



## Research article

## Level of nurses' knowledge on pressure ulcer prevention: A systematic review and meta-analysis study in Ethiopia

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## ABSTRACT

**Objective:** Pressure ulcers (PU) are injuries to the skin and underlying tissue because of prolonged pressure. It affects millions of people in the world. One of the major nursing roles is to prevent patients from developing PU. Inadequate knowledge of nurses' toward PU can have a significant effect on preventive care strategies. Therefore, the aim of this meta-analysis study was to assess the overall level of nurses' knowledge about the prevention of pressure ulcers.

**Methods:** A systemic review of primary research was undertaken and nurses' knowledge on pressure ulcer prevention was evaluated. All original cross-sectional studies conducted only in Ethiopia in the English language were included in this meta-analysis. After extraction, the data analysis was done using STATA version 11 statistical software. Based on heterogeneity between the studies, the data were analyzed using a random effects model.

**Results:** In this systematic review and meta-analysis, all the studies on nurses' knowledge on the prevention of PU were reviewed based on the PRISMA statement. The overall knowledge of nurses' on pressure ulcer prevention was 46.24 % (95 % CI: 26.63–65.85).

**Conclusion:** The overall knowledge of nurses' on pressure ulcer prevention was low in this meta-analysis study. Sustainable training about the prevention of PU is very important for all nurses.

## 1. Introduction

Pressure Ulcers (PU) are localized skin damages that occur when soft tissue is compressed between a bony prominence structure and external forces for an extended period of time. It can occur because of shear and friction. Its effect is worldwide, which affects millions of people and has variation in the magnitude and severity of damages to the skin, underlying tissue, and muscle. It remains a significant health problem that affects approximately 3 million adults [1, 2, 3, 4].

The tissues of the skin are destroyed, because of progressive exposure of external forces for a long period of time. It is a major threat to the health of clients by increased mortality rates, compromised quality of life, longer period of stay in hospital, high costs for patient care and body

image disturbance, a long period of time for the healing process and have a negative effect on patients' overall performance [5, 6, 7, 8, 9].

The most common predisposing factors for the occurrence of PU are immobility, sensory loss, impaired level of consciousness, and friction and shear [10, 11, 12, 13]. The treatment of PU is more expensive than the prevention of it and has been estimated that the cost of treating PU is 2.5 times higher than the cost of preventing it. The amount of annual cost for the treatment of PU in the United Kingdom is (\$1.4–2.1 billion), which consists up to 4 % of the annual National Health Service budget [14, 15, 16].

Providing of regular health education and sustainable training on the prevention of PU for the health care provider is considered as a determinant component of pressure ulcer prevention methods. Nurses are

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responsible to provide good nursing process to patients who are admitted in hospital. Qualities of care in a particular patient is maintained by the application of good nursing process and it prevents the incidence of PU. Knowledge and attitude of nurses have a significant effect on the type of nursing process and patient outcome intervention [17, 18, 19, 20].

The prevention of PU can be considered as intensive nursing. The frequent assessment and effective skin care prevent the development of PU. Proper application of the pressure ulcer risk assessment tool like the Braden scale can prevent the occurrence of the development of PU. Changing the patient's position every 2 h and the use of a pressure relieving mattress also reduces the development of PU [21, 22, 23, 24].

If the patient is developing PU, nurses can provide a wound healing process by change of dressing, continued wound assessment, and proper nutrition to maintain quality of care. Several studies showed that PU prevention remains a significant challenge for nurses and its incidence is considered an indicator of poor quality of care [25, 26, 27, 28, 29, 30].

Many studies that have been conducted to evaluate nurses' knowledge about pressure ulcer prevention, reported that only 23.5 % nurses had scored  $\geq 60$  % knowledge in Belgium [31], 73 % of Jordanian nurses had scored lower than the mean knowledge about pressure ulcer prevention [32], nurses had scored lower on pressure ulcer prevention knowledge than the average in Iran [33], 51.1 % which was less than the cutoff point (60 %) in Australia [34], 70.5 % which is a good level of knowledge in Greece [35], and Nepal revealed that only 59 % of nurses had adequate knowledge about pressure ulcer prevention [36].

