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Pressure Injuries in the Pediatric Population: Analysis of the 2008–2018 International Pressure Ulcer Prevalence Survey Data

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ABSTRACT

Pediatric pressure injuries continue to be a worldwide healthcare problem. Studying pediatric pressure injury point prevalence may provide more insight into the problem and drive prevention strategies for at-risk pediatric patients, a truly vulnerable population. This article reports 10 years of longitudinal pediatric pressure injury prevalence data and demographics from around the world.

KEYWORDS: global, International Pressure Ulcer Prevalence Survey, pediatric, pressure injury, pressure ulcer, prevalence

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INTRODUCTION

Pressure injuries (PIs) in the pediatric population continue to be a worldwide healthcare concern. The National Pressure Injury Advisory Panel has been a leader in championing and disseminating information regarding PIs in this population, including 2001 and 2012 monographs addressing the prevalence and incidence of PIs in the US[1,2] and a 2007 white paper on PIs in neonates and children.[3] Most recently, the 2019 white paper on PIs in the pediatric population[4] discusses the many vulnerabilities of this population and the need for standardized and concentrated efforts of interprofessional teams working together to reduce PIs.

The literature that reports PI prevalence and incidence, including medical device-related PIs (MDRPIs), focuses predominantly on adult populations.[5,6] In contrast, this article will present an overview of prevalence data from 2008 to 2018 from the pediatric population based on a subset analysis of the International Pressure Ulcer Prevalence (IPUP) Survey data. Prevalence data explicitly relating to MDRPIs in the pediatric population will be reported in another article.

Background

Raising awareness of PIs in the pediatric population has been a challenge, but in recent decades, there have been efforts to raise clinician awareness. Previously, PIs were minimally discussed, resulting in a lack of concentrated efforts surrounding prevention. Clinicians are increasingly cognizant of PI prevalence and incidence trends as a means to identify areas of needed prevention and educational strategies.

Pediatric Pressure Injury Prevalence. A 2009 article by VanGilder and colleagues[7] reported US data from

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the 2007-2009 IPUP surveys. A unit-specific analysis was conducted for US acute care data. Pediatric ICU overall and hospital-acquired (HA) prevalence was highest in 2007 at 8.9% and 7.4%, respectively (Table 1).[7] In other pediatric prevalence surveys conducted from 2007 to recent years, overall prevalence ranged from 1.4% to 35%,[8–11] pediatric ICU prevalence ranged from 3.7% to 44%,[8–10] neonatal ICU prevalence from 0.6% to 43%,[12,13] and rehabilitation unitshad a prevalence of 4.6%.[8] The facility-acquired (FA) prevalence has been reported at 1.1%.[8–10] Some reports did not specify their facility-acquired pressure injuries (FAPIs) in patient-level analysis, but rather as a percentage of all identified PIs ranging from 68% to 85%.[10,11]

It can be difficult to compare prevalence because studies vary in their reporting by the pediatric ages and units reported, categorization of units, reporting FAPIs as a prevalence estimate rather than a percentage, and the number of patients who participated on the day of survey (lower patient census can equal overinflated prevalence). Although these data are helpful in describing the scope of PI occurrence in the pediatric population, data from a large cross-sectional database such as the IPUP can provide a more comprehensive overview of the problem. Accordingly, the purpose of this article is to report 10 years of longitudinal pediatric PI prevalence data and demographics from around the world.

METHODS

The IPUP survey is designed to provide actionable feedback for healthcare facilities that participate in the survey. Facilities choose to participate in the survey by signing up on the Hillrom website (www.hillrom.com/ipup); participation is available to all facilities whether or not they buy or rent products from the survey's sponsor. Facilities receive packets with instructions and forms. A facility coordinator organizes the survey of patients with the stated aim of surveying 100% of admitted patients or residents. Coordinators return the survey forms; forms are scanned, and an actionable report is generated and provided to the facility. In addition to its primary purpose, the database that has developed over IPUP's 30-year life span can be analyzed to answer a variety of research questions.

The survey collects only deidentified data from the facilities, and only aggregate data are included in reports. The deidentified data collected are obtained through usual standard-of-care procedures such as skin assessments. In addition, facilities use their data from the survey for quality reporting initiatives and benchmarking PIs. The present study is an analysis of an existing deidentified database.

