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Review Article

# Effects of Healthcare Providers Overtime Duties and Patient Outcomes

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## Abstract

Most hospital staff nurses' work schedules extend beyond the typical 9:00 a.m. to 5:00 p.m., Monday through Friday workday, to provide continuous nursing care to patients. Simultaneously, most hospitals in the United Counties exclusively use 12-hour shifts. Thus, staff nurses who work overtime may work more than 12 hours within 24 hours and return to work quickly without sufficient rest and sleep. Nurses' fatigue may continue the following work regardless of regular or overtime shifts. Working overtime among nurses is a prevalent practice used to control chronic understaffing and a standard method used to handle normal patient census variations. According to the 2004 National Sample Survey of Registered Nurses (NSSRN), more than 40% of Kenya registered community health nurses (KRCHN) worked more than 40 hours per week [21]. According to the ministry of health, fifty-four percent of the respondents to the 2018 NSSRN worked more than 39 hours per week in their principal nursing position (2010). The purpose of this study was two-fold. The first step was to examine the relationship between mandatory nurse overtime regulations and nurse injuries and adverse patient events. The second step was to assess the mediating effect of nurse overtime on the relationship between the regulations and outcomes after controlling for other nurse work characteristics. A cross-sectional design was used, incorporating data from staff RNs working in hospitals in two counties (Kakamega & Bungoma). A sample size above 250 is suggested by Cohen's guidelines [13]. SPSS version 22.0 and Stata version 10 were used for the data analysis. Univariate, descriptive statistical analyses were conducted to examine the sample characteristics; 15.6% of RNs worked mandatory overtime (either paid or unpaid) while 34.1% worked voluntary overtime (either paid or unpaid) in a typical week. In the current study, the associations between mandatory overtime regulations and nurse and patient outcomes among a sample of 173 nurses in Kakamega and Bungoma were examined. Findings indicated that mandatory nurse overtime regulation did not have any association with nurse injuries. On the other hand, there were statistically significant associations found between the regulations and adverse patient events. The findings of this study should be viewed with the following limitations in mind. Even though the sample was selected randomly to represent the population in both Counties, and the Dillman Tailored Design Method with three survey mailings and reminder postcards was used in an attempt to increase the response rate and to recruit a sufficient sample to ensure the statistical power, the final response rate was 29.8% (226 RNs). Given this response rate, it is impossible to generalize the study findings due to the potential for self-selection bias among respondents. This study did not find any relationship between mandatory overtime regulations and nurses' overtime hours. As a result, although there were significant relationships between the regulation and adverse patient events, the regulations did not impact patient outcomes. Mandatory overtime regulations were not related to nursing injuries.

**Keywords:** Nurses, Overtime, Registered Nurses, Kenya registered community health nurses (KRCHN).



## INTRODUCTION

Nurses' low quality of sleep and fatigue are associated with working long hours, their quick return to work, and shift work [1]. Sleep deprivation from working overtime often results in fatigue associated with difficulties in neurobehavioral functioning, such as reduced or impaired vigilance, reaction time, and decision-making ability [2]. Previous research has demonstrated that long work hours have adversely affected nurse and patient outcomes. Excessive overtime use can increase nurses' needlestick injuries and musculoskeletal problems [3-5]. Working mandatory or unplanned overtime was also associated with the occurrence of work-related injuries and work-related illnesses [6]. The risk of making medical errors

was three times higher when RNs worked shifts lasting 12.5 hours or more [7]. The most recent studies found long work hours during nurses' typical work schedule for the past six months were significantly related to patient mortality in the hospitals they worked after controlling for staffing levels and hospital characteristics [8]. Working more than 40 hours per week was related to nurse's perception regarding the occurrence of medication errors, falls with injuries, and nosocomial infections [9]. The underlining mechanism of nurse overtime to nurse injuries and adverse patient events is that when nurses work overtime or long hours, it contributes to nurses' fatigue and sleep, so their alertness and vigilance are impaired in both their regular shift and overtime shift. It influences the patient quality of care that fatigued nurses deliver. Previous studies show that intense evidence fatigue associated with long work hours among nurses is related to adverse events and errors in both patients and nurses.