Several studies have explored about the prevalence of PU among hospitalized patients across the globe and revealed that it was 22.9 % in Sweden [37], 18.2 % in Norway [38], 27 % in Italy [39], and 18.7 % in Brazil [40]. On the other hand, the prevalence of PU in Africa was 17.23 % in the Sub-Saharan Tertiary Centre [41], 3.22 % in South-west Nigeria [42], and 19.3 % in Tunisia [43]. Similarly, many studies were conducted in Ethiopia to determine the prevalence of PU, which showed 13.4 % in Wolaita Sodo University Teaching Hospital [44], 14.9 % in Dessie Referral Hospital [45], and 16.8 % in Felegehiwot referral hospital [46].

Pressure ulcer prevention is one of the major activities of nursing care quality, which is influenced by nurses' knowledge. Although, limited research was conducted to investigate the knowledge of nurses about the prevention of pressure ulcer in Ethiopia, there is no meta-analysis study to show the pooled results about the knowledge of nurses' on pressure ulcer prevention. Therefore, to address this gap, systematic review and meta-analysis were conducted with an aim to evaluate nurses' overall pooled knowledge on pressure ulcer prevention in Ethiopia.

## 2. Methods

### 2.1. Search strategy

A systemic review of primary research was undertaken and the level of nurses' knowledge on pressure ulcer prevention was determined based on their scores on the pressure ulcer knowledge assessment materials (questionnaire). In terms of language, only the articles published in English were included in the analysis. The search was conducted in electronic databases such as Google Scholar, Africa journal of online PubMed, and Scopus using the following MeSH and free-text terms: "pressure ulcer," "pressure injury," "decubitus ulcer," "Pressure Sore," "bed sore," "knowledge of nurses," and "Ethiopia." This search was carried out from September 20 to October 30, 2019.

### 2.2. Inclusion and exclusion criteria

All original research articles conducted only in Ethiopian settings that fulfill the following criteria were included in this meta-analysis. Those articles that were published only in English, conducted with cross-sectional studies, and having a quantitative research design were

selected. In our study, articles which have not been fully accessed at the time of our search process were excluded.

### 2.3. Data extraction

Data were extracted by four authors using a pre-piloted and standardized data extraction format prepared in a Microsoft excel worksheet. The data extraction sheet was piloted on 4 randomly selected papers and modified accordingly. This form includes the study characteristics, namely author/s name, year of publication, study area, study design, sample size, knowledge, and the quality score of each study were extracted from each selected article by four independent authors. Any disagreements at the time of data abstraction between authors were resolved by discussion and arrived consensus.

### 2.4. Statistical analysis

Information on the studies' characteristics such as study year, study region, study design, study hospitals, sample size, and percentage of nurses' knowledge about pressure ulcer prevention methods were extracted from each study using a Microsoft Excel spreadsheet template. After the data extraction analysis was done using STATA version 11 statistical software [47], results of the meta-analysis were reported as pooled knowledge of nurses about pressure ulcer prevention methods with 95 % confidence intervals (CIs) and p-values  $< 0.05$  were considered statistically significant. Heterogeneity across the studies were evaluated using  $I^2$  index and Cochran's Q test ( $I^2$  statistics below 25 % indicated low heterogeneity, between 25 % and 50 % moderate heterogeneity, and over 75 % high heterogeneity) [48]. Because the test statistic indicated significant heterogeneity among studies ( $I^2 > 75$  % and  $p < 0.05$ ), a random effects model was used to evaluate the level of nurses' knowledge about the prevention of PU with 95 % CI.

To decrease the random variations between the primary studies, a subgroup analysis by study hospitals and used questionnaires were conducted to determine the knowledge of nurses about pressure ulcer prevention methods across the different hospitals in the country. Funnel plot asymmetry, Egger's, and Begg-Mazumdar Rank correlation tests were used to check for publication bias. Although both the funnel plot and Egger's test are used to determine the publication bias, Egger's test is better to identify publication bias than the funnel plot. The funnel plot shows the subjective observation of asymmetry, whereas Egger's method detects the actual values of effect sizes and their precision. The limitation of this study while using Egger's test is that it is sensitive when the number of studies is less than 10; as a result, it may not detect the publication bias. Egger's test may also have low precision due to a small number of studies.

