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Prevalence of pressure ulcer in Iran's intensive care units: A systematic review and meta-analysis

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ABSTRACT

Background & Aim: Pressure ulcer (PU) is a costly, painful, and often a preventable problem with varying prevalence in different health centers. PU is associated with prolonged length of stay and mortality. This systematic review and meta-analysis aimed to estimate the prevalence of PU in Iran's intensive care units (ICUs).

Methods & Materials: In this research, 9 articles published in Persian and English were studied. National (Science Information Database (SID) and Magiran) and international databases (PubMed, Scopus, and Web of Science) were searched using the keywords of pressure ulcers, bedsore, pressure sore, decubitus ulcer, pressure injury, Iran, and all of the possible combinations without time limitations.

Results: The total prevalence of PU in Iran's ICUs was 19.59% (95% confidence interval [CI]: 13.15-25.97). The prevalence of PU in region 1 of the country (Alborz, Tehran, Qazvin, Mazandaran, Semnan, Golestan, and Gom) was 28.55% (95% CI: 12.27-44.84), and it was 10.31 (95% CI: 3.88-16.75) in other areas of the country. Meta-regression results showed a significant relationship between the prevalence of PU and the mean age of the patients (P=0.012) as well as the study sample size (P=0.043).

Conclusion: We found that the overall prevalence of PU in Iran's ICUs was relatively high. Considering the high prevalence of PU in Iranian ICUs, it seems necessary to investigate and implement effective interventions to control and reduce this problem.

Introduction

Pressure ulcer (PU) is defined as a localized lesion on the skin and/or its underlying tissue that often appears over a bony prominence due to pressure or pressure in combination with shear and/or friction forces (1). The severity of PUs varies from skin redness (stage 1), loss of skin surface or epidermis (stage 2), loss of fat, muscle, and bone (stages 3 and 4) (2). The main groups at risk of developing PUs are patients with spinal cord injuries, elderly patients, hospitalized patients, especially those undergoing orthopedic surgeries and patients admitted to intensive care units (ICUs) (3). Diabetes, smoking, malnutrition, vascular disease, spinal cord injury, prolonged immobility, sleeping on tight surfaces, moisture, and sensory disturbances can contribute to the prevalence of PU (4, 5). PU is an indicator of the patient's safety and quality of care that its prevalence varies in different health centers (6, 7). The occurrence of PU increases the workload of the nursing staff by up to 50% (8). The prevalence of PU in the ICU is higher than other wards ranging from 8% to 40% (9). The prevalence of PU varies from country to country. For instance, its prevalence is 4% in Denmark (10), 11.5% in Australia (11), and 49 % in Germany (12).

Despite international guidelines and extensive evidence on PU risk factors as well as preventive measures, PU still occurs

significantly, and its prevalence remains the same as in the last few decades (13). The prevalence of PU is associated with significant pain, patient's reduced autonomy, increased risk of infection and sepsis, the conduction of additional surgical procedures on the patient, long periods of hospital stay, and the imposition of more costs on the patient, his/her family, and health care system (14-16). Due to pain and physical constraints, sufferers experience negative psychological feelings decreasing their quality of life (17). People with PU often experience fear, isolation, and anxiety about wound healing (18).

In the year 2007, the Netherlands allocated more than 1% of health costs to the treatment of PU (19). Following cancer and cardiac disease, PU is the most expensive health care problem in all care settings (20). The estimated cost of PU management and treatment (stages 3and 4) is $ 70,000 to 150,000 for each patient, while the annual cost of PU treatment in the United States is estimated to be $ 9 to11 billion (21). In total, the cost of PU treatment is 2.5 times the cost of its prevention (22). The literature review showed that the prevalence of PU in ICU varies from 3.6% to 45.7% in Iran (23, 24). Awareness of the status of PU is the first step in planning for the reduction of PU prevalence in Iran's ICUs. Accurate estimation of the prevalence of PU in Iran's ICUs could be helpful in health care decisions to control this problem. This systematic review and meta-analysis was conducted to estimate the prevalence of PU in Iran's ICUs.