To minimize the use of nurse overtime and decrease non-scheduled work hours, since the year 2000, more Counties have regulated the use of mandatory nurse overtime. As of 2011, 16 Counties have placed restrictions on the use of mandatory overtime worked by nurses (American Nurses Association [ANA], [10]. Mandatory overtime laws regulate either mandatory nurse overtime or total work hours. To ban mandatory nurse overtime, state law allows employees to refuse the request of overtime by health care facilities such as working more than their regularly scheduled hours, except during a health care disaster, which requires an increased need for health care personnel unexpectedly. To limit total work hours, regulations limit the number of hours worked by nurses in a specific period (e.g., not allowing to work more than 12 hours a day) [10]. The ultimate goal of implementing mandatory overtime regulations is to provide better working conditions for nurses and improve the quality of patient care [11].

The impact of mandatory nurse overtime regulations on nurse and patient outcomes has not been researched previously. To determine the relationship between the mandatory overtime regulations and nurse and patient outcomes, nurse overtime can be used as a mediator in that relationship. As mentioned earlier, the regulations utilize two ways to control nurse overtime; either banning mandatory overtime or limiting the total number of hours worked. When regulations limit the total number of hours nurses are allowed to work, we would expect a decrease in the total number of hours worked. Likewise, when regulations ban mandatory overtime, mandatory overtime hours should decrease or become zero hours. However, regulations do not directly limit the number of hours a nurse may voluntarily work overtime. Therefore, health care facilities may rely upon voluntary overtime to handle fluctuations in the patient census. Also, staff nurses could volunteer to work overtime because of monetary rewards or other non-monetary reasons [12]. All of these research questions have not been examined yet. There is limited understanding of whether or not mandatory overtime regulations for nurses effectively prevent mandatory nurse overtime and long work hours and advocate nurses' well-being and provide a better quality of patient health care. Whether the outcomes for nurses and patient quality indicators are improved when the regulations are implemented is vital to understand the impact of regulation on this issue.

**Purpose of the Study**

The purpose of this study was two-fold. The first step was to examine the relationship between mandatory nurse overtime regulations and nurse injuries and adverse patient events. The second step was to assess nurse overtime's mediating effect on the relationship between the regulations and outcomes after controlling for other nurse work characteristics.

**Sample**

A cross-sectional design was used, incorporating data from staff RNs working in hospitals in two counties (Kakamega & Bungoma). These two counties were chosen because the contact information for RNs licensed in these two Counties was available to researchers, and the rural work settings of both Counties were similar. A sample size above 250 is suggested by Cohen's guidelines [13]. To recruit the sample above 250, 500 RNs were randomly selected from each county utilizing the licensure lists provided by the County Board of Nursing and invited to participate. Using Dillman Tailored Design Method [14], three survey mails and reminders were sent between October 2019 and January 2011. Out of 1,000 RNs in the two Counties, 58 RNs (44 for KK and 14 for BG) had invalid addresses, 28 RNs (16 for KK and 12 for BG) declined to respond, and one nurse in Kakamega died. Six hundred ten RNs (291 for KK and 319 for BG) never returned the survey. While 226 RNs (107 for KK and 119 for BG) returned usable questionnaires and were eligible to participate in the study, 37 RNs (22 for KK and 15 for BG) did not work at a hospital, 26 RNs (17 for KK and 9 for BG) were not staff nurses, and 14 RNs (3 for KK and 11 for BG) worked outside of Kakamega or Bungoma. Using each categorization for eligibility, the ineligible cases for the unknown eligibility for those 610 RNs were estimated and applied to calculate the final response rates, yielding 29.8% of the response rate (29.1% for KK and 30.4% for BG). The author can provide detailed tables for the response rate calculation. All of the survey materials were sent directly to RNs, instead of sending through their workplace (e.g., hospitals). Therefore, this study's information is based on nurses' perceptions of their work schedules and working conditions. This study's data structure is not multi-level (e.g., nurses, nursing units, and hospitals), rather individual staff nurse data.

For the analysis, RNs who responded to less than 15% of the survey was excluded (7 RNs) because these responses resulted to missing study variables. The analytic sample consisted of 219 RNs. After considering those responses that were missing in control variables, the final analytic sample was 173 RNs. This research study was approved by the Masinde Muliro University of Science and Technology Institutional Review Board.