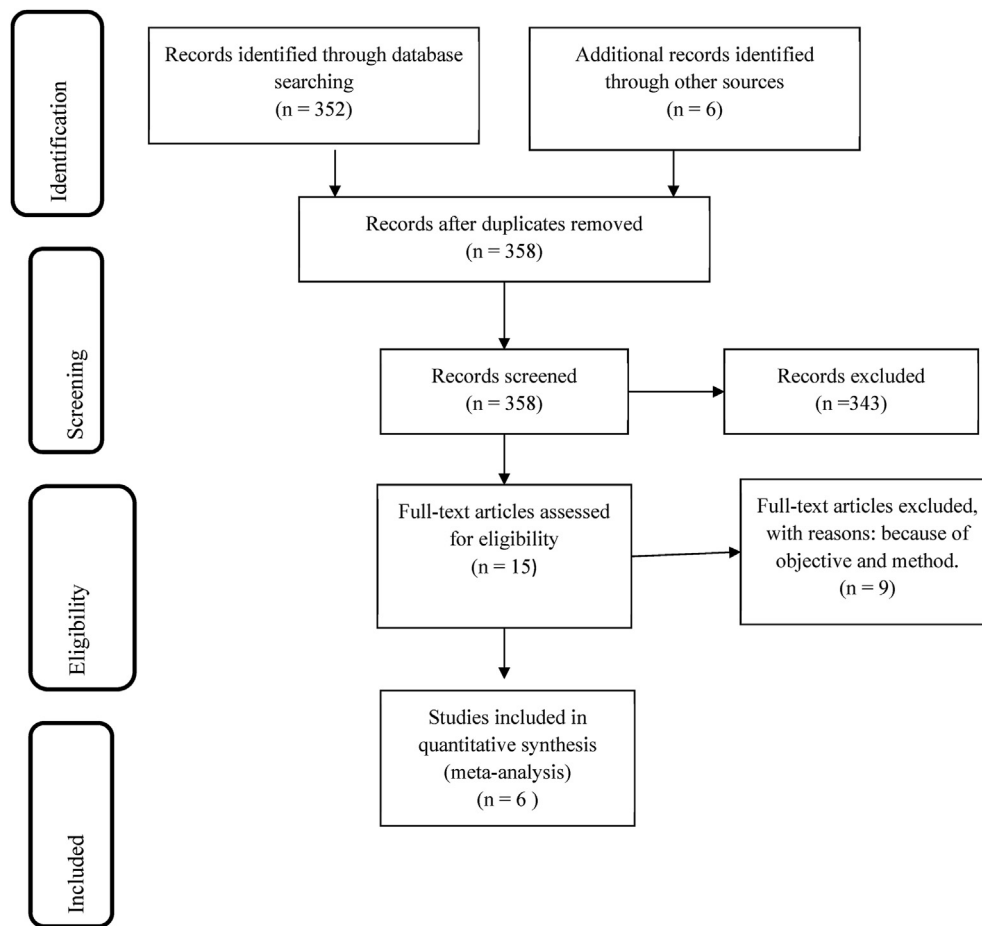
Two researchers independently carried out the main statistical analysis and results were crosschecked for consistency.

## 3. Result

This systematic review and meta-analysis study reviewed the level of nurses' knowledge on pressure ulcer prevention based on the PRISMA statement. In the initial search, 352 studies were identified, of which 346 were excluded based on the inclusion and exclusion criteria (Figure 1).

### 3.1. Characteristics of included studies

Six studies with a total sample of 1530 nurses were included in our study. All included studies in this meta-analysis used the cross-sectional study design to evaluate the knowledge of nurses. Overall distribution of studies based on region included in this review were one from the Amhara region [49], one from Southern Nations Nationalities and People's Region (SNNPR) [50], one from the Oromia region [51], two were from Addis Ababa [52, 53], and one from the Tigray region [54]. The highest and the lowest knowledge on pressure ulcer prevention scores



**Figure 1.** Flow chart shows a selection of studies for a systematic review and meta-analysis of the level of nurses' knowledge about the prevention of pressure ulcer.

were in Yitayih et al's study in Tigray and Ebi et al's study in the Oromia region among nurses, respectively [51, 54]. More details are reported in Table 1. All the studies used the self-administer questionnaire to assess the knowledge of nurses about pressure ulcer prevention methods. All of the studies reported high response rates (>90 %). The total score of nurses' about pressure ulcer prevention is presented in Figure 2. The overall percentage of total pressure ulcer prevention knowledge was 46.24 % (95 % CI: 26.63–65.85).

