Published in final edited form as:

Pain. 2017 March ; 158(3): 377–382. doi:10.1097/j.pain.0000000000000725.

How Nurse Gender Influences Patient Priority Assignments in U.S. Emergency Departments

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Abstract

The goals of this study were to compare whether emergency department (ED) patients' pain intensity (PI) is measured differently by male and female nurses and to determine whether PI, heart rate (HR) and respiratory rate (RR) we're used to prioritize patient urgency differently by male and female nurses. The associations between patients' PI|HR|RR and the Emergency Severity Index (ESI) scores they were assigned by attending nurses were analyzed using a national database of electronic medical records of U.S. Veterans Affairs ED patients from 2008 to 2012. A total of 129,991 patients presenting for emergency care ($M_{\text{age}} = 59.5$, 92% males) and their triage nurses ($n = 774$, $M_{\text{age}} = 47.5$, 18% males) were analyzed, resulting in a total of 359,642 patient/provider interactions. Patients' PI did not differ by nurse's gender; however a cross-classified mixed-effects model showed that nurse gender influenced how PI and RR measurements informed the ESI levels that male patients received. Higher PI levels were associated with more urgent (higher priority) ESI levels by female nurses, yet less urgent ESI levels by male nurses. In contrast, male patients with high RR received more urgent ESI levels by male nurses, while nurse gender did not influence ESI assignments for female patients. These findings show that ED patients receive disparate treatment based on inherent characteristics of their triage nurses, and more standardized (e.g., automated) protocols that can account for implicit social factors on healthcare practice for reliably assessing and prioritizing ED patients may be currently warranted.

Keywords

pain intensity; patient care; interpersonal; communication; health disparities

Healthcare inefficiency and basic measurement error can result from implicit social factors associated with the health provider's characteristics themselves. Characteristics of healthcare providers, such as gender, race, and perceived authority role can influence experimental pain behaviors [28,39–41,43] and clinical pain reporting [37]. Likewise, experimental studies show that females as compared to males exhibit greater overall empathic reactions (e.g., facial expressions, vocal utterances, self-reported feelings and perceptions) to behavioral suffering [8,32,35]. Female laypersons attribute higher pain intensity than males to people

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exhibiting pain behaviors [39]. Women have also been shown to demonstrate a stronger correspondence between neurocortical and verbal indicators of pain empathizing [13], while males tend to be more critical in their evaluations of others, potentially attenuating neurocortical empathizing responses and/or reporting [27]. These differences may be rooted in sexually dimorphic empathy-related neuroendocrine activity, with women recruiting greater amygdala and associated (e.g., ‘mirror’) neuronal activation than males on average [6,16,20,24,48]. Although sex differences in the expression of empathy likely impacts how healthcare is delivered, few investigations have measured just *how* these basic differences affect treatment decisions.

The goals of the current study were to compare how emergency department (ED) patients’ vital signs and pain reports were presented to female and male nurses, and to determine whether nurse’s gender influenced how these measurements were used to prioritize patient urgency. Emergency Severity Index (ESI) assignments were analyzed among a large national sample due to the wide use of this scoring method for prioritizing patient urgency in U.S. EDs, and because these assignments have been shown to be reliable predictors of hospital admission and expected resource needs of patients [14,18]. Numerous healthcare systems including the Veterans Health Administration (VHA) have adopted the ESI scoring system to triage patients who present for emergency care. ESI scoring uses vital signs including heart rate (HR) and respiratory rate (RR) to determine the order that patients are seen and sometimes the location, e.g. urgent care versus emergency department. Unlike HR and RR, self-reported pain is not a primary factor used to assign an ESI level. As in many emergency departments, pain intensity (PI) level reporting is a required measurement in Emergency Departments in the VHA [18]. Whether pain is used to determine ESI is left to the discretion of triage nurses [14,30]. In this study, we predicted that female and male triage nurses will assess patient symptom expression differently, and the differences will be more pronounced for measurements that are subjectively presented such as PI measurements, as compared to vital signs that are more objective, such as HR and RR. We hypothesized that female nurses would respond to pain expression with greater urgency than male nurses, whereas the associations between patients’ heart and respiratory rates and the ESI assignment were not expected to differ by nurse gender.