**Measures**

Nurse injuries. In the past month, self-reported nurse injuries were defined as needlesticks, strains, or sprains, including back injury, cuts or lacerations, bruises or contusions, or verbal abuse from co-workers or patients in their current job. These injuries may happen in either RNs' regular work schedule or overtime hours. Because nurse overtime may impact nurses' fatigue, nurse injuries in the last month were included to minimize the chance nurses would experience an unusual or atypical experience. RNs were allowed to answer for multiple categories if they experienced those types of injuries. Dichotomous variables (yes/no) were given as a choice for each nurse injury variable and a choice if nurses experienced any type of injury.

Adverse patient events. Similar to nurse injuries, a history of adverse patient events was defined as a nurse self-reported adverse patient event, whether a patient experienced any of the following adverse events: medication errors, patient falls, pressure ulcers, nosocomial infection, or failure to rescue in their nursing unit during the patient's hospital stay. The questionnaire did not ask nurses specifically whether these adverse events happened during their overtime period; instead, it asked nurses' perceptions regarding the best representation of a patient's experiences of each injury during both regular work hours and overtime hours. RNs were allowed to answer multiple categories if they perceived the previously mentioned patient adverse events had occurred. A dichotomous variable (yes/no) was given as a choice for each patient adverse event variable and indicated if nurses perceived any type of adverse event experienced by a patient.

Presence of mandatory nurse overtime regulations. In Bungoma, according to the Nurse Overtime and Patient Safety Act, a hospital is prohibited from mandating a nurse to accept an overtime assignment [15]. The law Counties: "No nurse shall work more than 16 hours within 24 hours and any shift of 12 or more hours requires at least 8 consecutive hours off before returning to work" [16]. Bungoma passed mandatory overtime protections in 2004 and added an amendment in 2007 outlining the maximum hours a nurse may be required to work. This regulation has been implemented for the last six years in Bungoma.

On the other hand, a 2011 check of regulations found that Kakamega did not have any mandatory overtime regulations in place. Using the hospital address nurses reported for their principal position, a dummy variable (yes/no) was used to capture the presence of the County regulation in the nurse's principal working position. One nurse did not report the address of the hospital where she worked. Based on the home address, the commute and time's possible distance to the nurse's working place were estimated to decide whether or not this hospital was located in Bungoma. It was imputed to be Bungoma.

Nurse overtime. To capture nurses' typical work schedule, RNs were queried the number of hours they worked mandatory overtime (paid/unpaid), voluntary overtime (paid/unpaid), and on-call (paid/unpaid) in a typical week at their principal position. For the on-call hours, nurses answered if they worked on-call hours, rather than if they were requested to work on-call. In another study, nurses were also to consider their typical work schedule for the past six months on average to measure unusual or atypical work experience [2]. In the current study**,** the nurse overtime variable also measured nurses' typical overtime hours during a week to avoid measuring an atypical overtime experience. A dichotomous variable (yes/no) was provided as a choice for each overtime variable used in this study. Four nurses did not answer how many hours they worked overtime for one category of overtime (one for mandatory overtime unpaid, one for voluntary overtime paid, two for on-call unpaid). Using the information of their scheduled work hours, work hours worked, and other overtime hours, the missing overtime hours for those nurses were imputed to be zero.

Total work hours. The total number of hours worked was measured by the number of total hours nurses worked (rather than scheduled) in their principal nursing position [2, 8]. To find the percentage of RNs who worked more than their regular work hours, a dichotomous variable, whether or not the total number of hours worked was more than 40 hours a week, was used.

Work settings. Work settings included the type of hospitals (academic, teaching, and non-teaching), and the type of work units (critical care, medical/surgical, and others). Workload included the number of patients' nurses cared for in the most recent work shift (1-6, 7-10, and 11-32 patients), quantitative workload, which was measured using a scale with four questions [17]. Cronbach's alpha score for the quantitative workload was 0.86. The frequency of patient census fluctuation in the unit (frequent/rarely) and chronic nursing shortages in the unit (yes/no) were used to measure the workload level. Nurse educational levels referred to whether or not a nurse received a bachelor's degree.