**3.2. Publication bias**

Both funnel plots of precision asymmetry and the Egger's test of the intercept were explored to identify the existence of publication bias in the included studies. Visual examination of the funnel plot showed an asymmetric distribution of studies (Figure 3). We also conducted the Egger's test of the intercept, which was 1.23 (95 % CI: 0.36–2.1)  $p < 0.05$ , this implies that there is publication bias. Additionally, we conducted sensitivity analysis, to further investigate the potential source of

heterogeneity observed in the level of knowledge about pressure ulcer prevention in Ethiopia. The result of sensitivity analyses using random effects model showed that there was a single study that affected the overall level of nurses' knowledge on pressure ulcer prevention. Among all six reviewed studies in the current analysis, the study conducted by Ebi et al's [51] had shown an impact on the overall finding (Figure 4).

**3.3. Pooled level of nurse's knowledge on the prevention of pressure ulcers in Ethiopia**

According to the current meta-analysis evidence, the pooled knowledge of nurses among pressure ulcer prevention in Ethiopia was 46.24 % (95 % CI: 26.63–65.85) (Figure 2). Using the random effects model, the statistically significant level of heterogeneity was observed ( $I^2 = 98.7 %$  and  $p < 0.001$ ). The existence of significant heterogeneity among the primary studies requires the need to conduct a subgroup analysis. As a result, to identify the sources of heterogeneity, we had conducted a subgroup analysis by using questionnaires (tools) and hospitals to

**Table 1.** Baseline characteristics of studies included nurses' knowledge about pressure ulcer prevention methods in Ethiopia, 2019.

S.no	First Author	Study Year	Region	Health Facility Name	Study Design	Sample Size	Level of knowledge % (95 % CI)
1	Nuru et al [49]	2014	Amhara	Teaching referral hospital	Cross-sectional	248	54.4 (48.2–60.6)
2	Molla et al [50]	2018	Debu	Teaching referral hospital	cross-sectional	356	52.5 (47.3–57.7)
3	Ebi et al [51]	2018	Oromia	Both teaching and nonteaching hospital	cross-sectional	212	8.5 (4.8–12.3)
4	Ebi et al [52]	2015	Addis Ababa	Both teaching and nonteaching hospital	Cross-sectional	356	36.2 (31.2–41.1)
5	Dilie et al [53]	2015	Addis Ababa	Both teaching and nonteaching hospital	cross-sectional	196	61.2 (54.4–68)
6	Yitayih et al [54]	2013	Tigray	Teaching referral hospital	cross-sectional	162	65.3 (57.9–72.6)

