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RESEARCH

Incidence of medical device-related pressure injuries: a meta-analysis

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Abstract

Background Medical device-related pressure injures (MDRPIs) are common in critically ill patients and associated with negative clinical outcomes and elevated healthcare expenses. We aim to estimate worldwide incidence of MDRPI and explore associated factors through systemic review and meta-analysis.

Methods The PubMed, Web of Science, Cochrane Library, and Ovid EMBASE databases were systematically queried to identify relevant studies published from Jan 1, 2010 up until June 30, 2024. Studies were included if they provided data on the incidence or prevalence of MDRPI. Random-effect models were utilized to calculate the overall or domain-specific aggregated estimates of MDRPI. A meta-regression analysis was additionally performed to investigate the heterogeneity among studies.

Results We included 28 observational studies on 117,624 patients in the meta-analysis. The overall incidence of MDRPI was 19.3% (95% confidence interval (CI) 13.5–25.2%). The incidence of MDRPI in Europe, North America, Asia, South America, and Oceania was 17.3% (95% CI 12.7–21.9%), 3.6% (95% CI 0.0–8.5%), 21.9% (95% CI 14.3–29.6%), 48.3% (95% CI 20.8–75.7%), and 13.0% (95% CI 5.0–21.1%), respectively ($p < 0.01$). Multivariate meta-regressions revealed South America and special inpatient (critically ill patient, etc.) were independently associated with higher MDRPI incidence.

Conclusions Nearly, 20% of the patients in ICU suffered from MDRPI. The incidence of MDRPI in underdeveloped regions is particularly concerning, highlighting the importance of focusing on measures to prevent it, in order to reduce the medical burden and enhance the quality of life for affected patients.

Keywords Medical device-related pressure injury, Incidence, Factors

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Introduction

Nursing remains the pivotal role for medical care worldwide [1]. With the continuous advancement of medical devices, pressure injuries related to medical equipment have gradually become an issue that cannot be ignored. Although medical devices can enhance treatment outcomes and facilitate patient survival, it is important to acknowledge that every device carries the inherent risk of pressure sore development. Medical device-related pressure injures (MDRPIs) are pressure ulcers that result from the use of devices designed and applied for diagnostic or therapeutic purposes [2]. The morphology of the injury site typically corresponds to the configuration of the medical device [3]. Common medical devices that cause MDRPI include endotracheal tubes, urinary catheters, nasogastric tubes and oxygen face masks [4–6]. Enhanced susceptibility to pressure ulcers related to medical devices can arise from compromised sensory perception, the presence of moisture underneath the device, insufficient blood circulation, modified tissue tolerance levels, suboptimal nutritional status, and edema [2].

MDRPI not only reduces the quality of life of patients and increases the medical cost of patients, but also consumes the resources of hospitals [7, 8]. Every year, an estimated 2.5 million patients in the United States receive medical treatment for pressure injuries, resulting in costs 9.1–11.6 billion and an annual average of over 17,000 lawsuits are associated with these wounds [9]. It may result in extended hospitalization periods, heightened incidence of complications, and potentially fatal outcomes [10, 11]. Due to the crucial role of numerous medical devices in the treatment process, refraining from utilizing medical equipment is impractical, thereby further complicating MDRPI treatment. Hospital lengths of stay, readmission rates, and hospital charges exhibit higher magnitudes in individuals who develop a pressure ulcer compared to those who remain free from ulcers [12, 13]. Nursing interventions for pressure injury also face serious challenges. The expertise and disposition of nurses regarding the MDRPI may influence the implementation of preventive measures in clinical practice [14]. Hence, it is necessary for medical staff to understand the incidence and risk factors of MDRPI.

Medical device-related stress injuries occur primarily in intensive care units (ICU), but also in inpatient units such as trauma centers and pediatrics. A study conducted in Australia revealed that the pooled incidence of MDRPI can reach as high as 27.9%, with a significant proportion of cases (68%) occurring within ICU [15]. The Norton Scale, Waterlow Scale, and Braden Scale are commonly used by healthcare providers to assess risk factors associated with MDRPI, but the results are not satisfactory [16–18].

A review conducted in 2019 tentatively revealed the incidence of MDRPI at approximately 12% [19]. However, the existing literature has not addressed the temporal changes and trends in the incidence of MDRPI, despite the increasing attention that medical professionals have devoted to the study of MDRPI in recent years. We believed that it is necessary to update the incidence in recent years and assessing the temporal trends in the incidence of MDRPI will enhance our comprehension of the detrimental impact and disease burden associated with MDRPI. We conducted a meta-analysis to estimate global incidence and associated risk factors of MDRPI.

Methods

Search strategy

We conducted a comprehensive registered meta-analysis in INPLASY (INPLASY202430103), which was in accordance with the previous publications [20–26] and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [27]. We conducted the literature search in renowned databases including PubMed, Web of Science, Cochrane Library, and Ovid EMBASE from January 1, 2010 until June 30, 2024. The keywords were utilized as follows: ("Pressure Ulcer" [All Fields] or "Bedsore" [All Fields] or "Pressure Injury" [All Fields] or "Pressure Sore" [All Fields] or "Decubitus Sore" [All Fields] or "Decubitus Ulcer" [All Fields]) AND ("medical device"[All Fields] or "device-related" [ALL Fields] OR "medical device related" [ALL Fields] or "medical device-related" [ALL Fields]) AND ("prevalence" [ALL Fields] or "prevalence rate" [ALL Fields] or "incidence" [ALL Fields] or "incidence rate" [ALL Fields] or "occurrence" [ALL Fields] or "frequency" [ALL Fields]) NOT ("Meta-Analysis" [Publication Type] or "Review" [Publication Type] or "Randomized Controlled Trial" [Publication Type]) (Supplementary Table 1). Only studies published in the English language met the eligibility criteria for inclusion in our comprehensive review.

Eligibility criteria

After eliminating duplicates, all full-text articles were retrieved and screened independently by two authors (Ning Zhang and Yanan Li) to determine their eligibility for inclusion in this systematic review. The primary outcome was the incidence of MDRPI, which was defined by National Pressure Ulcer Advisory Panel and European Pressure Ulcer Advisory Panel (NPUAP & EPUAP) [28]. Since the first edition of the guideline was published in 2009, to ensure the uniformity of the outcome of the included articles, all the included studies' publication time was after the guideline's first edition. Studies were considered eligible for inclusion in this review if they provided data on the incidence or prevalence of pressure injuries related to medical devices. We encompassed studies conducted across diverse healthcare settings and facilities, without any restrictions based on facility type, and involving populations spanning all age groups, including both adults and children. We excluded the studies as follows: (1) only the number of injuries was recorded, not the number of patients; (2) experimental studies examining the efficacy of devices in preventing or managing pressure injuries, including randomized controlled trials (RCTs) and quasi-experiments; (3) evaluation of research with low literature quality; (4) unable to obtain the full text; (5) the same sample had already been used in an included study.