The study evaluated overall and FAPI (HA in acute care) prevalence from 2008 to 2018 in the pediatric population, defined as all patients in the database 18 years or younger in acute care, long-term acute care (LTAC), or rehabilitation facilities. Demographic data included age, sex, weight, height, and body mass index by care setting. Overall prevalence was defined as the number of patients with PIs divided by the number of patients surveyed and is reported as a percentage. Facility-acquired prevalence was calculated as the number of patients who had FAPIs divided by the number of patients surveyed.

RESULTS

There were 82,806 pediatric patients in the 10-year sample, and an average of 367 facilities participated each year (Table 2). The US represented about 90% of the population, with the remaining 10% located in Canada, Australia, Germany, Italy, the Kingdom of Saudi Arabia, Lebanon, the Philippines, Poland, Turkey, the United Arab Emirates, and the United Kingdom.

Demographics

Demographic data were limited to 2017 and 2018 because of database field changes that did not allow consistent assessment of previous years. Weight, height, body mass index, age, and sex data were extracted by age groups that included preterm (younger than 40 weeks' gestation; n = 10,233); infant (40 weeks' gestation to 2 years; n = 1,567); child (2–12 years; n = 5,198); and adolescent (12–18 years; n = 3,060) and are shown in Table 3. Weight in the preterm category required an outlier cutoff where the top 2% of data were eliminated for calculations because of several very large outliers.

Prevalence Data

There were 1,862 patients (2.25%) with a PI in the sample, and 1,165 patients (1.41%) had an FAPI. Overall prevalence ranged from as high as 5.93% in 2009 to 1.36% in 2016 (Table 2), but ultimately all facilities and countries

Table 1. US PEDIATRIC ACUTE CARE DATA FROM THE 2007–2009 INTERNATIONAL PRESSURE ULCER PREVALENCE SURVEYS

	2007 (n = 72,490)		2008 (n = 83,914)		2009 (n = 86,932)	
Unit Type	Prevalence	Hospital-Acquired Prevalence	Prevalence	Hospital-Acquired Prevalence	Prevalence	Hospital-Acquired Prevalence
Pediatric ICU	8.9%	7.4%	7.8%	7.0%	7.1%	5.1%
Pediatrics	3.6%	2.2%	4.1%	1.8%	3.0%	1.6%
Neonatal ICU	0.7%	0.7%	3.2%	2.8%	4.6%	1.3%

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Table 2. PEDIATRIC PREVALENCE DATA SUMMARY, 2008–2018

