	1.06	0.63–1.80	1.06	0.58–1.92	5	0.18	0.07–0.43	2.14	0.41–11.02	–	–	–	–
	10–<15	17	0.95	0.59–1.53	0.91	0.49–1.68	0.92	0.49–1.75	2	0.11	0.03–0.45	1.33	0.19	1.74	–	–	–
	≥ 15	25	1.05	0.71–1.55	1.00	–	–	–	2	0.08	0.02	0.34	1.00	–	–	–	–
	Emergency Department	8	0.79	0.40–1.59	1.61	0.68–3.79	1.66	0.7–3.94	3	0.30	0.10–0.92	4.52	0.76–27.08	–	–	–	–
Hospital Unit	Department	8	0.79	0.40–1.59	1.61	0.68–3.79	1.75	0.74–4.15	3	0.30	0.10–0.92	4.52	0.76–27.06	–	–	–	–
	Float Pool	24	1.27	0.85–1.89	2.56	1.35–4.89	2.59	1.35–4.96	3	0.16	0.05–0.49	2.40	0.40–14.39	–	–	–	–
Intensive Care/Critical Care	Neurology	27	3.52	2.41–5.13	7.13	3.79–13.41	7.44	3.94–14.05	3	0.39	0.13–1.21	5.94	0.99–35.56	–	–	–	–
	Orthopedics	3	0.88	0.28–2.73	1.78	0.52–6.15	2.14	0.62–7.42	2	0.59	0.15–2.34	8.91	1.25–63.22	–	–	–	–
	Other Medical	47	0.97	0.73–1.29	1.96	1.10–3.51	2.16	1.2–3.88	6	0.12	0.06–0.28	1.88	0.38–9.31	–	–	–	–
	Psychiatry	22	8.98	5.91–13.64	18.19	9.44–35.07	26.76	13.23–54.13	1	0.41	0.06–2.90	6.20	0.56–68.39	–	–	–	–
	Rehabilitation	4	2.90	1.09–7.73	5.88	1.95–17.70	8.07	2.62–24.87	1	0.73	0.10–5.15	11.02	1.00–121.50	–	–	–	–
	Women s/Pediatrics [^]	15	0.49	0.30–0.82	1.00	–	–	–	2	0.07	0.016–0.26	1.00	–	–	–	–	–
	Emergency Department	8	0.79	0.40–1.59	1.61	0.68–3.79	1.66	0.7–3.94	3	0.30	0.10–0.92	4.52	0.76–27.08	–	–	–	–

* per 100 FTEs.

[^]Obstetrics, gynecology, labor, delivery, postpartum, neonatal, and pediatric units.

[±] Adjusted RR not calculated due to small number of events.

Table 4
 Assault Injury Unadjusted Rates* and Rate Ratios (RR), and Adjusted Rate Ratios (RR) and 95% Confidence Intervals (95% CI) for Upper Extremities and Head Injuries by Occupation, Demographic and Employment Characteristics, Duke University Health System, North Carolina 1997–2004