Methods

Study Population

This study used the Veterans’ Health Administration Corporate Data Warehouse (CDW) for patient encounters dating from January 1st, 2008 to December 31st, 2012. The CDW houses regional and national data downloaded from electronic health records from six million veterans nationwide [47]. The study was approved by the University of New Mexico Human Research Review Committee and the New Mexico VA Health Care System Research and Development Committee (HRRC 12-544). As described in the supplemental materials, ED were included only if identifiable pain scores and ESI ratings were used. Patients were included in the study if they were treated within the 5-year period and their medical records indicated that they had been treated for a pain-related visit associated with an inflammatory or a musculoskeletal condition, and were processed by a VHA staff member with a nursing

license (e.g., RN, LPN / LVN, NP). Visits in which patients were assigned an ESI level of 1 were excluded, because this rating is usually restricted to patients who require immediate resuscitation and in such cases there is little to no discretion to assign any but the most emergent ESI rating. Less than 1% of ED patients were assigned this rating.

Data tables from the patients and nurses who assigned the ESI levels were managed and combined via VHA Informatics and Computing Infrastructure as described elsewhere [10,38]; see supplemental information for a full description of data management procedures.

Study Design

The primary clinical variables at the level of individual visits were patients' pain intensity, heart rate, respiratory rate (PI|HR|RR), and ESI level. Nurse gender was coded, with male = -0.5 and female = +0.5. Additional nursing characteristics treated as covariates consisted of age and number of years of experience working for the VHA. Covariate patient characteristics included age, ethnicity, and the number of distinct ICD9 codes indicating a history of a substance or alcohol-related diagnosis (behavior problems). Patients' ethnicities were categorized into one of six self-identified categories, according to their chart records: non-Hispanic White (NHW), Hispanic, African-American, Asian-American, American Indian/Alaskan Native, or mixed / more than one. These categories were dummy-coded (using NHW as the reference group). Continuous predictors were centered at the mean across visits (nurse age = 47.5, nurse experience = 14.0, respiratory rate = 18.3, heart rate = 81.4, patient age = 59.5), except for problem behaviors (sum of alcohol/substance disorders), which was left centered at the modal value of 0. Extreme outlying values (<1% of the sample) for HR (<30 and >200) and RR (>50) were also excluded from analyses (see supplemental materials).

We used cross-classified, random-effects (multilevel) models [15] in order to account for the unbalanced number of patient-provider interactions and the fact that each PI/HR/RR/ESI assignment was provided for a particular patient by a particular nurse, but both nurses and patients were able to provide multiple patient data on multiple occasions and hence the non-independence of observations and errors [4].

In the models, the PI, HR, RR, or ESI assignment for a given visit is the dependent variable, and we included nurse gender as a predictor. For the equations predicting ESI assignments, we also included interaction terms between the nurse's gender and (1) PI (first ESI model); (2) HR (second ESI model); and (3) RR (third ESI model). In each model, we included as covariates additional characteristics (age, years of experience) and patient characteristics that may be expected to influence PI/HR/RR/ESI assignments (e.g., age, ethnicity, and substance abuse disorders) separately for male and female patients. We conducted our analyses in R v3.1.0 [31] using restricted maximum-likelihood estimation in the package lme4 v1.1-6 [2]. We used an online tool to decompose two-way interactions in random-effects models to examine potential follow-up effects [19].

Results

Patient and Nurse Characteristics

In total, the sample consisted of 129,991 patients with complete (patient and examiner) data for inclusion in the study. All patients were Veterans and the majority were males (91%). Patient age ranged from 18–103yrs ($M = 58.3$ yrs, $SD = 15.7$). Each patient was seen between 1 to 157 times on separate visits by one of 774 nurses (78% female) across a total number of 359,642 encounters (78% of patients had 3 or fewer total visits during the 5 year-period analyzed). Nurses ranged in age from 21 to 75 years ($M = 45.3$, $SD = 11.1$) and assigned multiple ESI ratings over the 5-year period analyzed (median = 16, 25th and 75th percentiles = [3.00, 287.25]). At the time of each assessment, the staff had between 0 and 43 years of experience ($M = 11.6$, $SD = 9.0$) since their initial employment with (and exclusive to) the VA Health Care System.

Male and female patients did not differ in reported PI scores ($p > .05$, $M_{\text{males}} = 4.5$, $SD = 3.8$; $M_{\text{females}} = 5.4$, $SD = 3.6$), nor were gender differences observed for HR ($M_{\text{males}} = 81.1$, $SD = 16.4$; $M_{\text{females}} = 84.1$, $SD = 15.2$), RR ($M_{\text{males}} = 18.3$, $SD = 2.2$; $M_{\text{females}} = 18.0$, $SD = 2.0$), or ESI level ($M_{\text{males}} = 3.5$, $SD = 0.8$; $M_{\text{females}} = 3.5$, $SD = 0.7$). Six separate multilevel models (3 for male patients and 3 for female patients) examined the interaction between nurse gender and patient's triage PI rating, HR, and RR on the ESI assignments. Table 1 shows that (for each of the three equations) among both male and female patients, older age and a larger sum of ICD9 codes were both associated with the assignment of more urgent ESI levels. Ethnic differences emerged as well.