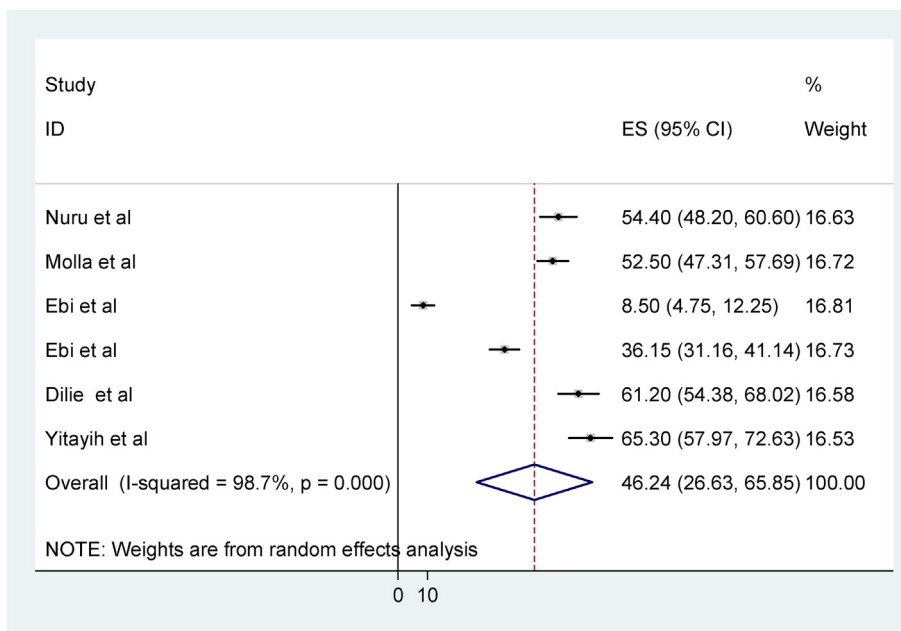


Figure 2. Forest plot shows percentages of total scores of Nurses' knowledge on pressure ulcer prevention methods.

determine the pooled level of nurse's knowledge about pressure ulcer prevention (Figures 4 and 5). The results of the subgroup analysis reveal that the lowest level of knowledge was observed among study groups that used standard questionnaires of the Pressure Ulcer Knowledge Assessment Tool (PUKAT) and nurses' who were assigned in both teaching and nonteaching hospitals show 32.34 % (95 % CI: 5.87–58.89) and 35.17 % (95 % CI: 6.00–64.35), respectively.

4. Discussion

This systematic review and meta-analysis aimed to assess the pooled level of knowledge among nurses about the prevention of PU in Ethiopia. A total of six studies with a total sample size of 1530 nurses were analyzed to determine nurses' knowledge on pressure ulcer prevention and overall pooled results revealed that only 46.24 % are knowledgeable, which was lower than the cutoff point of the PUKAT (more than 60 % of the total score) [55]. Our results indicated that nurses who were working in hospitals did not have a sufficient level of knowledge about the prevention of PU; as a result, this may have led to a compromise in the quality of care. The finding of the present meta-analysis was lower than

the other study's meta-analysis, which was conducted on the knowledge of pressure ulcer prevention in the world (53.18 %) [56]. The main reason for the variation might be due to different study participants and the materials (tools) used for data collection. Our study focuses only on Ethiopia, which is a single country, whereas study conducted worldwide consist of several studies.

In our study, the knowledge of nurses was slightly higher than in the study conducted in Belgium which revealed it as 29.3 % [57]. Moreover, this meta-analysis study shows a lower knowledge of nurses on the prevention of PU as compared to studies conducted in Sweden and Nigeria with the knowledge of nurses being 58.9 % and 61.03 %, respectively [58, 59]. The possible reason for the variation of results might be the methods of study (our study is a meta-analysis and other studies are cross-sectional comparative studies), the educational status of study participants, and work experiences of study participants.

In the present meta-analysis study, a subgroup analysis was conducted based on the study area (teaching referral hospital and both teaching and nonteaching hospital) and questionnaires (pressure ulcer assessment tool and others) used for the conducted study. The results of the subgroup analysis showed that variability was observed in overall pooled knowledge of nurses on the prevention of PU across the category of each study area and used questionnaires.

Among the categories of study area (hospitals), relatively highest pooled knowledge of nurses on pressure ulcer prevention was observed from those studies that were conducted in nurses who were working in teaching referral hospitals with the result of 57.04 % (95 % CI: 49.80–64.27). Most of the time, nurses who are working at teaching referral hospitals are bachelor degree holders [49, 50, 54] and may have increased access for information about pressure ulcer prevention methods; as a result, their level of knowledge is higher than nurses who are working in nonteaching hospitals [51]. Nurses who get formal training on the prevention of pressure ulcer methods have a better level of knowledge than nurses who did not get any training on the prevention methods of PU [53].