Methods

This systematic and meta-analytical review addressed the prevalence of PU in Iran's ICU based on Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement (25). The search was conducted during January 2019 at the library of Kurdistan University of Medical Sciences. Through Internet search and manual search in the library of Kurdistan University of Medical Sciences,

the related documents were collected. The articles were obtained from Iran's national databases, including Scientific Information Database (SID) and MagIran, and the international databases Web of Science (WoS), Scopus, and PubMed. The search was conducted using the keywords of pressure ulcers, bedsore, pressure sore, decubitus ulcer, pressure injury, and Iran. The references of the retrieved articles were also searched to identify additional related articles. The search strategy in PubMed database was as follows: ("Pressure Ulcers"[All Fields] OR "Bedsore"[All Fields] OR "Pressure Sore"[All Fields] OR "Decubitus Ulcer"[All Fields] OR "Pressure Injury"[All Fields]) AND ("Iran"[MeSH Terms] OR "Iran"[All Fields])

Initially, all articles which investigated the prevalence of PU in Iran were collected by two researchers independently. Then, the studies in whose titles there was "ICU" term were separated. Eligibility criteria to select the articles were as follows: being an observational study, be written in Persian or English, and having access to its full text. Non-related studies, interventional studies, duplicates, and studies on the incident of PU were excluded.

In order to reduce the risk of bias, search of articles, selection of studies, quality evaluation of each study methodology, and extraction of the data were done by two researchers independently. In case of discrepancy, the eligibility of an article was decided by consensus among all researchers. Data such as the first author's name, year of publication, place of study, total sample size, language, and the percentage of people with PU were extracted from the selected papers and then recorded on the data extraction form. The methodological quality of the articles was evaluated based on 10 items selected from Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) checklist (title and abstract, goals and hypotheses, research environment, inclusion criteria, sample size, statistical methods, descriptive data, interpretation of findings, research limitations, and research funding) (26).

If the item was addressed in the study, it was scored 1; otherwise, the score of 0 was considered. Accordingly, the articles were classified into three categories of weak (0-4), moderate (5 to 7), and good (8-10).

This research was based on a research proposal approved by the Kurdistan University of Medical Sciences (KUMS.REC.1397.287).

Considering point estimations and a 95% confidence interval (CI), the prevalence of PU was calculated based on the binomial distribution formula. The heterogeneity between the studies was investigated using Cochran's Q test and considering the significance level of less than 0.1 and the I2 index. Based on the I2 index, heterogeneities were classified into three classes, namely less than 25% (low heterogeneity), 25% to 75% (moderate heterogeneity), and more than 75% (high heterogeneity) (27). Due to the presence of heterogeneity (I2=95.7%) in the selected studies, the pooled prevalence was estimated using the random-effects model. To ensure the stability of the results, a sensitivity analysis was used by estimating the pooled effect when deleting a single study, sequentially. In this study, subgroup analyses and meta-regression analyses were used to study the potential factors of heterogeneity affecting the prevalence of PU.

Subgroup analysis was performed by country zoning and quality of articles (medium and robust). Given that out of nine selected studies, five were conducted in Region 1 (The provinces of Tehran, Qazvin, and Semnan), we subdivided the country regions into two categories (Region 1 and Other Regions) for the subgroup analysis. Univariate meta-regression analysis was used to examine the association between the prevalence of PU and mean age, year of publication, and the sample size of the selected studies. The funnel plot based on the Egger's regression test was used to determine the publication bias (28). Data analysis was performed by METAN command using the Stata software (version 11).