Nurse Gender and Patient Vitals

We then examined whether the gender of nurses influenced how patients' vitals (PI/HR/RR) were used to determine ESI levels, controlling for the remaining covariates. As shown in Table 1 under "Pain Score", the interaction term between nurse gender and pain score was significant for male patients, indicating that male and female nurses used pain scores differently when interacting with male patients. Figure 1 shows the nature of this interaction. A simple-slope analysis revealed that, controlling for the remaining covariates in Table 1, female nurses assigned more urgent ESI levels to male patients with higher pain scores ($B = -.005$ [$SE = .0004$], $z = -14.00$, $p < .001$), whereas male nurses assigned less urgent ESI levels to male patients with higher pain scores ($B = .003$ [$SE = .0008$], $z = 3.45$, $p < .001$). Conversely, among female patients, the effect of pain score on ESI (controlling for the other covariates) did not vary across nurse genders. Specifically, nurses (male and female) tended to assign more urgent ESI levels to female patients with higher pain scores, and this effect was not affected by nurse gender.

Table 1, column "Heart Rate" shows that patients with faster heart rates were assigned more urgent ESI levels (controlling for the other covariates), and this effect did not vary between male and female nurses for either male or female patients (as indicated by nonsignificant interaction terms). In contrast, column "Respiratory Rate" shows a significant interaction term between nurse gender and respiratory rate for male patients, indicating that nurses who interacted with male patients used respiratory rates differently depending on their own

gender. Figure 2 shows this interaction. A simple-slope analysis revealed that, controlling for the remaining covariates in Table 1, both male and female nurses assigned more urgent ESI levels to male patients with faster respiratory rates, though this effect was stronger among male nurses than female nurses (male nurses: $B = -.052$ [$SE = .0014$], $z = -37.49$, $p < .001$; female nurses: $B = -.037$ [$SE = .0007$], $z = -53.40$, $p < .001$). Conversely, among female patients, the effect of respiratory rate on ESI (controlling for the other covariates) did not vary across nurse genders. Specifically, nurses tended to assign more urgent ESI levels to female patients with faster respiratory rates, and this effect did not vary between male and female nurses (as indicated by a nonsignificant interaction term).

Other Nurse Characteristics

Two other nurse characteristics were investigated in this study: age and years of experience. When interacting with female patients, older nurses assigned less urgent ESI levels than younger nurses, even after controlling for other nurse and patient characteristics. Nurse age did not have an effect on ESI assignments among male patients after controlling for the other covariates. Similarly, nurse experience did not have a significant effect on ESI assignments among either male or female patients.

Discussion

These findings suggest that patients in U.S. VHA emergency departments receive disparate treatment based on the gender of the nurse during triage assessments. Patients did not present differences in PI levels, HR, and RR measurements to female and male nurses. However, nurse gender influenced the relationship between measured PI and RR and the ESI assignments given to male patients. Higher PI levels were associated with more urgent (higher priority) ESI scoring by female nurses, yet less urgent ESI scoring by male nurses. In contrast, male patients with high RR received more urgent ESI levels by male nurses, while nurse's gender did not influence ESI assignments for female patients. These results imply that factors such as the gender of health providers undermines the reliable assessment and treatment of patients, despite the widely viewed presumption that ESI rating methodology objectively and reliably informs patient condition and prioritization and urgency of patient care [30].

The strengths of this study include the large patient sample and many interactions over time, and the ability to statistically account for the repeated nature of patient visits and nurse assignments. However our sample consisted of predominantly male patients and female nurses who were overrepresented in the analysis. Although our analyses was able to control for several person-level characteristics of patients and nurse providers, the study does not determine causality, as it is possible that third variables (e.g., regional characteristics where the VHA ERs are located, work cycles) may account for the observed associations between nurse gender and their triage decisions. Further, triage decisions—even when using an algorithm as the ESI—are always influenced by far more than the simple parameters available in the CDW database. It is likely that additional implicit social factors such as patient or nurse physical characteristics, mannerisms, attire, and other status symbols (jewelry and Veteran awards) influenced vital sign measurement and/or triage ratings. In this