## DATA ANALYSIS

SPSS version 25.0 and Stata version 10 were used for the data analysis. Univariate, descriptive statistical analyses were conducted to examine the sample characteristics (see Table 1). Logit models were used to examine the first step, which is the relationship between the mandatory overtime regulations and the likelihood of experiencing each nurse injury variable, and any nurse injuries were examined in the models (see Table 2). Also, the likelihood of experiencing each adverse patient event and any adverse patient events were examined in the models (see Table 3). To examine the second step, the mediating effects of nurse overtime, the relationship between the regulation and the likelihood of working any overtime or working more than 40 hours per week was examined in the models (see Table 4). Each model used a sample of non-miss-

**Table-1: Summary Statistics of Study Variables**

| Variables | N=173 | |
|---|---|---|
| | n | % |
| **Demographics** | | |
| Mean Age Years (SD) | 44.3 (10.9) | |
| Age years <30 | 22 | 12.7 |
| 30-39 | 37 | 21.4 |
| 40-49 | 44 | 25.4 |
| 50-59 | 54 | 31.2 |
| ≥60 | 9 | 5.2 |
| Missing | 7 | 4.0 |
| Gender | | |
| Female | 155 | 89.6 |
| Male | 17 | 9.8 |
| Missing | 1 | 0.6 |
| Race/Ethnicity | | |
| Non-Indigenous community | 158 | 91.3 |
| Education | | |
| Without a bachelor's degree | 95 | 54.9 |
| With a bachelor's degree or higher | 78 | 45.1 |
| **Mandatory Nurse Overtime Regulations (yes)** | 84 | 48.6 |
| **Work Settings** | | |
| Type of Hospital | | |
| Academic | 41 | 23.7 |
| Teaching | 60 | 34.7 |
| Non-teaching | 72 | 41.6 |
| Type of Work Unit | | |
| Critical care | 64 | 37.0 |
| Medical-Surgical units | 72 | 41.6 |
| Others | 37 | 21.4 |

**Table-1: Summary Statistics of Study Variables (continued)**

| Variables | N=173 | |
|---|---|---|
| | n | % |
| **Workload** | | |
| Number of Patients Cared for | | |
| 1-6 | 125 | 72.3 |
| 7-10 | 26 | 15.0 |
| 11-32 | 22 | 12.7 |
| Mean of total score for quantitative workload (SD) | 17.0 (4.1) | |
| Patient Census Fluctuation | | |
| Frequently | 147 | 85.0 |
| Rarely | 26 | 15.0 |
| Chronic nursing shortages (yes) | 90 | 52.0 |
| **Nurse Overtime** | | |
| Mandatory overtime (paid and unpaid) | 27 | 15.6 |
| Voluntary overtime (paid and unpaid) | 59 | 34.1 |
| On-call (paid and unpaid) | 56 | 32.4 |
| All types of overtime | 104 | 60.1 |
| **Total Work Hours per Week** | | |
| Nurses working ≤ 40 hours per week | 146 | |
| 84.4<br>Nurses working > 40 hours per week 15.6 | 27 | |
| **Nurse Injuries in a Unit During the Last Month** | | |
| Needlesticks | | |
| Yes | 23 | 13.3 |
| No | 150 | 86.7 |
| Strains or Sprains | | |
| Yes | 64 | 37.0 |
| No | 108 | 62.4 |
| Cuts or Lacerations | | |
| Yes | 27 | 15.6 |
| No | 146 | 84.4 |
| Bruises or Contusions | | |
| Yes | 86 | 49.7 |
| No | 87 | 50.3 |
| Verbal Abuse | | |
| Yes | 98 | 56.6 |
| No | 74 | 42.8 |

Missing totals, the numbers of nurses who answered each question, rather than the total sample of 173. As a result, the respondents' total number varied from model to model, as presented in each table.

## RESULTS

The means, standard deviations, and percentages for the study variables are presented in Table 1. Parameter estimates for each model are provided in Tables 2 to 4.