	Upper Extremities (n = 99)										Head (n = 60)														
	Injuries Rate		95% CI		Crude RR		95% CI		Adjusted RR		95% CI		Injuries Rate		95% CI		Crude RR		95% CI		Adjusted RR [±]		95% CI		
Occupation	Nurse Aide	28	1.24	0.85–1.79	1.92	1.24–2.97	1.79	1.07–3.00	1.11	0.97–1.27	1.21	0.58–2.55													
	Nurse	71	0.66	0.51–0.81	1.00		1.00		1.00		1.00														
Gender	Female	86	0.72	0.58–0.89	0.76	0.43–1.37	1.19	0.65–2.16	0.46	0.40–0.53	0.60	0.31–1.16													
	Male	13	0.95	0.55–1.63	1.00		1.00		1.00		1.00														
Race	Black	28	0.76	0.52–1.10	1.02	0.66–1.58	0.56	0.33–0.93	0.52	0.26–1.02	0.39	0.19–0.80													
	Non-Black	71	0.74	0.59–0.90	1.00		1.00		1.00		1.00														
Age Group	≤ 29	29	0.83	0.57–1.19	1.14	0.61–2.13	1.46	0.67–3.19	1.75	1.46–2.09	2.74	0.94–7.97													
	30–39	29	0.70	0.48–1.00	0.96	0.52–1.80	1.36	0.66–2.83	1.28	1.06–1.53	1.82	0.66–5.0													
	40–49	26	0.74	0.50–1.09	1.02	0.54–1.93	1.33	0.68–2.60	1.19	0.99–1.44	1.55	0.6–3.97													
	50 +	15	0.72	0.44–1.10	1.00		1.00		1.00		1.00														
Tenure	< 5	54	0.86	0.66–1.12	1.28	0.73–2.23	1.20	0.59–2.41	1.37	1.17–1.61	0.94	0.36–2.5													
	5–<10	19	0.68	0.43–1.07	1.02	0.52–1.97	1.02	0.49–2.12	1.60	1.34–1.91	1.31	0.5–3.43													
	10–<15	10	0.56	0.30–1.04	0.83	0.38–1.83	0.83	0.37–1.87	1.33	1.09–1.63	1.19	0.43–3.29													
	≥ 15	16	0.67	0.41–1.09	1.00		1.00		1.00		1.00														
Hospital Unit	Emergency Department	6	0.60	0.27–1.33	3.62	1.10–11.86	3.47	1.05–11.47	1.72	1.34–2.22	1.51	0.43–5.28													
	Float Pool	5	0.50	0.21–1.19	3.01	0.87–10.41	3.16	0.91–10.95	1.72	1.34–2.22	1.92	0.56–6.6													
	Intensive Care/Critical Care	11	0.58	0.32–1.05	3.53	1.23–10.15	3.58	1.24–10.33	2.29	1.88–2.79	2.08	0.78–5.53													
	Neurology	17	2.22	1.38–3.57	13.47	4.97–36.51	13.66	5.02–37.18	3.96	3.20–4.91	3.91	1.36–11.3													
	Orthopedics	4	1.17	0.44–3.12	7.12	1.91–26.53	7.82	2.08–29.38	—	—	—	—													
	Other Medical	32	0.66	0.47–0.93	4.01	1.56–10.29	4.25	1.65–10.95	1.61	1.35–1.93	1.87	0.78–4.51													
	Psychiatry	17	6.94	4.31–11.16	42.17	15.56–114.31	56.16	19.8–159.32	15.95	13.02–19.5	26.09	8.93–76.2													
	Rehabilitation	2	1.45	0.36–5.80	8.81	1.71–45.43	10.30	1.96–54.13	3.15	2.05–4.84	5.12	0.61–43.1													
	Women's/Pediatrics [^]	5	0.17	0.07–0.40	1.00		1.00		1.00		1.00														

*per 100 FTEs.

[^]Obstetrics, gynecology, labor, delivery, postpartum, neonatal, and pediatric units.

[±]Excludes orthopedics unit due to zero events.

7]. Underutilization of services by African Americans may be due to their lack of trust in healthcare institutions due to history of past abuses in medical research, economic injustices and racial profiling practices found in the healthcare delivery system [2,22]. It is possible, therefore, that Blacks may have underreported the more severe as well as the less severe assaults in this study.

There may be unmeasured factors that are responsible for the association between race and physical assault found here. We suggest that ethnographic studies conducted on the hospital units may help clarify these associations. This method would allow for the investigation of other factors not available in this data set such as differences by race in social norms and thresholds for reporting assaults, patterns of interaction between patients and staff that may differ according to the racial combination of each and modify the risk of assault, and other variables rooted in the social contexts of the workplace that may require observational research methods.

Reasons for the lack of difference in assault rates by job among Blacks, as observed among Whites, are unknown. However, it is possible that underreporting also plays a part in concealing differences in assault risk by job title among Blacks. Since the effect of race observed here was stronger for aides than for nurses for both less and more severe assaults, there exists the potential for greater underreporting among Black aides than among Black nurses. It is therefore possible that reporting differences are confounding the association between job and assault risk among Blacks.