study, male patients with high PI scores were given more priority than equivalent female patients when seen by female nurses, irrespective of objectively measured HR and RR. This result implies that these male patients may receive more rapid care from physicians, a proposition that will need to be measured directly in future research. Additionally, these effects may result in males receiving more narcotic pain medications than females. Related studies have found that female physicians are more likely than male physicians to prescribe higher doses of analgesics to underserved categories of patients such as ethnic minorities and other females [45,46]. In our own (Vigil) lab, we have shown that females naturally express higher levels of pain empathizing than males on average, for instance, as indicated by attributing higher pain intensity or perceived suffering to other people engaging in painful discomfort task [39]. Neurologically, people show distinct brain activation when they experience pain empathy, which corresponds to the so-called “pain-matrix” [16,26], yet only a few studies have found sex differences in empathy-related neurocortical activity [6,24,25,48], while others have not [1,16,17,20]. As mentioned above, sex differences in pain empathizing behaviors is likely rooted in functional specialization in the association between person-perception impressions, neurocortical, and behavioral demonstrations of pain empathizing [13,27].

From an evolutionary perspective, conventional gender differences in the expression and reaction to pain can be attributed to broader communication styles characterized by the differential advertisement of vulnerability versus prowess and empathy versus apathy for constructing different types of peer network structures throughout human’s nature history [12,32,33,35,42,44]. From the perspective of this *Socio-relational Framework of Expressive Behaviors* [32], humans show sex differences in submissive behaviors including appeasement gestures (e.g., empathizing with another’s pain) and demonstrations of vulnerability that convey the impression of fragility, benignity, and ultimately trustworthiness via an array of behavioral mechanisms such as the formation of fluid in the eyes (tears), the verbalization of self-deprecating statements (low self-esteem), and expressed pain from discomfort that arises endogenously or through contact with environmental stimuli [see also 32,39]. According to this thesis, women report relatively higher pain experiences (both quantitatively and qualitatively), including higher experimental and clinical pain sensitivity, as well as higher levels of pain empathizing behaviors than men on average [11,21–23,29,34,39] as a means of strengthening the reliability and security of women’s peer networks, and hence a selection pressure that is believed to have generally been more relaxed among ancestral men [12,32,33,35,36,43].

During face-to-face communication, voluntary and involuntary and information is exchanged explicitly via language and implicitly by nonverbal cues [5,43]. In a health care context the motivation of the patient is to receive care. In order to receive it the patient signals their distress and care begins with the patient believing that their expression has been acknowledged and appropriately acted upon. This study demonstrates that characteristics of the nurse and the patient interact in unexpected ways to affect these early stages of perceived care received by patients. While this study did not examine the downstream consequences of nurse assessment differences, it is likely that decisions in early stage of patient evaluation may affect patients’ perceptions of care, intensity of health care utilization, costs and appropriateness of care.

From a healthcare delivery perspective, both overestimation and underestimation of ESIs can have negative consequences for patients and payers. Overestimation can lead to unnecessary treatment side-effects for example associated with prescription narcotic use.

Underestimation, on the other hand, can cause pain and suffering through inadequate treatment and associated (often costly) complications. Both over- and under-provision of care can have broader societal implications arising from the reduced work capacity of both patients and caregivers. Our results indicate differences by nurse gender on ESIs for male patients. This suggests that male nurses may underestimate male patient illness severity when patients report certain pain levels and/or that female nurses may overestimate male patient illness severity with differing consequences. However, these distinctions only emerged for patients that reported high pain levels, and no effect of nurse's gender was evident for patients who reported low pain levels. Over- and/or under-estimation of illness severity must exist because male and female nurse ESI assessments cannot be simultaneously accurate after controlling for selection effects.

Underestimation of male patient illness severity by male nurses has obvious negative consequences for male patients assessed by male nurses, but may be the less problematic option vis-à-vis overestimation by female nurses. First, fewer than one percent of registered nurses are male in the general nursing population, according to 2011 U.S. Census data.¹ Secondly, men are not generally considered to be a disadvantaged patient subgroup in the healthcare literature (although one can envision contexts in which males are over-diagnosed for some disorders such as conduct and hyperactivity 'problem behaviors').