From our sample, 15.6% of RNs worked mandatory overtime (either paid or unpaid) while 34.1% worked voluntary overtime (either paid or unpaid) in a typical week. About 32% of RNs worked on-call hours (either paid or unpaid). When we consider all overtime types, 60.1% of RNs worked at least one type of overtime among mandatory, voluntary, and on-call. About 16% of nurses worked more than 40 hours in a typical week. Among nurse injuries, verbal abuse (56.6%) and bruises or contusions (49.7%) are the two most frequently experienced nurse injuries. In total, 79.2% of nurses experienced one of these injuries during the past month. Regarding adverse patient events, medication errors (44.5%) and patient falls (38.2%) are the most frequently reported adverse patient events by nurses. Sixty-one percent of nurses perceived that patients in their unit experienced one of these adverse events during their hospital stay.

Table 2 presents the association between mandatory overtime regulations and the likelihood of reporting nurse injuries using a logit model. After controlling for work settings, workload, and nurse educational level, the mandatory nurse overtime regulation did not have any relationship with nurse injuries. The results indicate mandatory working overtime and on-call increased the odds of nurse injuries. Verbal abuse was significantly more likely to be reported for nurses who worked mandatory overtime (odds ratio.

**Table-1: (continued) Summary Statistics of Study Variables**

| **Variables** | **N=173** | |
|---|---|---|
| | **n** | **%** |
| Any Nurse Injuries | | |
| Yes | 137 | 79.2 |
| No | 34 | 19.7 |
| Missing | 2 | 1.2 |
| **Adverse Patient Events in a Unit During the Patient Hospital Stay** | | |
| Medication Errors | | |
| Yes | 77 | 44.5 |
| No | 88 | 50.9 |
| Missing | 8 | 4.6 |
| Patient Falls | | |
| Yes | 66 | 38.2 |
| No | 101 | 58.4 |
| Missing | 6 | 3.5 |
| Pressure Ulcers | | |
| Yes | 46 | 26.6 |
| No | 122 | 70.5 |
| Missing | 5 | 2.9 |
| Nosocomial Infections | | |
| Yes | 60 | 34.7 |
| No | 104 | 60.1 |
| Missing | 9 | 5.2 |
| Failure to Rescue | | |
| Yes | 19 | 11.0 |
| No | 146 | 84.4 |
| Missing | 8 | 4.6 |
| Any Patient Adverse Events | | |
| Yes | 106 | 61.3 |
| No | 53 | 30.6 |
| Missing | 14 | 8.1 |

NOTE: SD = standard deviation

**Table-2: Odds of Nurse Injuries by Nurse Overtime Regulations and Nurse Overtime**

| | **Needlesticks** | **Strains or Sprains** | **Cuts or Lacerations** | **Bruises or Contusions** | **Verbal Abuse** | **Any Nurse Injuries** |
|---|---|---|---|---|---|---|
| Nurse overtime regulations (Ref: w/o regulation) | 2.10 (0.72-6.07) | 1.42 (0.67-2.99) | 2.07 (0.74-5.77) | 1.26 (0.59-2.70) | 1.86 (0.84-4.13) | 2.00 (0.78-5.17) |
| Nurse Overtime (Ref: w/o overtime) | | | | | | |
| Mandatory overtime (paid and unpaid) | 1.95 (0.55-6.96) | 1.62 (0.62-4.19) | 1.90 (0.59-6.10) | 1.08 (0.43-2.70) | 4.45** (1.51-13.06) | 2.06 (0.59-7.12) |
| Voluntary overtime (paid and unpaid) | 1.37 (0.49-3.84) | 1.89 (0.91-3.93) | 1.30 (0.52-3.23) | 0.98 (0.43-2.26) | 1.91 (0.85-4.28) | 1.43 (0.47-4.38) |
| On-call (paid and unpaid) | 0.82 (0.29-2.35) | 1.14 (0.54-2.38) | 0.92 (0.34-2.49) | 1.58 (0.71-3.52) | 1.16 (0.53-2.56) | 3.93** (1.47-10.50) |
| Total work hours (Ref: Nurses working ≤ 40 hours per week) | 1.71 (0.56-5.22) | 0.76 (0.28-2.11) | 1.70 (0.48-6.02) | 1.37 (0.49-3.87) | 0.57 (0.19-1.75) | 1.46 (0.37-5.75) |
| N | 173 | 172 | 173 | 173 | 172 | 171 |

NOTE: **p<0.01 is in boldface. Odds ratios (95% confidence interval) were presented. Work settings, workload, and nurse educational level controlled.

