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**Perceptions, impact and scope of medication errors with opioids in Australian specialist palliative care inpatient services: A mixed methods study (the PERISCOPE project)**

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# **Chapter 4: Identifying opioid error prevalence, patient impact and characteristics in NSW and local palliative care services**

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## **4.1 Chapter preface**

Despite the frequency in which opioids are used in palliative care services, the systematic review reported in Chapter 2 identified a dearth of empirical studies reporting opioid error prevalence, patient impact and characteristics in this setting (Heneka, Shaw, Rowett, & Phillips, 2015). Given these gaps in the literature, the second and third studies in the PERISCOPE project sought to undertake a retrospective review of opioid errors reported by palliative care services across the NSW public health system (Study 2) and in three local specialist palliative care inpatient services (Study 3). This chapter reports the individual results of Studies 2 and 3.

## **4.2 Context for Study 2**

In Australia, opioids currently account for three of the top five medications involved in reported clinical incidents (Clinical Excellence Commission, 2019) and are widely used to manage cancer related pain. While a cohort of NSW palliative and cancer care clinicians had identified opioid errors as a patient safety priority (Heneka, Shaw, Azzi, & Phillips, 2018), little could be gleaned from the existing literature about the characteristics, contributory factors and patient impact of opioid errors in these care settings. In order to better understand opioid errors in palliative and cancer care services, it was decided to analyse clinical incidents involving opioids in palliative care and cancer services, reported through the NSW state-wide incident management system.

An unpublished report of study results from Study 2 was completed for the Clinical Excellence Commission (Heneka, Shaw, Rowett, Lapkin, & Phillips, 2018).

### 4.3 Objectives - Study 2

The objectives of Study 2 were to identify:

- i) the number of clinical incidents involving opioids reported in NSW via the incident management system [January 1, 2011 – December 31, 2014]; and
- ii) characteristics of opioid errors reported in NSW palliative and cancer care services, related to incident type, opioid involved and patient outcome.

### 4.4 Methods - Study 2

Study methods have been described in Chapter 3.

### 4.5 Results - Study 2

#### 4.5.1 Dataset 1

Over four years, NSW public health services (N=220) reported 13,555 incidents involving opioids (Table 4.1). The majority (71%, n=9066) of opioid incidents were categorised as SAC 4 (Table 4.1). Palliative care services had the 7<sup>th</sup> highest opioid incident reporting rate by service type (3.4%, n=467), while cancer services reported a much smaller proportion of opioid incidents (1.9%, n=258) (Table 4.2).

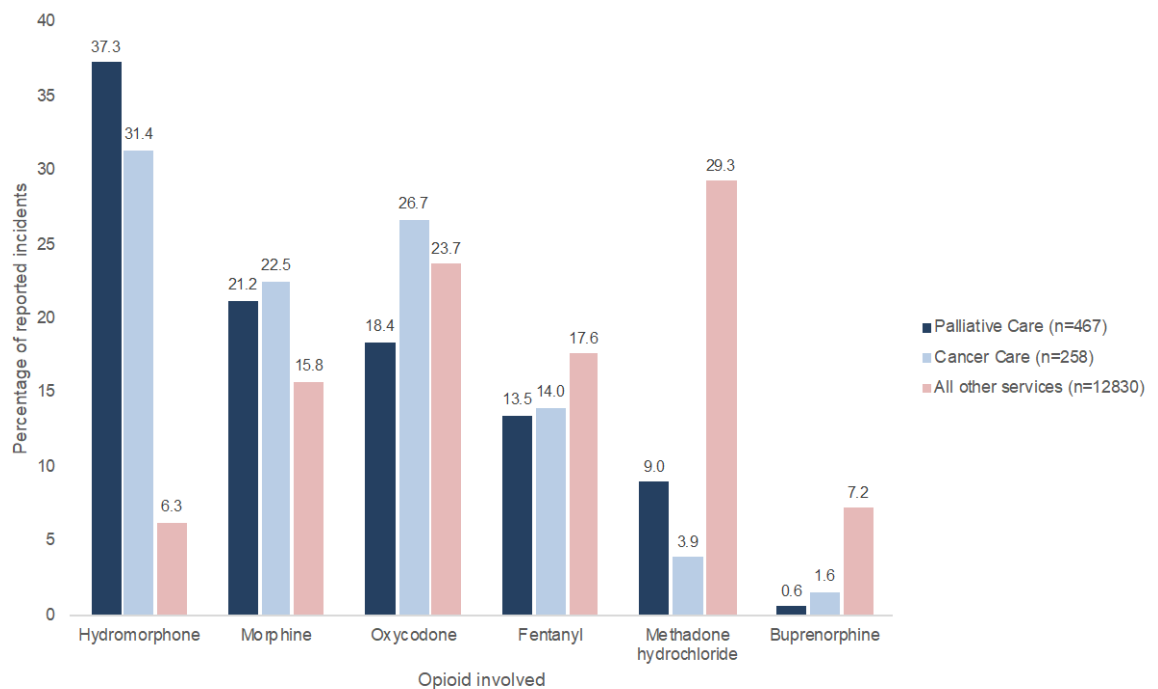
**Table 4.1 Reported opioid incidents by service and SAC [Jan 1, 2011 – Dec 31, 2014]**