If instead, or in addition, female nurses overestimate male patient illness severity, this has both important policy implications and could help explain the documented disparity faced by women in accessing and receiving necessary health care, e.g., in analgesic treatment for acute abdominal pain [3], in cardiac revascularization [9], and in elder care [7]. Given the prevalence of female nurses, it could be that male patients are systematically advantaged in emergency treatment. Even if the average ESIs do not differ by gender, this equality could mask the fact that male patients would have had less urgent average ESIs than female patients but for the prevalence of female nurses. Alternatively, it is possible that male patients may likewise have more urgent ESIs than female patients but for the prevalence of male nurses

One policy solution to this potential gender disparity in healthcare provisioning could be to increase the number of male nurses, thus increasing equality on average, even if an individual patient will still experience disparate treatment depending on whether or not their nurse is female. Unfortunately, increasing the number of male nurses alone will not address the cost implications from systematic gender-based under- or over-estimation. Automation of the ESI process might be the best policy solution for both increasing equality in ESI assessments across genders and in reducing the patient and payer costs associated with under- and over-provision of healthcare. The downside of automated patient care, of course, is fewer jobs for humans of both genders.

¹<http://www.census.gov/people/io/publications/reports.html>. Accessed 12/12/2015.

Acknowledgments

This project was supported in part by the National Center for Research Resources and the National Center for Advancing Translational Sciences of the National Institutes of Health through Grant Number UL1 TR000041. This study was supported by the New Mexico VA Health Care System, Albuquerque, New Mexico. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the U. S. Department of Veterans Affairs. None of the authors declare any financial or other conflicts of interest related to this work.

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Figure 1. Predicted ESI level for male and female nurses interacting with a male patient's pain score, when other covariates are 0.

Figure 2. Predicted ESI level for male and female nurses interacting with a male patient's respiratory rate, when other covariates are 0.

Table 1

Cross-classified random-effects models predicting assigned ESI level from nurse gender, patient vitals, and the interactions between nurse gender and each of the vitals of male and female patients

Effect	Pain Score			Heart Rate			Respiratory Rate		
	Males	Females		Males	Females		Males	Females	
Intercept	3.355 ***	3.453 ***		3.353 ***	3.454 ***		3.352 ***	3.454 ***	
Patient Age	-0.006 ***	-0.004 ***		-0.006 ***	-0.004 ***		-0.006 ***	-0.004 ***	
Sum of ICD9 Codes	-0.011 ***	-0.013 **		-0.011 ***	-0.013 **		-0.011 ***	-0.013 **	
Ethnicity: Black	0.081 ***	0.035 **		0.081 ***	0.035 **		0.081 ***	0.035 **	
Ethnicity: Asian	0.033 **	0.036		0.034 **	0.036		0.033 **	0.036	
Ethnicity: AIAN	0.011	0.106		0.011	0.105		0.010	0.105	
Ethnicity: Hispanic	0.010	0.002		0.010	0.002		0.010	0.002	
Ethnicity: Mixed	0.039 **	-0.010		0.039 **	-0.011		0.039 **	-0.011	
Nurse Gender	-0.016	-0.042		-0.012	-0.046		-0.012	-0.046	
Nurse Age	0.002	0.005 **		0.002	0.005 **		0.001	0.005 **	
Nurse Experience	0.002	0.004		0.002	0.004		0.002	0.004	
Pain Score	-0.001 **	-0.006 ***		-0.004 ***	-0.007 ***		-0.004 ***	-0.007 ***	
Heart Rate (HR)	-0.005 ***	-0.004 ***		-0.005 ***	-0.004 ***		-0.005 ***	-0.004 ***	
Respiratory Rate (RR)	-0.040 ***	-0.040 ***		-0.040 ***	-0.040 ***		-0.044 ***	-0.039 ***	
Nurse Gender * Pain Score	-0.008 ***	-0.004							
Nurse Gender * HR				0.0004	0.0003				
Nurse Gender * RR							0.015 ***	-0.002	

Note. Nurse gender was effect coded with male nurse = -0.5, female nurse = +0.5. Ethnicity variables were dummy coded with 0 = White, 1 = Ethnic group. Pain score, patient age, nurse experience and age, heart and respiratory rate, and sum of ICD9 codes were centered at their respective mean. Estimates shown are unstandardized regression weights that account for the different repeated measures, and their sign (+ or -) indicates whether increasing values on the predictor are associated with an increase (+) or a decrease (-) in ESI level, controlling for the other predictors in the table. For example, for each additional year of experience the nurse has, we expect an increase of .002 in ESI level, holding all the other predictors constant. The intercept is the predicted ESI level, averaging across male and female nurses, for White patients with an average score on the predictors included in the table.

* $p < .05$;

** $p < .01$;

.100 > *p*

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