Results

A total of 106 articles were found by searching national (52 papers) and international databases (54 papers). In the identification and screening stages, 68 unrelated articles were excluded from the analysis, and the full texts of the remaining 38 articles were read. Out of 38 articles, 29 ones were excluded for various reasons, such as reporting the prevalence of PU in hospital general wards or reviewing previous meta-analyses. Finally, 9 papers in 10 groups underwent further analysis (Figure 1).
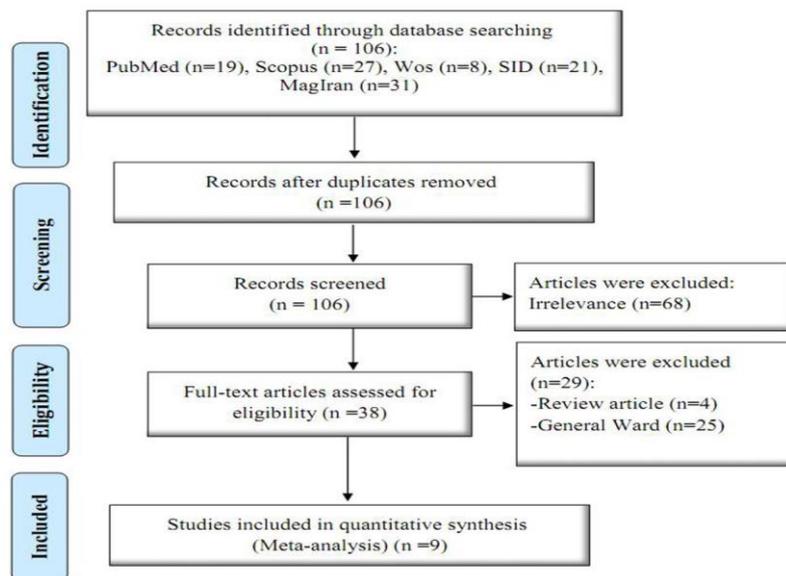
Figure 1. Flow diagram of the article screening and selection process

The total sample size was 2489 (on average, 277 participants in each study). The smallest and highest sample size was related to Rafiei's study (n= 70) (24) and Afkar's study (n=673) (23). Five studies were conducted in region 1 of Iran, and the rest were performed in other regions of the country.

One study was written in Farsi (23), and the rest of the studies were published in English. A review of the selected articles based on the checklist showed that four studies (in five groups) had high methodological quality, and the rest had moderate methodological quality studies (29-32) (Table 1).

Table 1. The characteristics of selected articles

First author	Year of publication	Sample size		Language	Mean age	Location	Prevalence (%)			Quality
		Total	M/F				Total	Male	Female	
Zarei (32)	2019	634	309/334	English	52.4	Tehran	8.9	–	–	**10**
Azimian (33)	2016	82	46/36	English	60.9	Qazvin	23.9	–	–	**7**
Shokati Ahmadabad (34)	2016	70	43/27	English	63.4	Qazvin	45.7	–	–	**7**
Rahimi Bashar (35)	2014	248	178/70	English	48.36	Hamadan	8.5	76.1	23.8	**6**
Afkar (23)	2014	673	254/419	Persian	45.35	Gilan	3.6	4.3	3.1	**6**
Nassaji (30)	2014	160	160/0	English	55.7	Semnan	38.8	–	–	**9**
Nassaji (30)	2014	192	192/0	English	48.8	Semnan	14.6	–	–	**9**
Valizade (31)	2012	249	155/94	Persian	49.43	Urmia	17.3	–	–	**8**
Iranmanesh (29)	2011	82	56/26	English	41.4	Kerman	13.4	–	–	**8**
Akbari Sari (36)	2014	90	–	English	–	Tehran	26.7	13.8	26.8	**7**

To investigate whether all articles investigated PU in Iran's ICUs were included in the study, publication bias was used. Results showed that publication bias was not significant (P=0.159)(Figure 2).
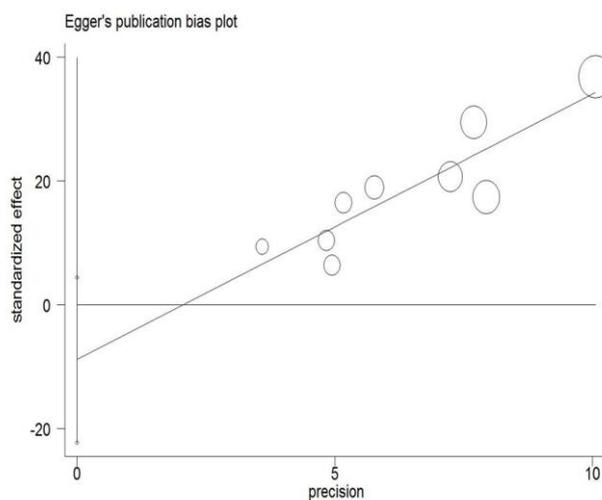
Figure 2. Publication bias; The size of the circles represents the sample size of the studies