Data collection and quality assessment

The extracted data consisted of: study publication date, authors, study region, study beginning and ending date, population source, gender distribution of the sample, methodological information of the studies, common medical devices that cause MDRPI, number of MDRPI cases and overall population. Population source were from four categories: (1) ICU; (2) hospitalized patients (3) special inpatient group and (4) large database. Quality assessment entailed evaluating the risk of bias for each included study using the Newcastle–Ottawa scale [29], a validated tool for assessing quality in observational studies (supplementary Table 2).

Data analysis

A random-effects model was utilized to estimate the incidence of MDRPI and its 95% confidence interval. To assess the impact of moderator variables on heterogeneity, we employed a stratified approach for pooling outcome measures and conducted subgroup analyses. The moderating factors included study year, sex, continent, country, and population source. I^2 values exceeding 50% indicate substantial heterogeneity. Subgroup analyses and meta-regressions were performed to evaluate heterogeneity between studies based on study year, geographic locations, gender, and population source. Sensitivity analyses were conducted by systematically removing each study to explore its effect on MDRPI incidence. The Egger test was used to quantitatively assess publication bias. All statistical analyses were carried out using the meta (version 6.5-0, https://cran.r-project.org/web/packages/available_packages_by_name.html) and metafor (version 4.6-0, https://cran.r-project.org/web/packages/available_packages_by_name.html) package in R 4.2.2 (https://www.r-project.org/foundation/). Statistical significance was attributed to p values less than 0.05.

Results

Study selection and basic characteristics of included studies

A total of 5242 studies have been identified in the literature search. After removing duplication, 4130 titles and abstracts have been screened. 4096 studies were deleted after reading the titles and abstracts based on the inclusion and exclusion criteria. We obtained and examined a total of 34 full-text articles. Out of these, 6 articles were deemed ineligible for inclusion in this meta-analysis. Ultimately, our analysis comprised 28 studies. The flowchart illustrating the process of study selection is presented in Fig. 1. The basic characteristics of 28 included studies are shown in Supplementary Table 3. A total of 30 groups were extracted from the 28 studies. The incidence analysis of the MDRPI encompassed a sample population of 117,624 individuals across 28 studies. The study duration spanned from 2013 to 2022, while the publication period ranged from 2014 to 2023. The literature sources include Netherland, Norway, America, Canada, Australia, New Zealand, Brazil, China, Jordan, Japan, Turkey, Korea, and the United Kingdom. There were 11 cross-sectional studies, 2 retrospective cohort studies, and 15 prospective cohort studies in this review.

Overall incidence of MDRPI

The overall MDRPI incidence was 19.3% (95% CI 13.5%–25.2%, $n=30$, $I^2=99\%$) (Table 1). Figure 2 illustrated a forest plot depicting the overall MDRPI incidence across different arms and the entire study population.

MDRPI incidence by geographical regions

The incidence of MDRPI was 48.3% (95% CI 20.8–75.7%, $n=2$, $I^2=94\%$) in South America, 21.9% (95% CI 14.3–29.6% $n=17$, $I^2=98\%$) in Asia, 17.3% (95% CI 12.7–21.9% $n=2$, $I^2=62\%$) in Europe, 13.0% (95% CI 5.0–21.1% n=5, $I^2=96\%$) in Oceania, 3.6% (95% CI 0.0–8.5% $n=3$, $I^2=92\%$) in North America, and 3.1% (95% CI 1.7–5.1% $n=1$) in North America and Oceania (Table 1 and Fig. 3). A statistically significant difference was observed among the subgroups ($p<0.01$). In the Asian region, Turkey emerged as the most frequently reported country, exhibiting an incidence rate of 30.6% (95% CI 16.7–44.6%) across 7 studies conducted (Table 1 and Fig. 4).

MDRPI incidence by age

MDRPI incidence was 20.0% (95% CI 13.4–26.6%, $n=26$, $I^2=99\%$) in the adult population (aged ≥ 18), 6.9% (95% CI 2.8–11.0%, $n=2$, $I^2=66\%$) in the child population (aged < 18) and 23.8% (95% CI 16.6–30.9%, $n=2$, $I^2=72\%$) in the mixed population ($p<0.01$) (Table 1 and Fig. 5).

MDRPI incidence by study years

The incidence of MDRPI in patients was 14.4% (95% CI 3.6–25.2%, $n=2$, $I^2=92\%$) from 2010 to 2015, increased to 20.2% (95% CI 12.0–28.4%, $n=16$, $I^2=99\%$) between 2016 and 2020, and further rose to 25.2% (95% CI 12.0–38.5%, $n=7$, $I^2=98\%$) after the year of 2020. The incidence of MDRPI for the five studies that did not mention study time was 10.7% (95% CI 0.0–23.9%, $n=5$, $I^2=98\%$). The incidence demonstrated a numerical increase in patients over the observed time period; however, no statistically significant differences were observed among the subgroups ($p=0.39$; see Table 1 and Fig. 6).

MDRPI incidence by population source

A significant difference in MDRPI incidence was observed among subgroups based on the population