	Palliative Care		Cancer Care		All other services combined		Total	
<b>2011-2014</b>	N=467	(%)	N=258	(%)	N=12830	(%)	N=13555	(%)
<b>Opioid incidents by year</b>								
2011	104	(22.2)	55	(21.3)	2874	(22.4)	3033	(22.4)
2012	132	(28.3)	65	(25.2)	3104	(24.2)	3301	(24.3)
2013	109	(23.3)	71	(27.5)	3298	(25.7)	3478	(25.7)
2014	122	(26.1)	67	(26.0)	3554	(27.7)	3743	(27.6)
<b>Opioid incidents by SAC</b>								
SAC 1	0	(0)	2	(0.8)	5	(0.1)	7	(0.05)
SAC 2	4	(0.9)	1	(0.4)	48	(0.4)	53	(0.4)
SAC 3	133	(28.5)	68	(26.4)	3553	(27.7)	3754	(27.7)
SAC 4	314	(67.2)	185	(71.7)	9066	(70.7)	9565	(70.6)
SAC not allocated	16	(3.4)	2	(0.8)	158	(1.2)	176	(1.3)

**Table 4.2 Percentage of reported opioid incidents in the NSW public health service by service type [January 1, 2011 – December 31, 2014]**

Service type	Reported opioid errors		Service type	Reported opioid errors	
	n	%		n	%
Drug - Alcohol Services	2014	14.9%	Adolescent Health	29	0.2%
Pharmacy	1283	9.5%	Surgical - Gynaecology	29	0.2%
Medicine - General	1133	8.4%	Women's Health - General	29	0.2%
Aged Care - Geriatrics	788	5.8%	Paediatric Surgery	28	0.2%
Ambulatory Care	620	4.6%	Burns - Severe	22	0.2%
Surgical - General	477	3.5%	Outpatient Services	21	0.2%
<b>Palliative Care</b>	<b>467</b>	<b>3.4%</b>	Clinical	18	0.1%
Emergency Medicine	445	3.3%	Pharmacology/Toxicology	18	0.1%
Intensive Care	437	3.2%	Spinal Services	18	0.1%
Ambulance Emergency	436	3.2%	Transplant Services	15	0.1%
Surgical - Orthopaedics	400	3.0%	Rheumatology	13	0.1%
Rehabilitation	341	2.5%	Surgical - Cardiothoracic	13	0.1%
Pain Management	296	2.2%	Trauma Services	13	0.1%
<b>Medical/Radiation Oncology</b>	<b>258</b>	<b>1.9%</b>	Aged Care - Community	12	0.1%
Other	202	1.5%	Imaging	12	0.1%
Obstetrics - Maternity	175	1.3%	Stroke	12	0.1%
Mental Health - Inpatient	172	1.3%	Endocrinology	10	0.1%
Anaesthetics	166	1.2%	Surgical - Neurosurgery	9	0.1%
Recovery	130	1.0%	Mental Health - Community	8	0.1%
Cardiology	125	0.9%	Surgical - Ophthalmology	8	0.1%
Respiratory Medicine	124	0.9%	Forensic Inpatient Services	7	0.1%
Operating Theatre	119	0.9%	Surgical - Hand	7	0.1%
Paediatrics	117	0.9%	Ambulance Aeromedical	6	0.0%
Haematology	113	0.8%	Immunology & Allergy	6	0.0%
Renal Medicine	105	0.8%	Ambulance Patient Transport	5	0.0%
Surgical - Colorectal	86	0.6%	Infection Control	5	0.0%
Gastroenterology	84	0.6%	Surgical - Oral Maxillo-Facial	5	0.0%
Surgical - Vascular	78	0.6%	HMO/VMO	4	0.0%
Neurology	74	0.5%	AIDS - Infectious Diseases	3	0.0%
Neurosurgery	64	0.5%	Mental Health - Rehabilitation	3	0.0%
Mental Health - Forensic Inpatient	61	0.5%	Public Health	3	0.0%
Neonatology	61	0.5%	Aboriginal Health Services	2	0.0%
Cardiothoracic	57	0.4%	Dental - Oral Health	2	0.0%
Surgical - Urology	57	0.4%	NETS	2	0.0%
Aged Care - Psychogeriatrics	53	0.4%	Ambulance Administrative Services	1	0.0%
Paediatric Oncology	52	0.4%	Ambulance Education/Training	1	0.0%
Community Nursing	42	0.3%	Ambulance Rapid Response	1	0.0%
Surgical - Plastic & Reconstructive	37	0.3%	Ambulance SCAT	1	0.0%
General Practice	36	0.3%	Ambulatory Care - Paediatric	1	0.0%
Ambulance Equipment	34	0.3%	Child Protection	1	0.0%
Surgical - ENT - Otolaryngology	31	0.2%	Occupational Therapy	1	0.0%
			Patient Transport	1	0.0%
			Service Not Specified	1318	9.7%
			<b>Total</b>	<b>13555</b>	<b>100%</b>