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
No. of facilities	291	391	337	474	376	368	382	355	409	352	313	368
Total population	3,054	2,801	4,628	6,809	7,777	8,043	9,349	9,878	10,409	10,210	9,848	82,806
Patients with PI	124	166	177	209	161	161	216	172	142	166	168	1,862
Overall prevalence, %	4.06	5.93	3.82	3.07	2.07	2.00	2.31	1.74	1.36	1.63	1.71	2.25
FAPI patients	75	73	126	115	105	114	147	114	85	101	110	1,165
FAPI prevalence, %	2.46	2.61	2.72	1.69	1.35	1.42	1.57	1.15	0.82	0.99	1.12	1.41
US only												
No. of facilities	283	376	322	448	360	339	341	319	367	326	283	342
Total population	2,818	2,616	4,217	6,071	7,087	7,170	7,919	8,533	9,119	8,992	8,706	73,248
Patients with PI	118	159	164	180	137	135	175	134	107	143	141	1,593
Overall prevalence, %	4.19	6.08	3.89	2.96	1.93	1.88	2.21	1.57	1.17	1.59	1.62	2.17
FAPI patients	73	68	122	100	93	97	126	90	65	86	91	1,011
FAPI prevalence, %	2.59	2.60	2.89	1.65	1.31	1.35	1.59	1.05	0.71	0.96	1.05	1.38
Outside US[a]												
No. of facilities	8	15	15	26	16	29	41	36	42	26	30	26
Total population	236	185	411	738	690	873	1,430	1,345	1,290	1,218	1,142	9,558
Patients with PI	6	7	13	29	24	26	41	38	35	23	27	269
Overall prevalence, %	6.12	3.78	3.16	3.93	3.48	2.98	2.87	2.83	2.71	1.89	2.36	2.81
FAPI patients	2	5	4	15	12	17	21	24	20	15	19	154
FAPI prevalence, %	0.85	2.70	0.97	2.03	1.74	1.95	1.47	1.78	1.55	1.23	1.66	1.61
US acute care												
No. of facilities	264	351	308	424	345	325	323	304	347	314	274	325
Total population	2,688	2,533	4,111	5,796	6,886	7,079	7,831	8,447	9,026	8,880	8,623	71,900
Patients with PI	111	149	151	169	128	129	169	130	102	137	137	1,512
Overall prevalence, %	4.13	5.88	3.67	2.92	1.86	1.82	2.16	1.54	1.13	1.54	1.59	2.10
HAPI patients	73	67	116	97	91	95	126	89	64	86	90	994
HAPI prevalence, %	2.72	2.65	2.82	1.67	1.32	1.34	1.61	1.05	0.71	0.97	1.04	1.38
US long-term acute care												
No. of facilities	10	14	5	19	9	10	11	8	12	8	4	10
Total population	34	18	39	71	47	16	15	8	12	38	4	302
Patients with PI	4	5	7	5	3	2	2	1	1	4	1	35
Overall prevalence, %	11.76	27.78	17.95	7.04	6.38	12.50	13.33	12.50	8.33	10.53	25.00	11.59
FAPI patients	0	1	4	1	1	1	0	0	0	0	0	8
FAPI prevalence, %	0.00	5.56	10.26	1.41	2.13	6.25	0.00	0.00	0.00	0.00	0.00	2.65
US rehabilitation facilities												
No. of facilities	9	10	9	5	6	4	7	7	8	4	5	7
Total population	96	64	67	204	154	75	73	78	81	74	79	1,045
Patients with PI	3	5	6	6	6	4	4	3	4	2	3	46
Overall prevalence, %	3.13	7.81	8.96	2.94	3.90	5.33	5.48	3.85	4.94	2.70	3.80	4.40
FAPI patients	0	0	2	2	1	1	0	1	1	0	1	9
FAPI prevalence, %	0.00	0.00	2.99	0.98	0.65	1.33	0.00	1.28	1.23	0.00	1.27	0.86

Abbreviations: FA, facility-acquired; HA, hospital-acquired; PI, pressure injury.
[a]Outside of the US, facilities were from Australia, Canada, Germany, Italy, Lebanon, the Philippines, Poland, Saudi Arabia, Turkey, the United Arab Emirates, and the United Kingdom.

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Table 3. PEDIATRIC PATIENT DEMOGRAPHICS FOR 2017 AND 2018

Age Group	No. of Patients	Weight, kg	Height, cm	BMI[a]	Age	% Male	% Female	% Unknown
Preterm (<40 wks)	10,233	3.41 (1.89)[b]	53.27 (24.87)	12.05	7.42 (9.23) wk	55.04	43.89	1.07
Infant (40 wk to 2 y)	1,567	13.19 (44.99)	76.74 (33.54)	22.40	1.004 (0.12) y	52.46	47.16	0.38
Child (2-12 y)	5,198	27.23 (30.40)	114.24 (36.94)	20.86	5.84 (2.90) y	53.89	45.25	0.87
Adolescent (12-18 y)	3,060	65.04 (51.53)	161.51 (51.71)	24.93	14.76 (1.70) y	50.07	49.31	0.62

Abbreviation: BMI, body mass index.
[a]BMI was calculated as follows: weight / height in meters squared.
[b]Removed top 2% of observations (n = 125) because there were several outliers (>1,000 kg).

showed a decreasing trend of 0.35% per year (Figure 1). The FAPI prevalence was as low as 0.82% in 2016 and as high as 2.72% in 2010 (Table 2), but prevalence for all countries and all facilities showed a decreasing trend of 0.18% per year (Figure 2).

US Data (2008–2018). Of the 73,248 pediatric patients located in the US, 1,593 patients (2.17%) had a PI, and 1,011 patients (1.38%) had an FAPI. Overall prevalence over the entire period ranged from as high as 6.08% in 2009 to as low as 1.17% in 2016 (Table 2), a decreasing trend of 0.36% (Figure 1). The overall FAPI prevalence also showed a decreasing trend of 0.2% (Figure 2).