We acknowledge that in the process of identifying violence-related events we were limited by reported events provided by employees and/or supervisors, by the level of detail provided, and possibly by the employees' perceptions of the patients' intent to harm. It is possible that we missed identifying some events after performing the keyword search because not enough information was available to determine intent to harm. We also recognize as a major limitation the fact that we were not able to capture non-physical assault events (e.g., verbal abuse and threats). We tried to minimize undercounting of events by including all workers' compensation reports regardless of outcome and/or time lost. Finally, assault events which were not severe enough to be recorded in the Workers' Compensation system were not analyzed here.

Reported estimates of intentional injury rates among nursing staff likely underestimate the true risk among these workers. Underreporting of injuries may occur due to lack of reporting policies, the perception that

assaults are part of the job, employee perception that reporting may not benefit them, and employee concerns that assaults may be viewed as a result of poor job performance or worker negligence [4,15]. Other reasons for not reporting are lack of physical injury and understanding the patient's source of anger and feeling sorry for them [4,15].

Recent studies have used workers' compensation reports to capture non-fatal intentional injuries among nursing staff, ascertaining injuries via self-report using surveys and cross-sectional study designs [5,6,9,10,15]. These studies aimed at ascertaining all violence-related events are subject to the worker's interpretation of what constitutes an intentional injury and rely on the worker's recollection of the events some time after they happened. Other studies have focused attention on intentional injuries within particular hospital units (e.g., emergency medicine or psychiatry) [15]. Workers' compensation data have been used to ascertain intentional injury events among hospital workers for a three year period (1991–1993) [24], to estimate statewide risk of nonfatal physical assault [12], and to describe non-fatal workplace violence claims submitted to a large workers' compensation carrier from 51 US jurisdictions [11].

Our study, based on a well-defined cohort, demonstrated the usefulness of workers' compensation data in identifying and characterizing intentional injury among nursing staff. These data have the advantage of being routinely collected and may be analyzed over long periods of time. Contrary to other studies that have used workers' compensation data we were able to link these data with workers' employment records to define the population-at-risk and to provide data on characteristics of employment, such as tenure, occupation, and unit of employment, demographic factors, and time-at-risk. The available data allowed us to perform cohort analyses of injury rates by hospital unit, by characteristics of each unit, and characteristics of employment (e.g., tenure and occupation). In addition, access to text data describing these events, even though very brief, allowed for more accurate identification of events that appeared to be truly related to violence.

5. Conclusion

Patterns of risk in this population suggest that preventive interventions should target newly-hired staff and those caring for patients with mental illness, neurological disease and undergoing longer-term rehabil-

itation. The majority of the injuries were the result of strikes by patients directed to the upper extremities and the head and face. These patterns likely reflect the proximity of these body parts to the patient or the use of the arms/hands as a first line of protection. This suggests the need to train nursing staff to be aware that these body parts are more likely to be targeted during an assault.

Given the observed unexpected lower risk of physical assault in the emergency room, we suggest further studying this unit to identify what policies, work environment modifications, security and educational opportunities are available to staff, patients and visitors in order to explore their potential influence on injury occurrence and/or reporting. Also, the results of our study regarding tenure of employment point out the importance of addressing more senior staff in order to learn more about how they deal with violence at work and about their prevention and coping strategies. Differences in risk by race still deserve further investigation.

We recognize that for violence prevention programs to be most successful they should be systematic and comprehensive. In future studies it will be important to identify other sources of non-physical violence-related data within the health system. We suggest the use of sources such as security and unit incident reports to help account for those events.

The results on race observed here have not been seen in other studies. More research is needed to investigate differences in assault risk by race and how race may interact with job title. In addition, the possibility of reporting differences by race and by job title should be explored to determine how these may affect measures of association between race or job title and assault risk.

More detailed understanding of circumstances surrounding violence, and consequently preventive efforts, could be improved through active surveillance efforts. A standardized definition of violence-related events (regardless of outcome), and collection of detailed data, particularly circumstances surrounding these events are key elements in this process. Involvement of all nursing staff, both nurses and nurse aides, in active surveillance efforts including defining intentional injury or assault, describing the circumstances surrounding those events and information on perpetrators as well as the identification of possible preventive strategies could be useful in helping control this occupational hazard in the acute care environment. We believe that a reporting system, independent from workers' compensation, will ensure a more complete documentation of all violence related events regardless of outcome.

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