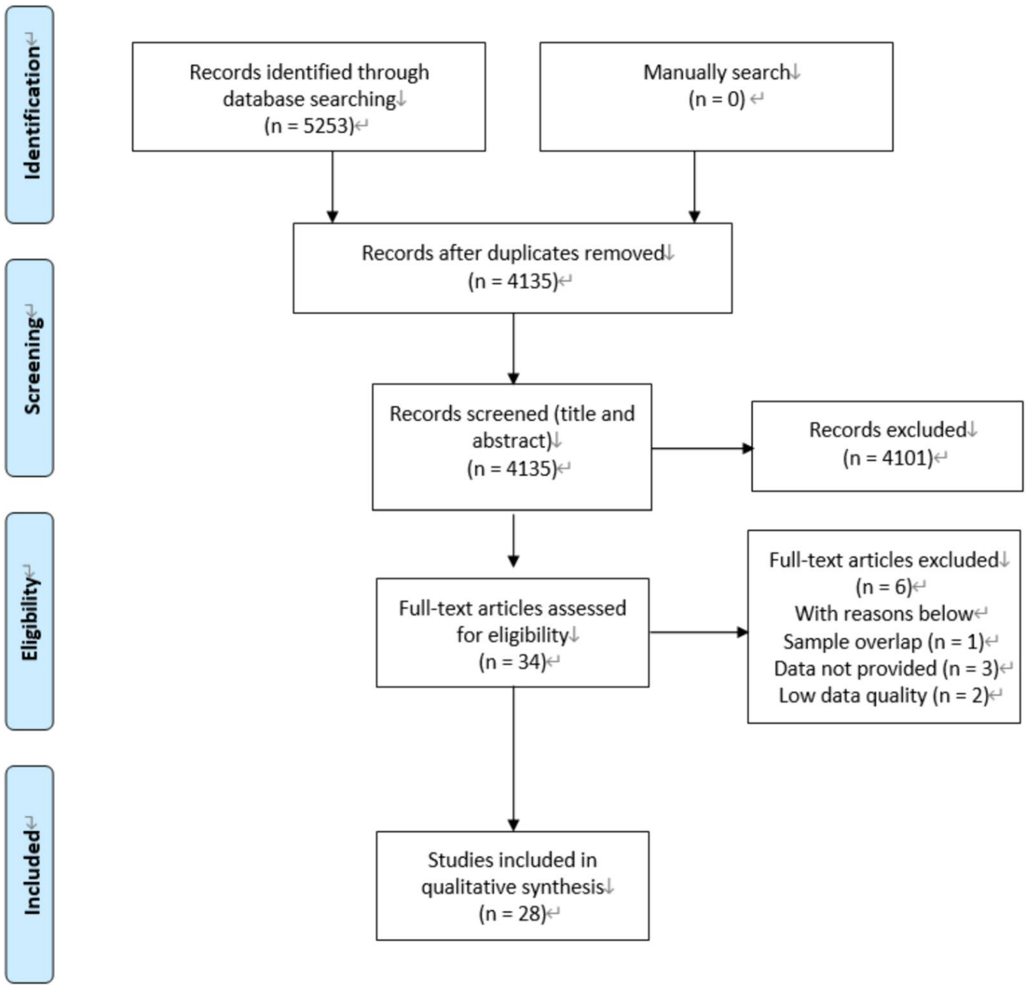

Fig. 1 The flowchart illustrating the process of study selection

source ($p < 0.01$). Incidence of MDRPI was 19.0% (95% CI 12.4–25.6%, $n = 17$, $I^2 = 98\%$) in the ICU, 11.0% (95% CI 2.8–19.2%, $n = 6$, $I^2 = 97\%$) in hospitalized patients, 32.0% (95% CI 13.8–50.2%, $n = 6$, $I^2 = 97\%$) in special inpatient groups, and 0.6% (95% CI 0.6–0.7%, $n = 1$) in large database (Table 1 and Fig. 7).

MDRPI incidence by gender

The MDRPI incidence of men was 17.0% (95% CI 9.0–25.0%, $n = 13$, $I^2 = 95\%$), and 17.7% (95% CI 8.0–27.4%, $n = 13$, $I^2 = 95\%$) of women. There was no statistical difference in gender subgroups ($p = 0.91$) (Table 1 and Fig. 8).

Results for meta-regression analysis

In a univariate meta-regression analysis, South American continents, ICU or special inpatient group, and study years 2016–2020 or > 2020 were related to higher MDRPI incidence ($p = 0.0004$, $p = 0.0404$, $p < 0.0001$, $p = 0.0045$ and $p < 0.0001$, respectively) and child was associated with lower incidence of MDRPI ($p = 0.0018$) (Table 2). Multivariate meta-regression showed that continent from South America ($p = 0.0457$) and population source from special inpatient group ($p = 0.0255$) were significantly associated with higher incidence of MDRPI (Table 2).

Medical devices and risk factors of MDRPI

21 articles mentioned about medical devices that cause MDRPI. Among all the devices, nasogastric and tracheal tubes are the predominant medical devices associated with MDRPI, as indicated by 17 articles highlighting their causative role. Devices such as oxygen masks, neck immobilization devices, pulse oximeters, and orthopedic instruments were also mentioned as common contributors to MDRPI. Risk factors associated with MDRPI were identified in 12 articles. Among all the risk factors, length of hospital stay as a risk factor for MDRPI was mentioned in 8 articles. Other risk factors cited included multiple medical devices, male sex, poor initial health score,

Table 1 Stratification of MDRPI incidence estimates by moderator variables

	Number of study populations (%)	Number of participants	MDRPIs incidence, % (95% CI)	I^2	*p* value
Overall	30 (100%)	117,624	19.3% (13.5–25.2)	99%	
Study year					0.39
2010–2015	2 (6.7%)	509	14.4% (3.6–25.2)	92%	
2016–2020	16 (53.3%)	114,118	20.2% (12.0–28.4)	99%	
> 2020	7 (23.3%)	1547	25.2% (12.0–38.5)	98%	
NA	5 (16.7%)	1450	10.7% (0.0–23.9)	98%	
Sex					0.91
Male	13 (43.3%)	2171	17.0% (9.0–25.0)	95%	
Female	13 (43.3%)	1725	17.7% (8.0–27.4)	95%	
Continents					< 0.01
Europe	2 (6.7%)	848	17.3% (12.7–21.9)	62%	
North America	3 (10.0%)	103,471	3.6% (0.0–8.5)	92%	
Asia	17 (56.7%)	10,132	21.9% (14.3–29.6)	98%	
South America	2 (6.7%)	218	48.3% (20.8–75.7)	94%	
Oceania	5 (16.7%)	2472	13.0% (5.0–21.1)	96%	
North America and Oceania	1 (3.3%)	483	3.1% (1.7–5.1)	NA	
Country					< 0.01
Europe					
Netherland	1 (3.3%)	254	20.1% (15.3–25.5)	NA	
Norway	1 (3.3%)	594	15.3% (12.5–18.5)	NA	
North America					
America	2 (6.7%)	606	5.3% (0.0–12.2)	92%	
America and Australia	1 (3.3%)	483	3.1% (1.7–5.1)	NA	
America and Canada	1 (3.3%)	102,865	0.6% (0.6–0.7)	NA	
Asia					
China	2 (6.7%)	795	11.1% (6.1–16.0)	67%	
Jordan	3 (10%)	783	15.9% (0.0–37.4)	98%	
Japan	1 (3.3%)	1418	3.3% (2.4–4.4)	NA	
Turkey	7 (23.3%)	6407	30.6% (16.7–44.6)	99%	
Korea	1 (3.3%)	147	27.2% (20.2–35.2)	NA	
Iran	1 (3.3%)	404	20.5% (16.7–24.8)	NA	
Indonesia	1 (3.3%)	32	21.9% (9.3–40.0)	NA	
India	1 (3.3%)	146	19.2% (13.1–26.5)	NA	
South America					
Brazil	2 (6.7%)	218	48.3% (20.8–75.7)	94%	
Oceania					
Australia and New Zealand	1 (3.3%)	624	4.3% (2.9–6.2)	NA	
Australia	4 (13.3%)	1848	15.3% (6.5–24.1)	93%	
Age					< 0.01
Adult	26 (86.6%)	116,620	20.0% (13.4–26.6)	99%	
Child	2 (6.7%)	421	6.9% (2.8–11.0)	66%	
Mixed	2 (6.7%)	583	23.8% (16.6–30.9)	72%	
Population source					< 0.01
ICU	17 (56.7%)	5616	19.0% (12.4–25.6)	98%	
All hospitalized patients	6 (20.0%)	7510	11.0% (2.8–19.2)	97%	
Special inpatient group	6 (20.0%)	1633	32.0% (13.8–50.2)	97%	
Large database	1 (3.3%)	102,865	0.6% (0.6–0.7)	NA	