Outside the US (2008–2018). Of the 9,558 patients located outside the US, 269 patients (2.81%) had a PI, and 154 patients (1.61%) had an FAPI. Overall prevalence over the entire period ranged from as high as 6.12% in 2008 and was at its lowest in 2017 at 1.89% (Table 2); data showed a decreasing trend of 0.28% (Figure 1). However, FAPI prevalence did not decrease over the 10-year period outside the US, as noted by the flat regression line in Figure 2.

US Acute Care (2008–2018). Of the 71,900 pediatric patients in participating US acute care facilities, 1,512 patients (2.10%) had a PI, and 994 patients (1.38%) had a hospital-acquired pressure injury (HAPI). Overall prevalence ranged from greater than 5.88% in 2009 to a low of 1.13% in 2016; prevalence has remained below 2% in recent years (Table 2). Overall prevalence shows a decreasing trend of 0.36% (Figure 1). The overall HAPI prevalence also showed a decreasing trend of 0.2% (Figure 2).

US LTAC Hospitals (2008–2018). There were 35 patients (11.59%) with a PI and 8 patients (2.65%) with an FAPI in the 2008–2018 sample of 302 patients. Overall prevalence ranged from as low as 6.38% in 2012 to nearly 28% in 2009. More recently, the prevalence was 25% in 2018 (Table 2). The sample for this group is extremely small (only four patients in 2018), and the data report only one patient in this group in 2009, 2011, 2012, and 2013, respectively. Many years did not see any FAPI.

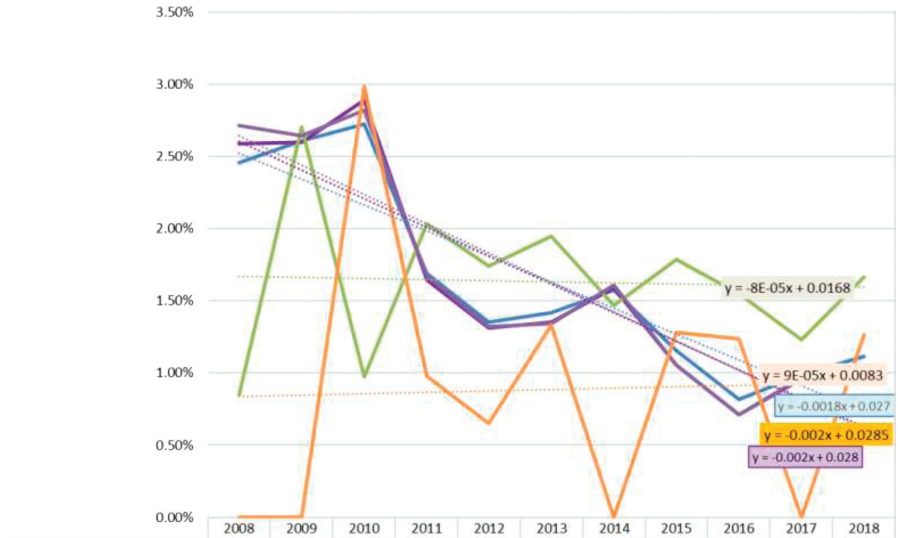
US Rehabilitation Facilities (2008–2018). There were 46 patients (4.40%) with a PI of the 1,045 patients at participating US rehabilitation facilities and 9 patients

Figure 1. OVERALL PRESSURE INJURY PREVALENCE



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
All Countries / all facilities	4.06%	5.93%	3.82%	3.07%	2.07%	2.00%	2.31%	1.74%	1.36%	1.63%	1.71%
US ONLY	4.19%	6.08%	3.89%	2.96%	1.93%	1.88%	2.21%	1.57%	1.17%	1.59%	1.62%
Outside US*	6.12%	3.78%	3.16%	3.93%	3.48%	2.98%	2.87%	2.83%	2.71%	1.89%	2.36%
US Acute Care	4.13%	5.88%	3.67%	2.92%	1.86%	1.82%	2.16%	1.54%	1.13%	1.54%	1.59%
US Rehab	3.13%	7.81%	8.96%	2.94%	3.90%	5.33%	5.48%	3.85%	4.94%	2.70%	3.80%