Seven SAC 1 notifications involving hydromorphone (n=3), morphine (n=3) and fentanyl (n=1) were reported. In this trend search, two SAC 1 notifications involving hydromorphone (n=1) and fentanyl (n=1) occurred in cancer services. All SAC 2 notifications in cancer and palliative care services involved hydromorphone; whereas, oxycodone (n=15), morphine (n=12) and fentanyl (n=11) resulted in the majority of SAC 2 notifications in all other services combined. Cancer and palliative care services were significantly more likely to report errors with hydromorphone ( $\chi^2_1=787, p<.001$ ) and morphine ( $\chi^2_1=17, p<.001$ ), compared to all other services combined (Figure 4.1).



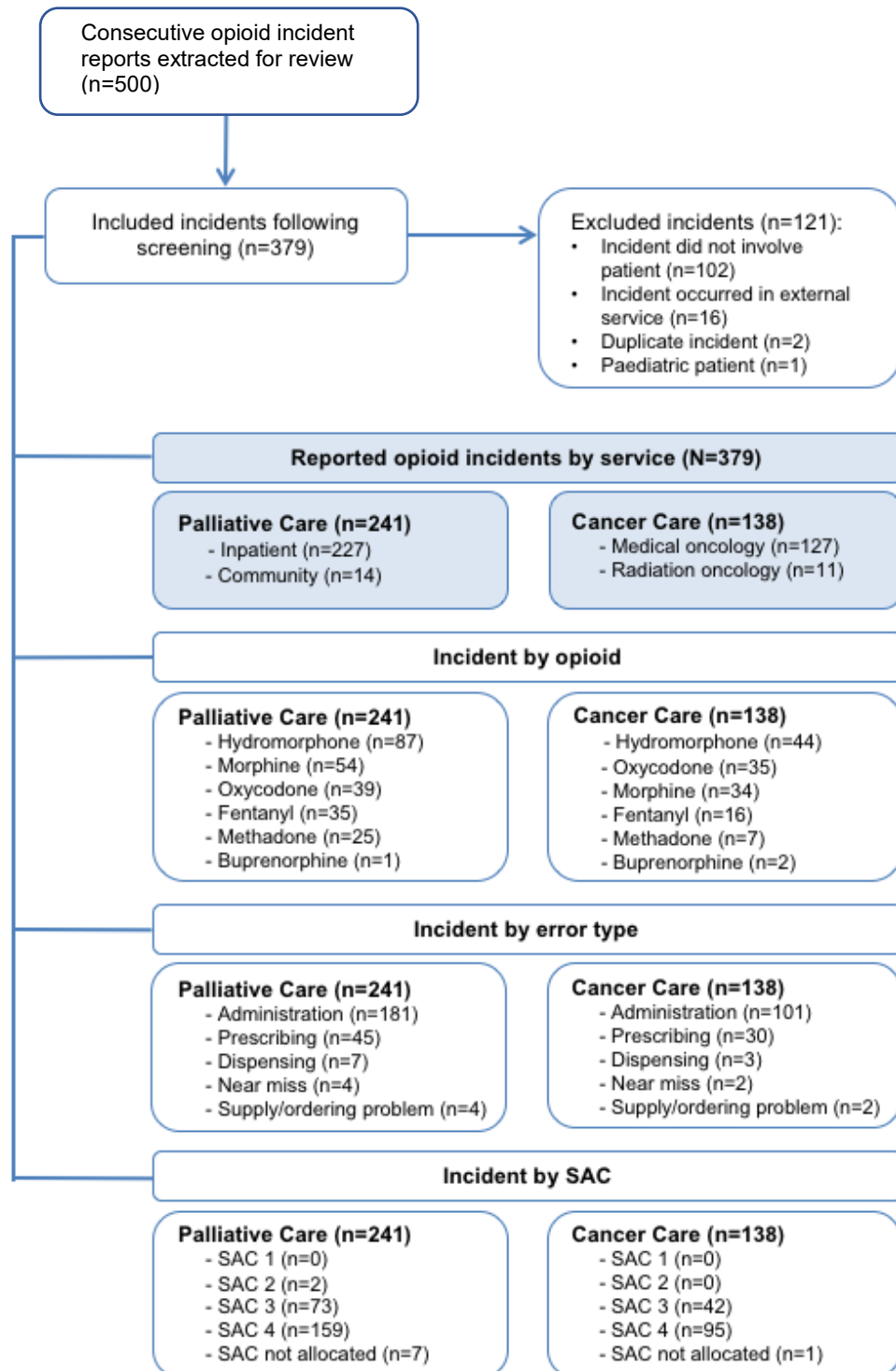
**Figure 4.1 Incident reports by service type and opioid involved (2011-2014) (N=13555)**