In other words, nurses who have not used standard PUKAT for data collection showed a slight increment in their level of knowledge on the prevention of PU, which revealed 60.07 % (95 % CI: 53.74–66.39) as compared to that of nurses who have used standard pressure ulcer assessment tools with the result of 32.34 % (95 % CI: 5.78–58.89). The possible reason might be that standard pressure ulcer assessment tools

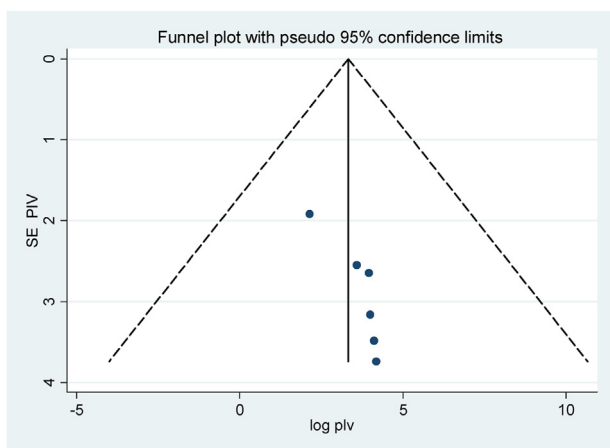


Figure 3. Meta funnel presentation of level of Nurses' knowledge on pressure ulcer prevention.

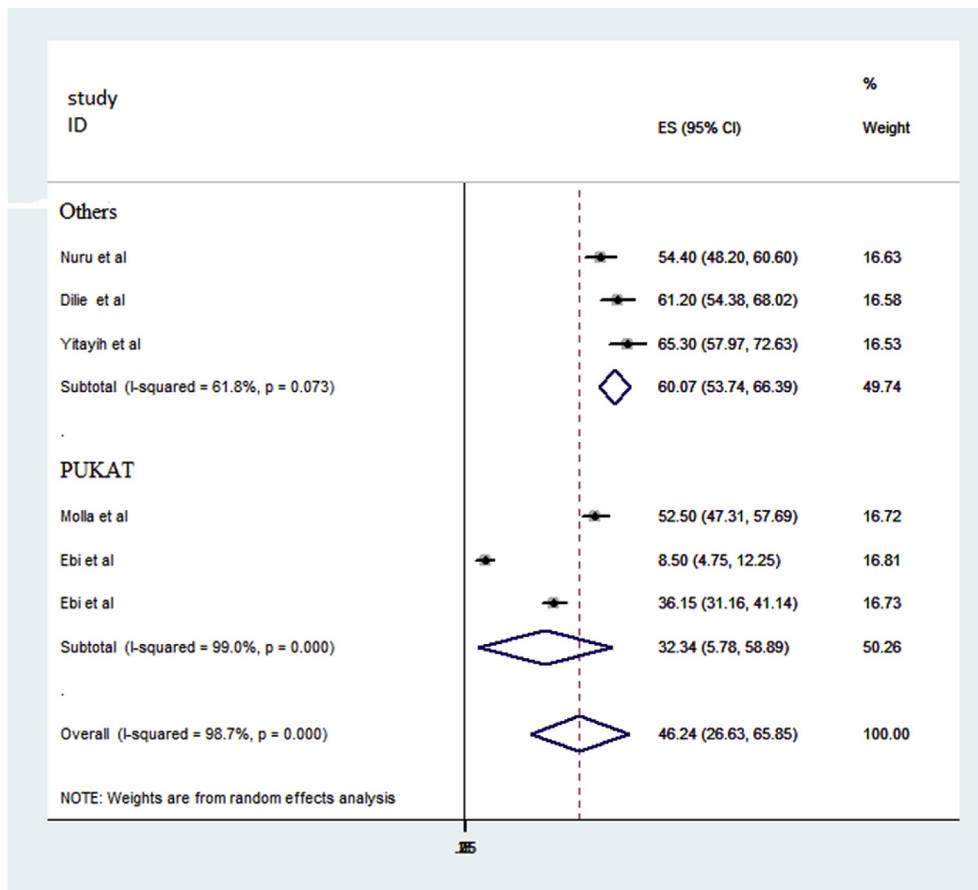


Figure 4. Subgroup analysis by study questionnaires on the level of nurses' knowledge about the prevention of pressure ulcers.