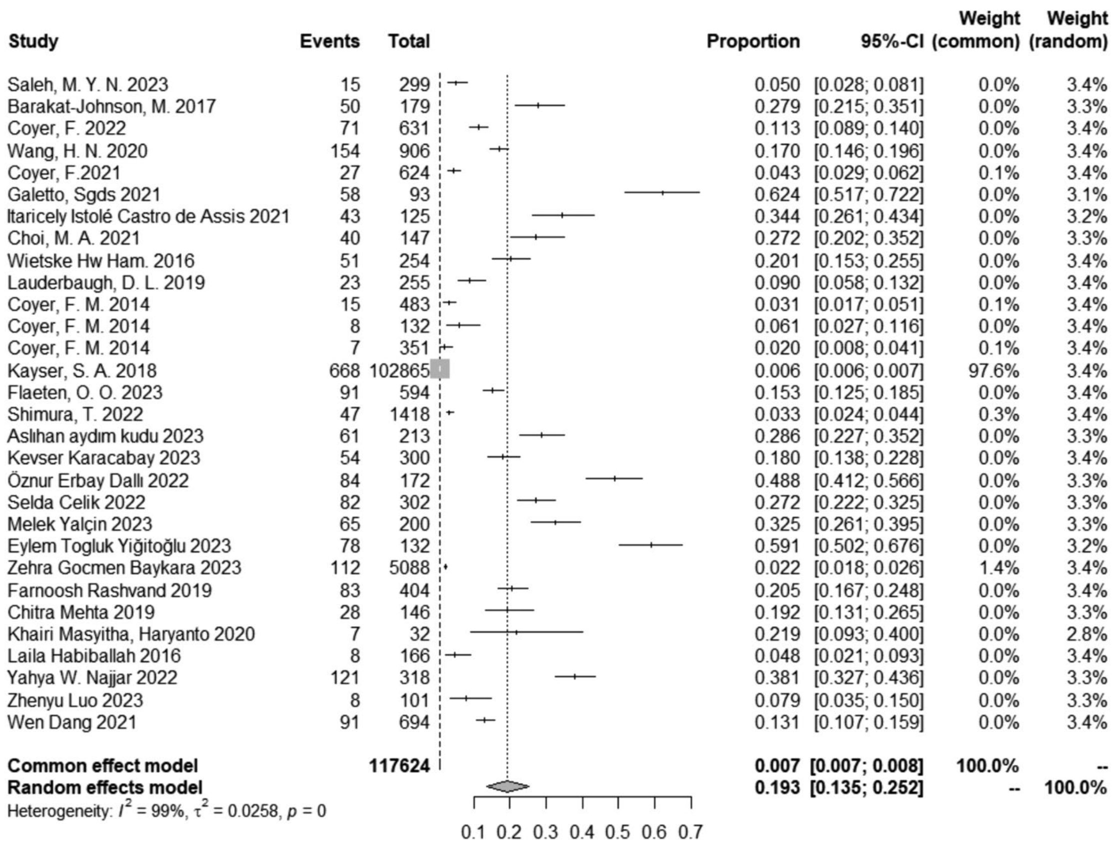

Fig. 2 The forest plot depicting the overall MDRPI incidence

mechanical ventilation, multiple medications, vasoactive drug infusions, old age, history of cardiovascular diseases, administration of vasopressors, postural ulcers, chronic liver disease, hemoglobin less than 9.0, Lower Braden scores and having skin edema (Supplementary Table 3).

Publications bias and sensitivity analysis

The Egger test showed publication bias involving the overall incidence of MDRPI ($p < 0.0001$). The sensitivity analyses showed little change after estimating the effect of each study (Supplementary Fig. 1).

Discussion

Main interpretation

This systemic review and meta-analysis estimated the overall incidence of MDRPI up to date in 117,624 individuals worldwide. The overall incidence of MDRPI was 19.3%, surpassing the 12% reported in the meta-analysis conducted in 2019 [19]. The increasing incidence highlights the escalating severity of the MDRPI issue. Subgroup analyses and meta-analysis have indicated that the incidence of MDRPI is higher in South America, and among special inpatients. These findings hold significant importance in raising awareness about the burden of MDRPI and can provide comprehensive data for optimizing the appropriate utilization of medical devices.

In our study, the incidence of MDRPI exhibited significant variation across 5 continents. MDRPI incidence was found to be higher in South America (48.3%) and lower in North America and Oceania (3.1%, shown in Table 1). Limited medical resources and economic constraints in developing countries may be contributing factors. In the subgroup analysis of the study year period, the resulting differences were not statistically significant. Surveys conducted on the guideline in 86 Australian public hospitals revealed facility-acquired pressure ulcer rates of 7.8%, 9.3%, 6.3%, and 7.4% for the years 2007, 2008, 2009, and 2011 respectively, which had no statistical difference either [30]. However, it was evident that the incidence has steadily numerically risen over time in our analysis since 2010. This result suggests that the global community's efforts to strengthen the prevention and treatment of MDRPI still need improvement. Furthermore, in a subgroup analysis of age, the incidence of MDRPI in children (internationally recognized as aged < 18) was 6.9%, which was much lower than in adults. Children's skin is thinner, softer, and contains more collagen and