#### 4.5.2 Dataset 2

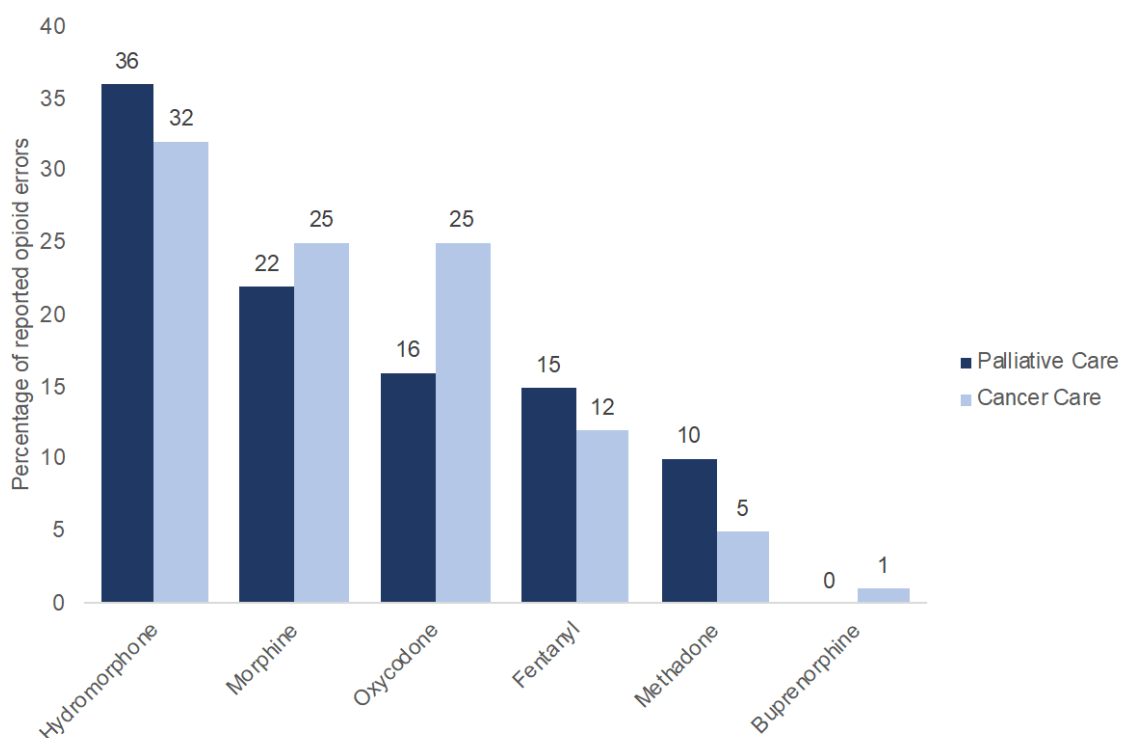
Of the 500 extracted records, 379 incident reports from palliative care and cancer services met the inclusion criteria for data analysis ('opioid incidents') (Figure 4.2). Two-thirds (64%, n=241) of opioid Incidents were reported in palliative care services.