The pooled prevalence of PU among patients admitted to Iran's ICUs was 19.57% (95% CI: 13.15- 25.97). Subgroup analysis of PU prevalence in patients admitted to ICUs based on country zoning showed that its prevalence of PU in region 1 (Tehran, Qazvin, and Semnan) was 28.55% (95% CI: 12.87-44.24), and it was 10.31% in other regions of the country (95% CI: 3.88-16.85). The results also showed that the prevalence of PU in high and moderate-quality articles was 18.2% (95% CI: 9.8-26.5) and 20.4% (95% CI: 10.2-30.6), respectively(Figure 3).
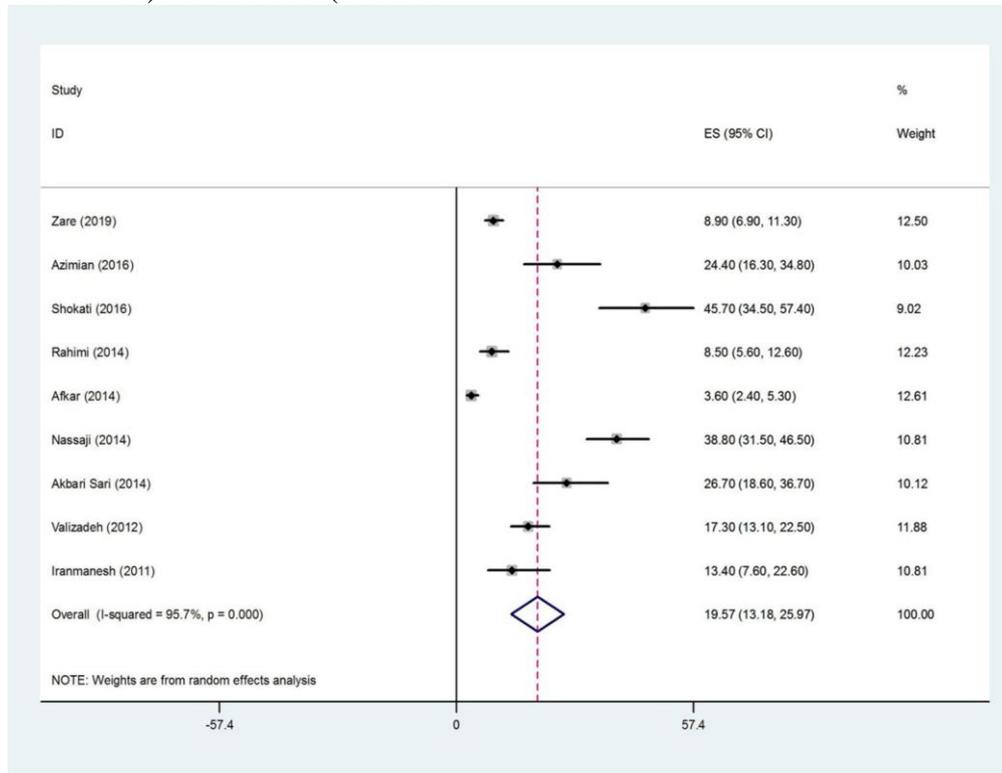
Figure 3. Prevalence of PU and its 95% confidence interval in patients admitted to ICU for the first author's name and year of research publication and based on the random-effects model. The midpoint of each line segment shows the prevalence of PU in each study, and diamond shape illustrates the prevalence of PU in all studies conducted in Iran.

Sensitivity analysis indicated that the omission of each study alone did not affect the overall prevalence of PU. Meta-regression analysis showed no relationship between the prevalence of PU in patients admitted to ICUs and the year of publication (p=0.770); in other words, the prevalence of PU in Iran's ICUs did not undergo significant change from 2001 and 2019. On the other hand, we found that the prevalence of PU in ICUs was significantly correlated with the mean age of the patients (p=0.012) and sample size of the study (p=0.043) (Figure 4).
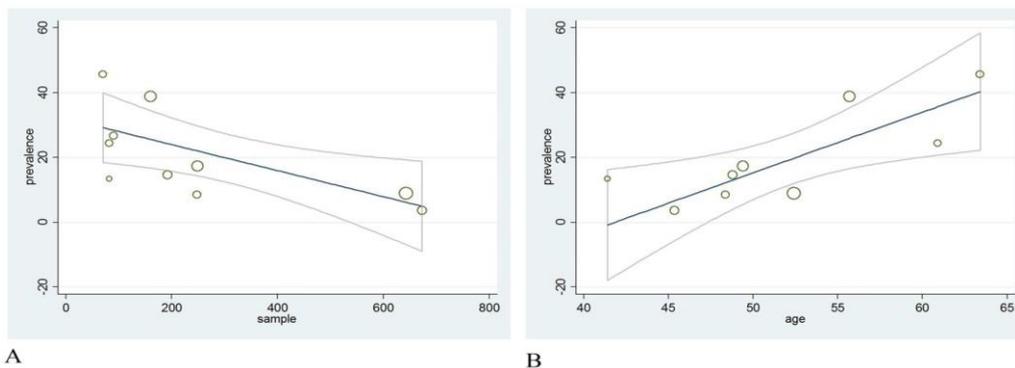
Figure 4. Meta-regression of the relationship between the prevalence of PU in patients admitted to ICUs and the year of study publication (A) and patients' mean age (B)