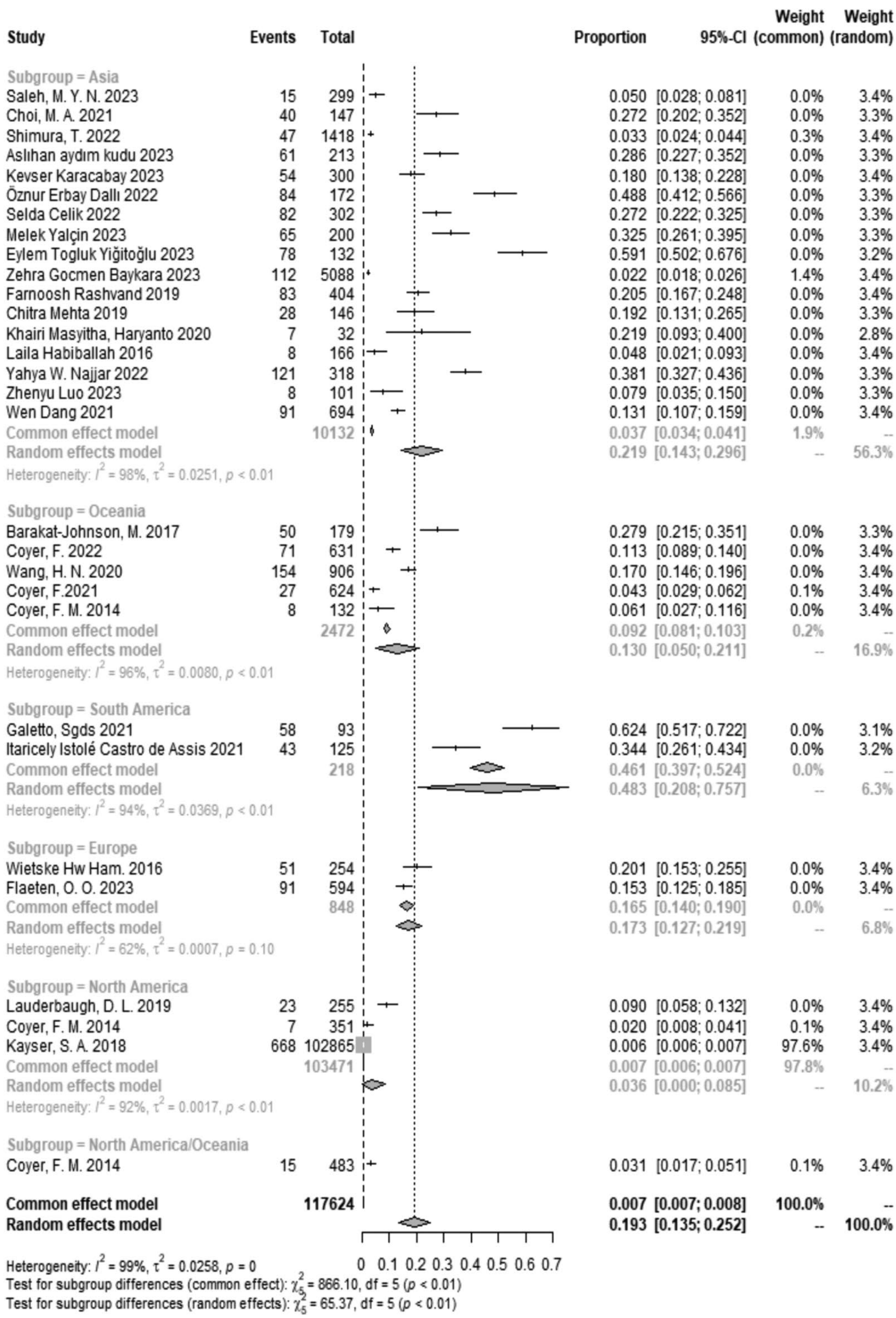

Fig. 3 The forest plot depicting MDRPI incidence by continents

elastic fibers. These properties make children's skin more elastic and able to withstand external pressure and friction. In contrast, adult skin gradually loses its elasticity as it ages, becoming more fragile and prone to damage. Our results are supported by multiple observational studies that include age as a risk factor for MDRPI [5,