Figure 2. HOSPITAL- AND FACILITY-ACQUIRED PREVALENCE



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
All Countries / all facilities	2.46%	2.61%	2.72%	1.69%	1.35%	1.42%	1.57%	1.15%	0.82%	0.99%	1.12%
US ONLY	2.59%	2.60%	2.89%	1.65%	1.31%	1.35%	1.59%	1.05%	0.71%	0.96%	1.05%
Outside US*	0.85%	2.70%	0.97%	2.03%	1.74%	1.95%	1.47%	1.78%	1.55%	1.23%	1.66%
US Acute Care	2.72%	2.65%	2.82%	1.67%	1.32%	1.34%	1.61%	1.05%	0.71%	0.97%	1.04%
US Rehab	0.00%	0.00%	2.99%	0.98%	0.65%	1.33%	0.00%	1.28%	1.23%	0.00%	1.27%

(0.86%) with an FAPI. Overall prevalence in this period ranged from 8.96% in 2010 down to 2.70% in 2017 (Table 2).

DISCUSSION

Overall pediatric PI prevalence has decreased from 2008 and 2009 compared with 2016 through 2018. The lowest FAPI prevalence was 1.36% in 2016. The overall prevalence in this study was lower (2.25%) as compared with data reported in the 2007–2009 IPUP pediatric surveys[7] and other studies within this time frame.[9–11] However, it is higher than Razmus and Bergquist-Beringer's[8] National Database for Nursing Quality Indicators findings, although their findings were only from 2012.

Overall, the FAPI prevalence was lower (1.41%) than the prevalence reported in the 2007–2009 IPUP pediatric surveys.[7] The FAPI prevalence is similar to Razmus and Bergquist-Beringer's[8] 2012 findings. That said, the prevalence in LTAC tended to be higher than in other facility types. Pediatric patients in LTAC facilities are likely to have multiple comorbid and/or chronic conditions that may drive a higher overall prevalence in those facility types; in addition, the overall census in these facilities is lower, which may contribute to an overinflated prevalence.

Overall prevalence trends show an initial decrease with a small increase in 2018. This surge may represent increased provider awareness that pediatric patients do develop PIs. The prevalence for rehabilitation facilities has decreased since the earlier years and is now more variable. As compared with facilities outside the US (Table 2), overall prevalence in the US is lower, except for 2009 and 2010 data.

The overall prevalence of HAPIs in US acute care has decreased. This decrease may be attributable to concerted efforts to reduce HA conditions, especially pediatric PIs. Organizations such as the Children's Hospitals' Solutions for Patient Safety Network have made concerted efforts to educate staff about the harm that PIs can cause among hospitalized children and neonates.

The data provide evidence of increased clinician awareness about pediatric PI.[4] Earlier data showed that PIs were misdiagnosed as skin breakdown, trauma, or necrosis, especially when referring to MDRPIs, which only further concealed the issue and delayed diagnosis and thus prevention.[4] With recent concerted efforts to raise awareness regarding pediatric PI, more focus has been placed on standardized prevention strategies.[4,14–17] Younger patients are inherently more vulnerable to PIs because of differences in skin maturity at different ages. Accordingly, facilities have rightly identified the pediatric population as high-risk for PI and may have even standardized their prevention strategies in bundles or by pediatric age groups.[3,4,15–19] These efforts, however, need to be sustained. Razmus and Bergquist-Beringer[13] found that most pediatric patients were being assessed for PI risk, but the consistent implementation of prevention strategies needed improvement. More importantly, an interprofessional team including industry partners is key in creating and sustaining prevention efforts.[4]

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Limitations

The primary limitations of this study are twofold. First, the data are self-reported by facilities that choose to participate in the IPUP survey. Second, although facilities are encouraged to survey 100% of admitted patients, this may not be clinically possible. Therefore, the data may or may not be representative of the full scope of FAPI.

CONCLUSIONS

This article provides evidence that PI prevalence is trending downward but continued vigilance and sustained prevention efforts are needed to maintain this trend. Up-to-date research and interprofessional collaboration are required to ensure that prevention efforts remain clinically relevant. The pediatric population is a vulnerable population and will always require special attention. Further analyses of large databases are needed to continue to define the problem in the pediatric population including more specific data such as PI staging, PI location, and MDRPIs. ●

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