Error SAC ratings were similar for both service types with two-thirds of incidents rated SAC 4 (cancer services: 69%, n=95; versus palliative care: 66%, n=159), and one-third rated SAC 3 (cancer services: 30%, n=42 versus palliative care: 30%, n=73). Two SAC 2 errors were reported in palliative care, both involving hydromorphone. The majority of opioid incidents across both service types involved

hydromorphone (35%, n=131), morphine (23%, n=88) or oxycodone (20%, n=74) (Figure 4.3).



**Figure 4.2 Overview of incident reports included for analysis (N=379)**



**Figure 4.3 Opioid errors by service type and opioid involved (N=379)**

#### *Opioid incidents by problem type*

In both palliative and cancer care services, opioid administration errors comprised approximately three-quarters (74%, n=282) of reported errors (Table 4.3).

Prescribing errors accounted for one-fifth (20%, n=75) of errors with much smaller numbers of dispensing (3%, n=10), near miss (2%, n=6) and drug supply issues (2%, n=6) reported.

#### *Administration errors*

Omitted dose (29%, n=81), wrong dose (15%, n=42) and wrong route (14%, n=38) errors were the leading reported administration error types overall (Table 4.3).

Palliative care services reported significantly more omitted dose errors ( $\chi^2=15$ ,  $p<.001$ ) compared to cancer services, whereas cancer services reported significantly more wrong route errors ( $\chi^2=15$ ,  $p=.001$ ). All omitted doses, bar one, were non-therapeutic omissions, not doses withheld based on clinical judgement. Three-quarters (74%, n=28) of wrong route errors occurred when opioids were administered subcutaneously instead of orally, almost half of which (47%, n=13) occurred with hydromorphone.

**Table 4.3 Reported opioid incidents by service and problem type (N=379)**

Problem type	Incident type	Palliative Care		Cancer Care		Total		p-value*
		N=241	(%)	N=138	(%)	N=379	(%)	
<b>Administration</b>	<b>Total</b>	<b>181</b>	<b>(75.1)</b>	<b>101</b>	<b>(73.2)</b>	<b>282</b>	<b>(74.4)</b>	0.55
	Omitted dose	66	(36.5)	16	(15.8)	82	(29.1)	<.001
	Wrong dose	22	(12.2)	20	(19.8)	42	(14.9)	0.12
	Device – wrong rate	20	(11.0)	5	(5.0)	25	(8.8)	0.07
	Transdermal patch error	14	(7.7)	11	(10.9)	25	(8.8)	0.43
	Device – other error	14	(7.7)	4	(4.0)	18	(6.4)	0.41
	Wrong route	13	(7.1)	25	(24.8)	38	(13.5)	0.001
	Wrong drug	13	(7.1)	12	(11.9)	25	(8.8)	0.22
	Wrong patient	6	(3.3)	2	(2.0)	8	(2.8)	**
	Incomplete administration	5	(2.8)	2	(2.0)	7	(2.5)	**
	Wrong technique	4	(2.2)	2	(2.0)	6	(2.1)	**
	Wrong time	4	(2.2)	2	(2.0)	6	(2.1)	**
<b>Prescribing</b>	<b>Total</b>	<b>45</b>	<b>(18.7)</b>	<b>30</b>	<b>(21.7)</b>	<b>75</b>	<b>(19.8)</b>	0.35
	Medication charting	20	(44.4)	18	(60.0)	38	(50.1)	0.15
	Wrong dose	10	(22.2)	4	(13.3)	14	(18.7)	**
	Wrong drug	8	(17.8)	3	(10.0)	11	(14.7)	**
	Wrong dosage form	2	(4.4)	2	(5.0)	4	(5.3)	**
	Opioid conversion error	2	(4.4)	0	0	2	(2.7)	**
	Wrong route	1	(2.2)	1	(2.5)	2	(2.7)	**
	Wrong patient	1	(2.2)	1	(2.5)	2	(2.7)	**
	Device – wrong rate	1	(2.2)	0	0	1	(1.3)	**
	Delayed order	0	0	1	(3.2)	1	(1.3)	**
<b>Dispensing</b>	<b>Total</b>	<b>7</b>	<b>(2.9)</b>	<b>3</b>	<b>(2.2)</b>	<b>10</b>	<b>(2.6)</b>	**
	Labelling error	2	(28.6)	1	(33.3)	3	(30.0)	**
	Wrong device	2	(28.6)	0	0	2	(20.0)	**
	Wrong amount	1	(14.3)	1	(33.3)	2	(20.0)	**
	Wrong patient	1	(14.3)	0	0	1	(10.0)	**
	Unauthorised dispensing	1	(14.3)	0	0	1	(10.0)	**
	Communication error	0	0	1	(33.3)	1	(10.0)	**
	<b>Near miss</b>	<b>Total</b>	<b>4</b>	<b>(1.7)</b>	<b>2</b>	<b>(1.4)</b>	<b>6</b>	<b>(1.6)</b>
Wrong drug	2	(50.0)	0	0	2	(33.3)	**	
Wrong dose	1	(25.0)	0	0	1	(16.7)	**	
Wrong route	1	(25.0)	0	0	1	(16.7)	**	
Wrong patient	0	0	1	(50.0)	1	(16.7)	**	
Drug preparation	0	0	1	(50.0)	1	(16.7)	**	
<b>Supply/ordering problem</b>	<b>Total</b>	<b>4</b>	<b>(1.7)</b>	<b>2</b>	<b>(1.4)</b>	<b>6</b>	<b>(1.6)</b>	**
	Nil stock	4	(100)	2	(100)	6	(100)	**