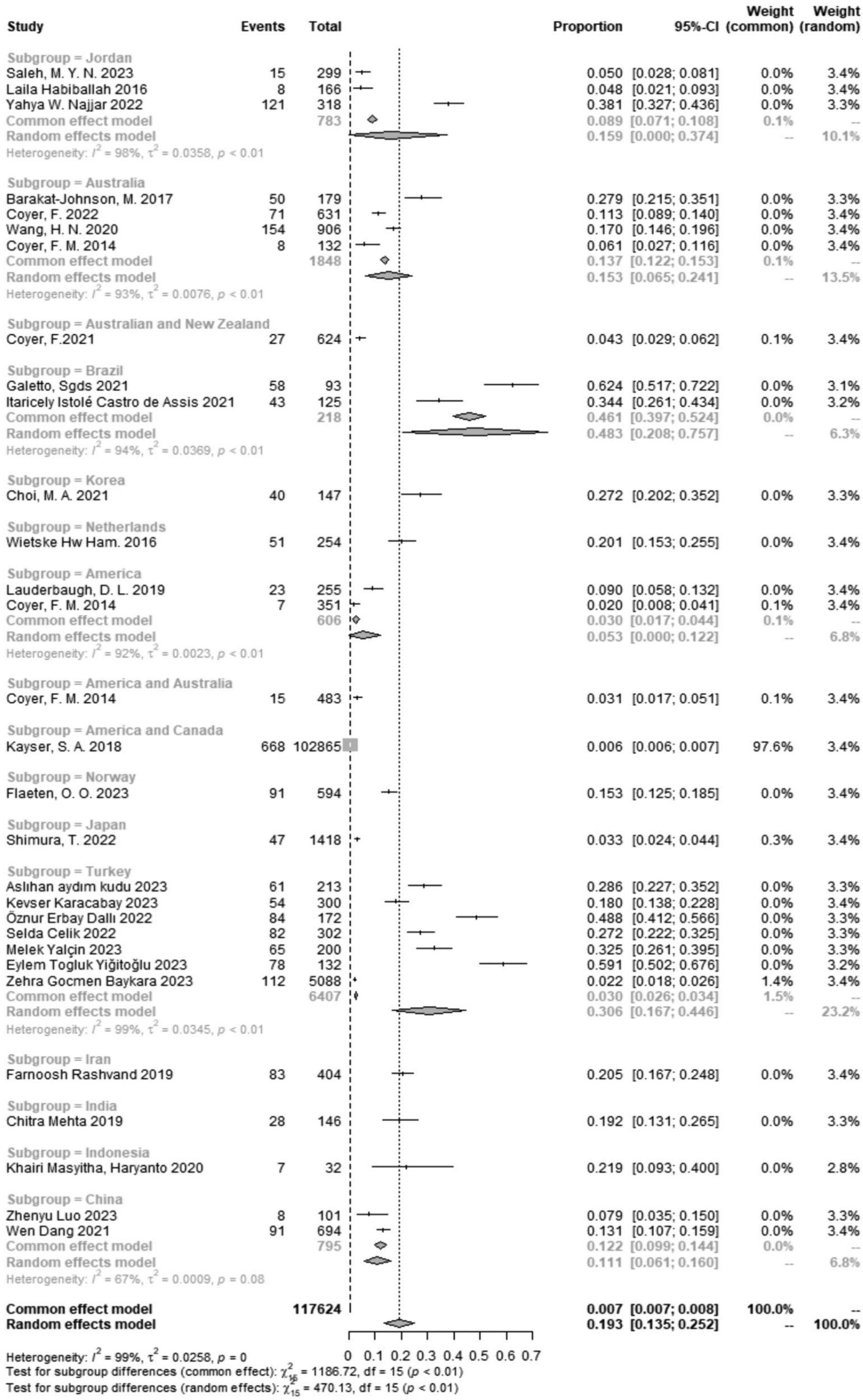

Fig. 4 The forest plot depicting MDRPI incidence by countries

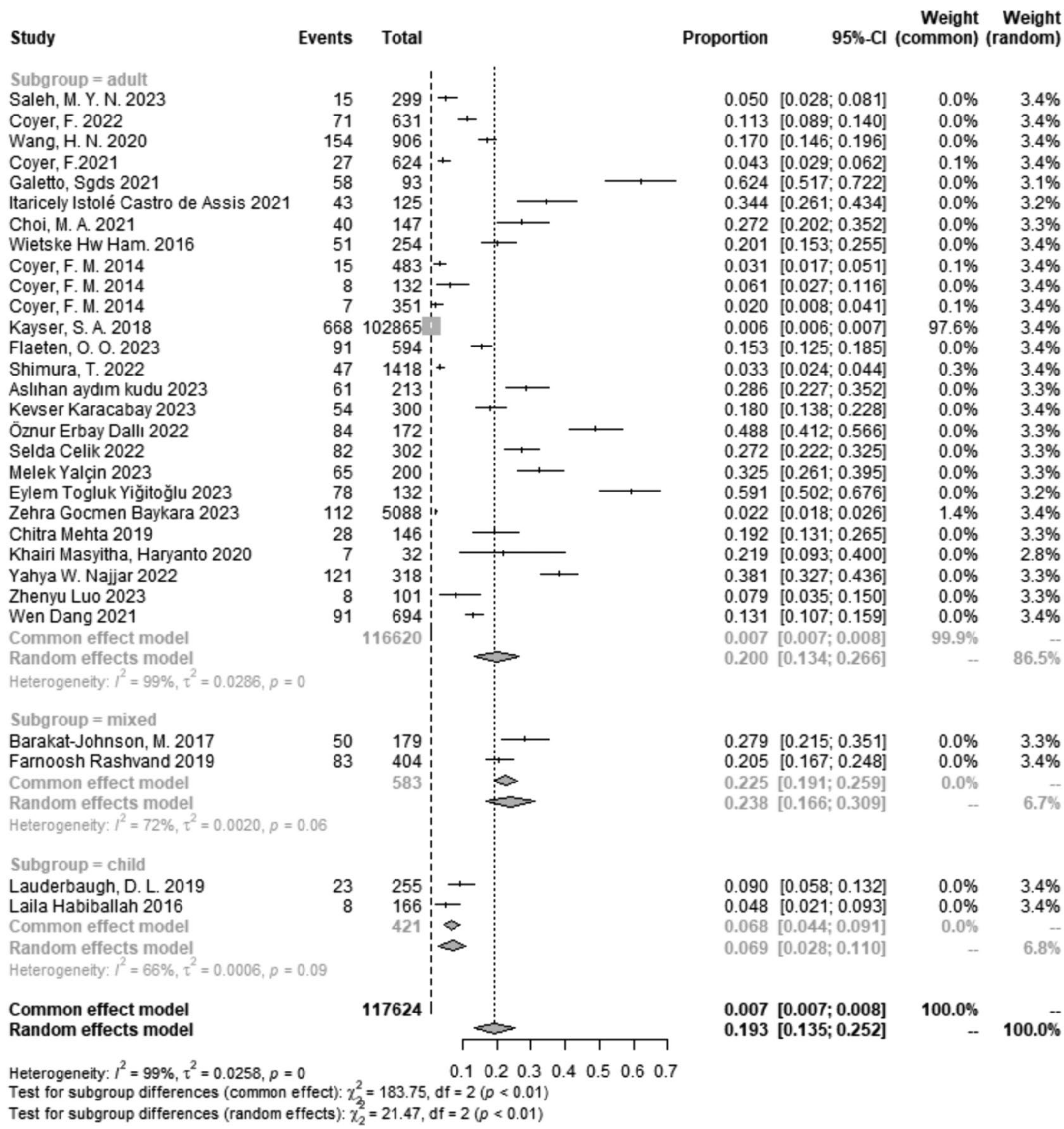

Fig. 5 The forest plot depicting MDRPI incidence by age

31, 32]. However, children can also develop pressure sores, especially if they are under stress for a long time or lack proper care [33]. Therefore, although children's skin is relatively more elastic, it is still necessary to pay attention to prevent and protect children's skin from stress damage. Studies on MDRPI have predominantly been conducted in the intensive care unit ($n = 17$ in our review). A comprehensive analysis of risk factors for MDRPI in ICU patients revealed potential associations with age, diabetes, hemoglobin levels, serum albumin levels, edema presence, Braden scale score, SOFA score, APACHE II score, duration of medical device usage, utilization of a subglottic suction catheter, administration of vasoconstrictors, surgical procedures performed on the patient, positioning techniques employed during care delivery and prone position ventilation [34].

Our findings demonstrated a higher incidence of MDRPI (32%) in the special inpatient group, which encompassed patients with a cervical collar in situ, patients utilizing at least one medical device, patients undergoing prone position spine surgery, patients suspected of having a spine injury, patients diagnosed with COVID-19, and those referred by ambulance for more than 2 h [35–40]. Bassam Alshahrani et al. argue that every critically ill patient needs interventions to prevent stress injuries, and interventions and