Discussion

This study aimed to estimate the prevalence of PU in Iran's ICUs. Our research showed that the prevalence of PU was 19.57% in this population. In Australia, Coyer et al., (2017) yielded that the prevalence of PU in ICUs and other wards were 11% and 3%, respectively, which is less than Iran (11). The results of various studies showed that the prevalence of PU in ICUs of Saudi Arabia and South Korea was 35.7% and 23.7%, respectively, which is more than what we found in this study (37, 38). Costa et al. (2015) revealed that the prevalence of PU in Brazil's ICUs was 52.9% (39). The high prevalence of PU in patients admitted to ICU is expected because they are often sedated, mechanically ventilated, and confined to bed (16). In the past, the development of PU in patients was attributed to inadequate nursing care. However, today, the number of professional nurses has risen dramatically and PUs remains a clinical problem. In the present study, we found that the prevalence of PU in region 1 (Tehran, Qazvin, and Semnan) was more than in other regions of the country. Region 1 of the county includes Tehran (the capital of Iran) and many other large industrial cities. The reasons for this finding can be due to more convenient access to health facilities, extensive use of tools for identifying patients at risk in the hospitals of these cities, which led to the identification and report of this problem. PU is also associated with increased mortality, as the results of a retrospective national-wide study on American patients admitted to ICU showed that the mortality rate was 1.8% for patients without PU, but 9.1% for patients with PU (40). This finding demonstrated that the prevalence of PU had a significant relationship with age. In fact, with increasing age, the prevalence of PU was also increased, which is consistent with the results of a study by Latifa et al. (2016) (41). The findings of another study by Serrano et al. (2017) also assured that the prevalence of PU increased with age (42). In Bours et al.'s study (2001), the prevalence of PU in Dutch patients admitted to ICUs was 58.7%, and the high age of patients along with the presence of infection in the patient, the length of stay in the hospital, and total Braden score were introduced as the most critical risk factors PU (43). Elderly patients, in addition to low physical strength and social dependence, have higher medical complexity and suffer from various comorbidities that make them more susceptible to PU than other patients.

One of the strengths of this study was the estimation of the prevalence of PU in patients admitted to ICUs in Iran for the first time, whose findings can be the basis for future research. This research also had several limitations. Previous studies aimed at investigating the prevalence of PU in Iran have not focused on a specific area, while the nature of the ICU and patients admitted there should be examined separately. Given that the selected studies were conducted only in several parts of Iran, the findings of this study should be cautiously generalized. Another limitation of this study was a short presentation of other studies' findings that made further analysis impossible.

Conclusion

The results of this meta-analysis showed that the overall prevalence of PU in Iran's ICUs was 19.55%. The findings of this study can contribute health policy-makers to understand better the prevalence of this problem in patients admitted to ICU. Given the high prevalence of PU in Iranian ICUs, it seems necessary to investigate and implement effective interventions to control and reduce this problem. PU is one of the most common, costly, and often predictable problems in ICUs, which significantly increases the workload of nurses as well as patients' mortality. Nurses' familiarization with the international guidelines for the prevention of PU and the identification of at-risk patients through screening tools can help reduce the prevalence of this problem. Currently, screening tools for identifying people at risk of PU, such as Norton, Braden, and Waterlow, are not commonly

used in general and critical care wards, while their application can mainly prevent the development of PU. Therefore, proper training to overcome this problem is suggested.

Acknowledgments

Conflict of Interest

The authors of this study declare no conflicts of interest.

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