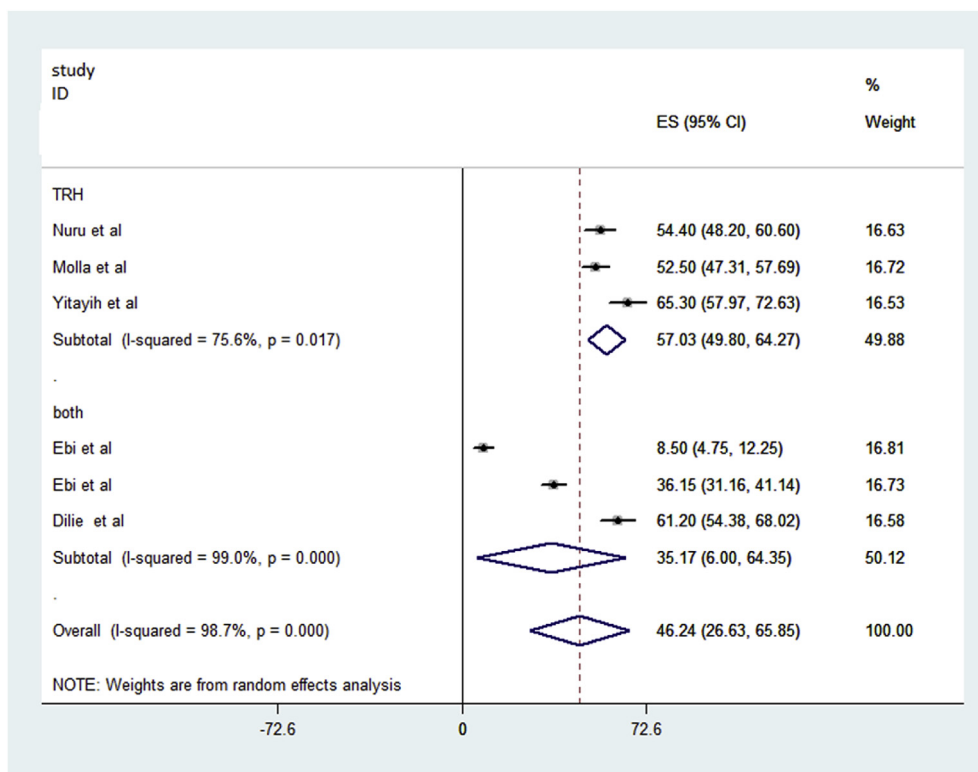


Figure 5. Subgroup analysis by study hospitals on the level of nurses' knowledge about the prevention of pressure ulcers. TRH: teaching referral hospitals and both: teaching and non-teaching hospitals.

(questionnaire) used more deep and wide components and need evidence-based practice, whereas in nonstandard pressure ulcer assessment tools (questionnaire) the components are simple and easily understandable by study participants.

Although, there were some limitations in our study, it provided important information about the level of nurses' knowledge in the prevention of PU in the national level. Therefore, researchers and policy makers can easily compare on nurses' knowledge about the prevention of PU with the expected level and current level of nurses' knowledge in this regard. However, the limitations are: first, the present study was including only English articles that were considered to provide this nationally based review. Second, some studies did not report baseline sociodemographic characteristics of the study participants. This prevented the provision of a subgroup analysis based on the educational level and other essential variables, to determine the level of nurses' knowledge on the prevention of PU. The third limitation of this study, while using Egger's test is that it is sensitive when the number of studies is less than 10; as a result, it may not detect the publication bias.

## 5. Conclusion

The overall nurses' level of knowledge on the prevention of PU was low in this meta-analysis study. Unless the acquisitions of nurses' knowledge about the prevention methods of PU is obtained, the prevalence of PU may not be decreased. Therefore, nurses' knowledge will be increased by sustainable training on the prevention of PU, which provides updated guidelines and continuity educational development.

## Declarations

### Author contribution statement

Haileyesus Gedamu: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Teshager Abate and Yilkal Tafere: Performed the experiments; Wrote the paper.

Emiru Ayalew: Analyzed and interpreted the data.

Abebu Tegenaw and Minyichil Birhanu: Contributed reagents, materials, analysis tools or data.

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### Data availability statement

Data included in article/supplementary material/referenced in article.

### Declaration of interests statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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