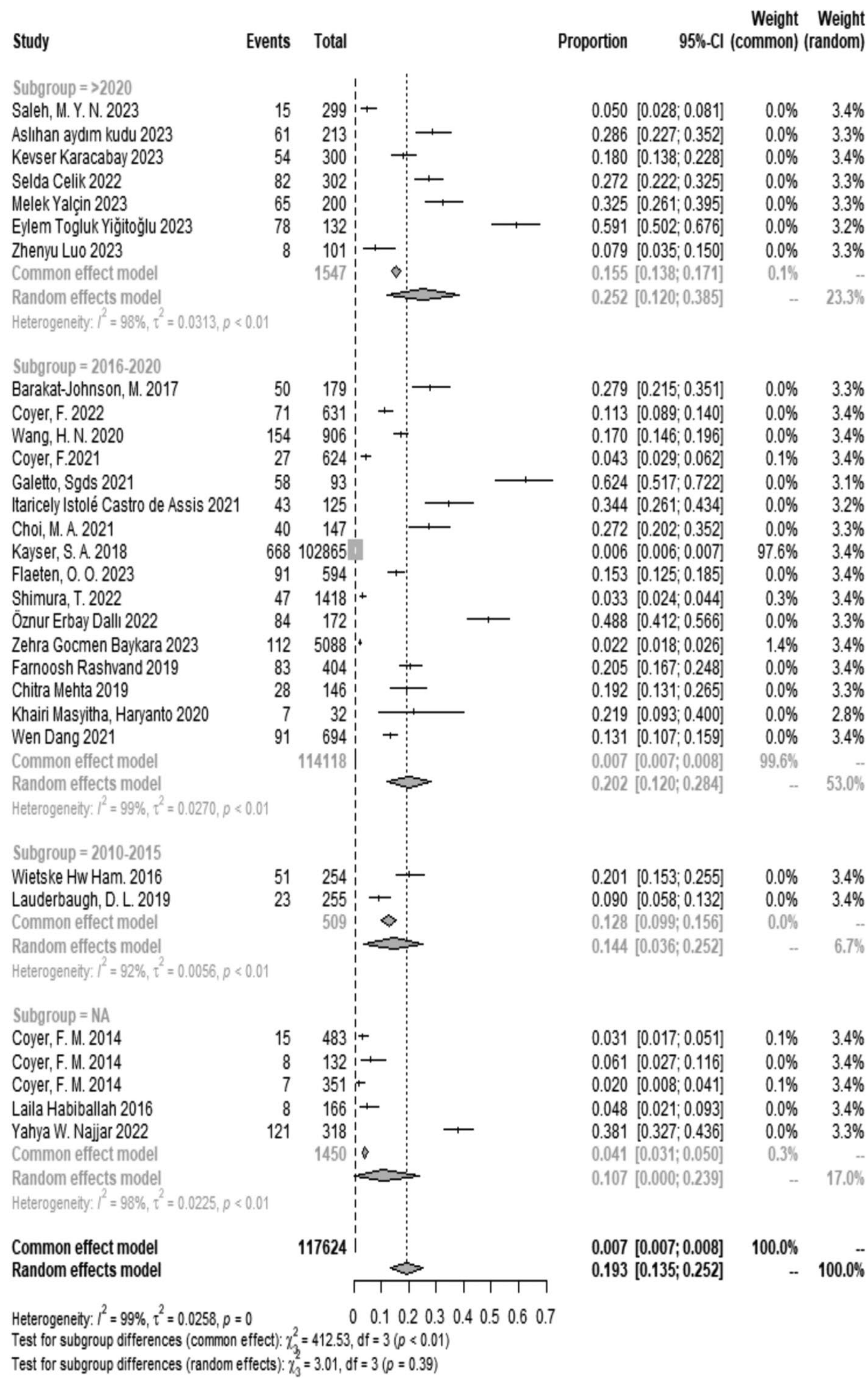

Fig. 6 The forest plot depicting MDRPI incidence by study years

prevention measures for critically ill patients and various special populations were particularly complex [41]. A significant prevalence study revealed that medical device-related pressure injuries (MDRPI) manifest more rapidly after admission to a healthcare facility compared to non-MDRPI, with a median onset of 12 days versus 15 days, respectively ($p<0.05$) [42]. Nurses possess the necessary qualifications to assume leadership roles in the prevention of pressure injuries within critical care units. Moreover, they were on the front lines of the MDRPI.

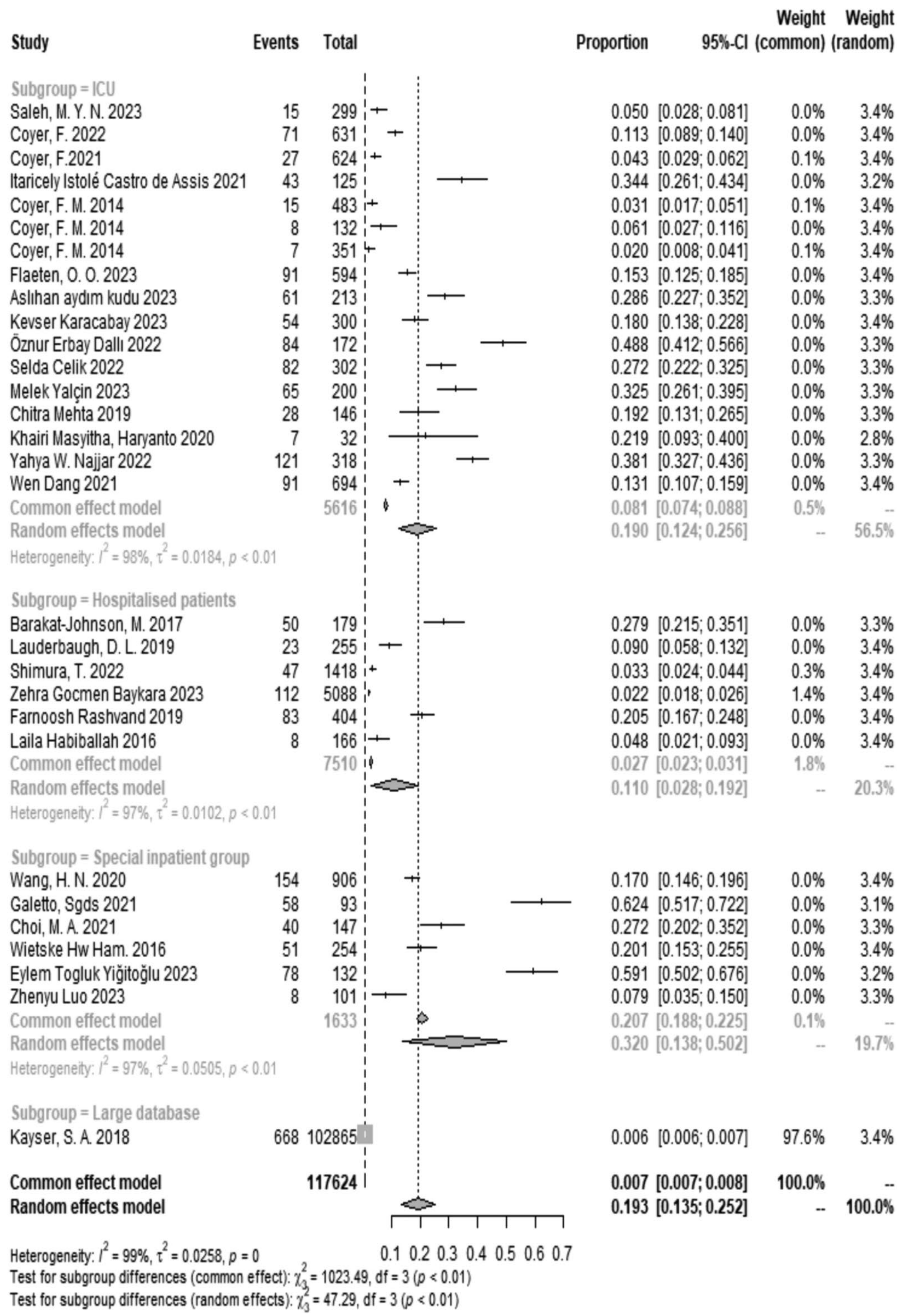

Fig. 7 The forest plot depicting MDRPI incidence by population source

A cross-sectional study in Western China revealed that ICU nurses possessed acceptable levels of knowledge, attitude, and practice in preventing MDRPI. Moreover, it also highlighted the necessity for a comprehensive strategy to further improve these competencies and the quality of care for critically ill patients [43].