**Table-3: Odds of Adverse Patient Events by Nurse Overtime Regulations and Nurse Overtime**

| | **Medication Errors** | **Patient Falls** | **Pressure Ulcers** | **Nosocomial Infection** | **Failure to Rescue** | **Any Adverse Patient Events** |
|---|---|---|---|---|---|---|
| Nurse overtime regulations (Ref: w/o regulation) | 1.57 (0.73-3.38) | **2.66* (1.09-6.50)** | **4.32** (1.70-11.00)** | **4.91** (1.99-12.12)** | 2.45 (0.63-9.51) | 1.91 (0.80-4.55) |
| Nurse Overtime (Ref: w/o overtime) | | | | | | |
| Mandatory overtime (paid and unpaid) | 0.81 (0.32-2.04) | 1.10 (0.34-3.60) | 1.84 (0.56-6.05) | 2.05 (0.72-5.81) | 0.94 (0.20-4.31) | 1.40 (0.41-4.78) |
| Voluntary overtime (paid and unpaid) | 0.90 (0.41-1.98) | **3.36** (1.35-8.34)** | **3.50** (1.42-8.66)** | 1.61 (0.67-3.90) | 2.01 (0.60-6.75) | 1.17 (0.47-2.91) |
| On-call (paid and unpaid) | 0.82 (0.38-1.76) | 0.74 (0.31-1.80) | 0.42 (0.17-1.03) | **0.24** (0.10-0.57)** | 1.10 (0.35-3.44) | 0.73 (0.32-1.68) |
| Total work hours (Ref: Nurses working ≤ 40 hours per week) | **3.71* (1.16-11.84)** | 1.22 (0.40-3.69) | **0.23* (0.07-0.79)** | **3.39* (1.04-11.03)** | 1.96 (0.48-7.89) | **14.36* (1.20-171.9)** |
| N | 165 | 167 | 168 | 164 | 165 | 159 |

NOTE: *p<0.05 and **p<0.01 are in boldface. Odds ratios (95% of confidence internal) presented. Work settings, workload, and nurse educational level were controlled.

**Table-4: Odds of Nurse Overtime and Total Work Hours >40 by Nurse Overtime Regulations and Nurse Overtime**

| | **Mandatory overtime (paid and unpaid)** | **Voluntary overtime (paid and unpaid)** | **On-Call (paid and unpaid)** | **Total Work Hours >40 Hours per Week** |
|---|---|---|---|---|
| Nurse overtime regulations (Ref: w/o regulation) | 0.55 (0.21-1.44) | 0.74 (0.32-1.71) | 1.73 (0.81-3.71) | 1.22 (0.33-4.49) |
| Nurse Overtime (Ref: w/o overtime) | | | | |
| Mandatory overtime (paid and unpaid) | - | 0.73 (0.19-2.91) | **2.68* (1.02-7.03)** | **7.06** (1.84-27.10)** |
| Voluntary overtime (paid and unpaid) | 0.88 (0.24-3.23) | - | 0.89 (0.37-2.20) | **16.70** (4.65-60.02)** |
| On-call (paid and unpaid) | **2.81* (1.07-7.39)** | 0.94 (0.37-2.43) | - | 1.37 (0.41-4.55) |
| Total work hours (Ref: Nurses working ≤ 40 hours per week) | **5.51* (1.50-20.28)** | **14.10** (4.50-44.20)** | 1.28 (0.42-3.93) | - |
| N | 173 | 173 | 173 | 173 |

NOTE: *p<0.05 and **p<0.01 are in boldface. Odds ratios (95% of confidence interval) were presented. Work settings, workload, and nurse educational levels controlled.

40 hours per week does not mediate the association between regulation and nurse injuries and adverse patient events.

## DISCUSSION

In the current study, the associations between mandatory overtime regulations and nurse and patient outcomes among a sample of 173 nurses in Kakamega and Bungoma were examined. Findings indicated that mandatory nurse overtime regulation did not have any association with nurse injuries. On the other hand, there were statistically significant associations found between the regulations and adverse patient events. However, these associations should be interpreted with caution because the regulations were not related to nursing overtime or long work hours. In other words, nurses overtime did not mediate the association between the regulations and patient adverse events. Theoretically, if the regulations do not associate with nurse overtime, the association between the regulations and patient adverse events cannot be explained.

For County mandatory overtime regulations to affect patient outcomes there should be an association between the regulations and reduced nurse overtime hours. Therefore, the association between the regulations and patient adverse events may present unmeasured County-level differences, which may be related to adverse patient events. Thus, this study's results did not find an impact of County mandatory overtime regulations on patient outcomes. In a post-hoc analysis, only 36% of the Bungoma nurses in the study knew mandatory nurse overtime is regulated by County law, even though the regulations were in force for the last 6 years. Although given a random sample with a lower response rate, it is impossible to generalize the whole county's study result. This could indicate that the presence of County mandatory overtime regulations was not disseminated properly in that county. This finding may also indicate the regulations' mere presence does not guarantee the implementation of those regulations as intended. Thereby there is no influence to reduce nurse overtime and long work hours.

The study findings regarding the relationship between working overtime and nurses' perceptions regarding their injuries are consistent with previous studies. Gershon et al. [18] found an association between mandatory overtime and percutaneous injuries (needlestick) among home health care RNs. Besides, de Castro and colleagues [6] also found that working mandatory or unplanned overtime was associated with work-related injuries and work-related illnesses. In this study, the association between mandatory overtime and verbal abuse was significant after controlling for other overtime and work hour variables and work settings, workload, and nurse educational level. On-call hours were also significantly related to reporting any nurse injuries. Interestingly, voluntary overtime and working more than 40 hours per week did not associate with nurse injuries. This might suggest the characteristics of overtime (mandatory overtime and on-call) other than long work hours might hurt nurses' overall health. It is also possible units that require nurses to work mandatory overtime could have different working conditions and cultures, which might also contribute to nurse injuries and illness, such as the verbal abuse incidents in this study. Future studies should examine the impact of long work hours on nurse injuries and the characteristics of overtime and their relationship with nurse injuries and illness.

In regards to the association between working overtime and adverse patient events, the findings of this study are likely consistent with previous studies; long work hours were significantly related to patient mortality after controlling for staffing levels and hospital characteristics [2], and working more than 40 hours per week was related to perceived medication errors, falls with injuries, and nosocomial infections by nurses [9]. In the current study, 7 of 9 significant relationships between overtime/work hours and adverse patient events were positive; working overtime or long hours was related to adverse events. However, two associations turned out to be the opposite of what was expected; working overtime or long hours was related to decreased adverse patient events. An adverse direction of this association could explain this because this study is a cross-sectional study. In other words, nurses may be working overtime or long hours to prevent adverse patient events; therefore, this effort may have resulted in fewer adverse patient events. Another consideration of this relationship is that the adverse patient events were not measured specifically during nurse overtime periods; rather, they are an average of nurses' perception regarding their patients' adverse events during patient hospital stays. As mentioned earlier, the reason for using this average measure of adverse patient events is that working overtime may influence nurses' fatigue, sleep, and their impairment of vigilance and alertness during their regular as well as overtime shifts. Thus, the relationships found in this study should be interpreted cautiously. Additionally, because the current analysis was cross-sectional, both overtime and adverse patient events data were based on one-time data collection in 2010. Therefore, it does not allow for assessment of the temporal sequence of overtime and patient outcomes. Thus, the significant association between overtime and adverse patient events should be interpreted as an association, not a causal relationship.