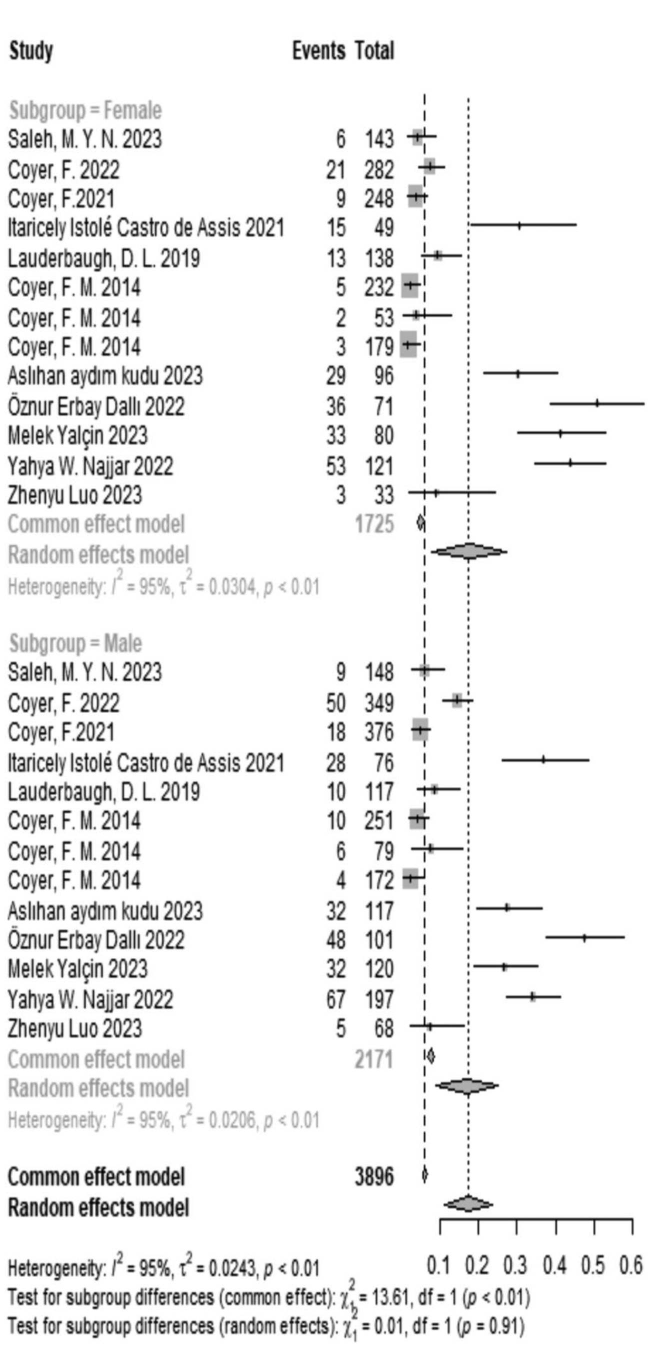

Fig. 8 The forest plot depicting MDRPI incidence by gender

We did not observe any significant differences in subgroup analyses and meta-regressions based on gender. No correlation between gender and MDRPI occurrence was found in this review.

Whenever a pressure injury occurs as a result of a medical device, it is advisable to consider the removal or replacement of the device, if clinically feasible. In cases where the device must remain in place, it is essential to implement strategies aimed at alleviating pressure (https://internationalguideline.com/2019). While enhancing understanding of the prevention and management of MDRPI, healthcare practitioners have concurrently undertaken numerous studies aimed at improving quality. Lawrence C et al. reduced neonatal nasal pressure injury using bubble continuous positive airway [44]. Grigatti A et al. suggested that hydrogel dressings could

Table 2 Meta-regression analysis for incidence of MDRPI

	Univariate meta-regression		Multivariate meta-regression	
	Coefficient (95% CI)	***P* value**	**Coefficient (95% CI)**	***P* value**
Continent				
Europe	Reference	–	Reference	–
North America	– 0.1382 (– 0.2790 to 0.0026)	0.0544	– 0.0131 (– 0.3323 to 0.3060)	0.9357
Asia	0.0354 (– 0.0814 to 0.1522)	0.5528	0.1427 (– 0.1430 to 0.4284)	0.3275
South America	0.3014 (0.1353 to 0.4674)	**0.0004**	0.3431 (0.0066 to 0.6797)	**0.0457**
Oceania	– 0.0469 (– 0.1770 to 0.0833)	0.4802	0.0062 (– 0.2807 to 0.2931)	0.9664
North America and Oceania	– 0.1452 (– 0.3323 to 0.0419)	0.1284	– 0.0575 (– 0.4539 to 0.3389)	0.7762
Gender				
Female	Reference	–	–	–
Male	0.0010 (-0.0707 to 0.0727)	0.9782	–	–
Age				
Mixed	Reference	–	Reference	–
Adult	– 0.0640 (– 0.1445 to 0.0165)	0.1189	– 0.2813 (– 0.5746 to 0.0120)	0.0602
Child	– 0.1692 (– 0.2752 to – 0.0631)	**0.0018**	– 0.1958 (– 0.5480 to 0.1563)	0.2758
Population source				
All hospitalized patients	Reference		Reference	
ICU	0.0756 (0.0033 to 0.1480)	**0.0404**	0.2124 (– 0.0212 to 0.4460)	0.0747
Special inpatient group	0.1939 (0.1038 to 0.2839)	**< .0001**	0.2961 (0.0363 to 0.5559)	**0.0255**
Large database	– 0.1014 (– 0.2605 to 0.0578)	0.2118	0.1348 (– 0.3083 to 0.5779)	0.5511
Study year				
NA	Reference	–	Reference	–
2010–2015	0.0452 (– 0.0403 to 0.1308)	0.3002	0.0856 (– 0.2475 to 0.4187)	0.6144
2016–2020	0.0754 (0.0234 to 0.1273)	**0.0045**	0.0088 (– 0.1809 to 0.1984)	0.9278
> 2020	0.1354 (0.0747 to 0.1961)	**< .0001**	– 0.0035 (– 0.2166 to 0.2096)	0.9743

be effective in preventing MDRPI [45]. Miyashita K et al. presented evidence supporting the efficacy of skin protectants in preventing MDRPI [46].

Our study has several strengths. First, we updated the global incidence of MDRPI since the first edition of pressure ulcers guideline (https://internationalguideline.com/). We divided the period into three phases (2010–2015, 2016–2020, > 2020) to demonstrate the differences of the incidence of MDRPI. Second, since the initial release of the guidelines for Pressure Ulcers/Injuries by EPUAP & NPIAP in 2009, there has been a consistent adherence to standardized definitions of MDRPI within the included studies, ensuring the data's representativeness. Third, the inclusion of the population did not exclude minors under the age of 18 years, ensuring the comprehensiveness of the results.

Limitations

Our study had several limitations. Our data sources were not sufficiently comprehensive to encompass global coverage. Some countries, such as Iran and South Korea, only included one article, and many countries have no relevant data. Second, although we included as many studies as possible, publication bias could not be avoided. Third, the clinical presentations of ICU patients are highly intricate, and the therapeutic modalities available in ICUs exhibit considerable heterogeneity across different nations. Based on previous literature, we cannot establish a definition of load leveling of ICU patients that is universally applied.

Conclusion

In conclusion, the incidence of MDRPI is 19.3% in ICU or other nursing institutions. It is crucial to prevent MDRPI in critically ill patients and individuals residing in underdeveloped regions. Further research is required to enhance the prevention and treatment of MDRPI, as well as to investigate the health policy preferences of countries regarding MDRPI.

Abbreviations

MDRPI Medical device-related pressure injury
CI Confidence interval
ICU Intensive care unit

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40001-024-01986-2.

Additional file 1: Figure 1 The sensitivity analyses showed little change after estimating the effect of each study. Table 1 Search terms of MDRPI. Table 2 The Newcastle-Ottawa scale for assessing quality. Table 3 Basic characteristics of included studies.

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Author contributions
JFM as the chief investigator of the study conceived the study and is responsible for the overall conduct of the study. ZFG, ZFJ, and TL are responsible for literature screening. XGL and FFL are responsible for the statistical analysis. NZ and YNL supervised the drafting of the manuscript. All the authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Data availability
Retracted data are available on https://www.jianguoyun.com/p/DeRapJQQu6iFChibwsgFIAA, and other data are available from published literature, which were included in this meta-analysis for analysis.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no conflicts of interest.

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