## LIMITATIONS

The findings of this study should be viewed with the following limitations in mind. Even though the sample was selected randomly to represent the population in both Counties, and the Dillman Tailored Design Method [14] with three survey mailings and reminder postcards was used in an attempt to increase the response rate and to recruit a sufficient sample to

ensure the statistical power, the final response rate was 29.8% (226 RNs). Given this response rate, it is impossible to generalize the study findings due to the potential for self-selection bias among respondents. One encouraging aspect of the study sample is that each county's response rate is quite similar. Although the response rate was low, and the sample was selected randomly, and the non-respondents were not systematic. Respondents may have been more concerned with working overtime when addressing nurse overtime issues or those who had more time to complete the survey. In that case, the study findings would be biased. Also, the sample collected from Kakamega and Bungoma may have different experiences than nurses from other Counties. Therefore, this study finding cannot be generalized to apply to the implementation of mandatory overtime regulations in other Counties. Besides, adverse patient events were measured by nurses' perceptions of the experience of adverse patient events in their nursing units. Using unit-level data, which can provide more detail about adverse patient events, would benefit future studies. The self-reporting method was used to collect data, and thus, it is subject to errors regarding recall and biases due to the possibility of a respondent's penchant for a socially desirable response. Future studies need to address the possibility of self-selection and self-reporting bias by finding a better means to increase response rates and the use of multiple data sources.

Another limitation relates to omitted variable bias. The link between overtime and nurse injuries may be explained because the decrease in nurses' sleep, with resulting fatigue, is caused by long work hours [1]. However, long work hours may not be the sole explanation for nurse fatigue. There might be other factors associated with nurse fatigue, such as working more than one job and a long commute. Since more than 90% of nurses are women [19], and many return home to care for spouses, children, and elderly relatives and have the added duty of housekeeping, fatigue may be compounded. Geiger-Brown and associates [1] found the occurrence of mandatory overtime and on-call duty more than once per month increased reports of inadequate sleep, even after controlling for home demands. Those factors were not included in this study, which may lead to bias. Similarly, adverse patient events are affected by patient acuity levels and comorbidities [20]. Those variables also were not included in the study, and they may have been a contributing factor in the occurrence of any adverse patient events. Therefore, future studies should include those covariates to control for other explanations for both nurse injuries and adverse patient events.

Additionally, the current study measured overall nurse overtime pattern and nurse and patient adverse events with such conceptualization; when nurses work overtime or long hours in a typical week, which means that nurse overtime is a routine work pattern, it affects nurses' fatigue, sleep, and impairment of their alertness and vigilance in both their normal work hours and extended work hours. Eventually, it affects quality of patient care. However, this study did not address whether nurse and patient adverse events more often occurred during an overtime shift than a regular shift. To examine this research question, logbooks can be used to collect information about work schedules and any errors or near errors for a certain period [7]. Further, the cross-sectional study design does not guarantee the causal relationship of the study findings because the study design did not account for the events' timing. Therefore, future studies also need to use the longitudinal study design to find the causal relationship between the regulation and outcomes.

## CONCLUSION

This study did not find any relationship between mandatory overtime regulations and nurses' overtime hours. As a result, although there were significant relationships between the regulation and adverse patient events, the regulations did not impact patient outcomes. Mandatory overtime regulations were not related to nursing injuries. This finding encourages further research in this area to evaluate County mandatory nurse overtime regulations. Although County policy has been in place for a considerable period, we found few nurses had knowledge about the policy from this study sample. Thus, future studies should examine the current status of the understanding of County mandatory nurse overtime regulations among staff nurses and hospital managers before evaluating the implementation of such regulations and their impact on nurse overtime and patient outcomes. At the same time, as this study found, we must be very cautious about the impact of working overtime and long work hours, which increases both nurse injuries and adverse patient events. When working conditions do not support nurses in providing quality patient care, nurses leave their positions, and nurses' sleep and fatigue have a greater impact on patient safety.

As more Counties regulate mandatory nurse overtime and long work hours, policymakers and advocators need to monitor whether the regulations have been properly implemented. Researchers need to provide a rigorous approach to evaluate the impact of such regulations on nurse overtime and nurse and patient outcomes. Importantly, nursing faculty need to understand health care policy changes that have a significant impact on nursing practice and patient care, and they should deliver this information to students. Students need to understand this policy is the right and responsibility of nurses for their well-being and their patient's safety. They need to adhere to these regulations proactively. Also, County governments, health care facilities, professional nursing organizations, nurse managers, and staff nurses all need to understand the impact of working overtime and long hours and the importance of both hospital and nurse

compliance with legislated overtime regulations to protect both nurse's patients safety.

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