\*df=1; \*\*Count not strong enough to provide statistical evidence



### *Prescribing errors*

Prescribing errors accounted for 20% (n=75) of reported incidents. Medication charting errors comprised half (50%, n=38) of all reported prescribing errors, over one third (39%, n=15) of which were due to ambiguous written opioid orders. One-quarter (23%, n=9) of charting errors occurred when re-charting opioid orders, including discharge medications. Wrong dose (20%, n=15) and dosage form (immediate versus extended release) errors (5%, n=4) collectively accounted for one quarter of prescribing errors, almost half of which (47%, n=9) involved hydromorphone.

### *Other errors*

Dispensing (3%, n=10) and opioid supply/ordering (2%, n=6) problems were less frequently reported; however, almost half (44%, n=7) of these incidents directly resulted in patient harm due to clinically significant opioid underdose.

### *Patient impact*

Of the 379 errors reported, 93% (n=353) reached the patient (Table 4.4). Almost half (49%, n=184) of opioid errors that reached the patient required clinical intervention to preclude or manage harm. Patient impact/outcome was not recorded in the incident report in 43% (n=161) of incidents, limiting data analysis. In this data set, palliative care services recognised and notified significantly more incidents involving opioid underdosing ( $\chi^2=11$ ,  $p=.001$ ), whereas opioid overdose was significantly more recognised and notified in cancer services ( $\chi^2=13$ ,  $p<.001$ ). There were no significant differences in patient harm reported ( $p=.684$ ), or reported need for clinical intervention ( $p=.434$ ) following an opioid error for patients aged 65 years or over (57%, n=202) in either service type. Almost half of all omitted doses (48%, n=39) resulted in patients requiring additional monitoring and/or PRN opioids to manage increased pain. The majority (79%, n=30) of wrong route errors resulted in opioid overdose, and over half (55%, n=23) of wrong dose errors resulted in opioid overdose ranging from 1.5 to 10-fold higher doses being administered than ordered.

**Table 4.4 Impact of reported opioid errors on patient outcomes by service type**

	Palliative Care		Cancer Care		Total		p-value*
	N=241	(%)	N=138	(%)	N=379	(%)	
<b>Error reached patient</b>							
Yes	223	(92.5)	130	(94.2)	353	(93.1)	0.15
No	16	(6.6)	4	(2.9)	20	(5.3)	
Could not determine	2	(0.8)	4	(2.9)	6	(1.6)	
<b>Patient outcome (NCC MERP error category (Hartwig, Denger, &amp; Schneider, 1991))</b>							
Category B - error occurred, did not reach patient	15	(6.2)	3	(2.2)	18	(4.7)	0.19
Category C - error reached patient, no patient harm <sup>a</sup>	11	(4.6)	5	(3.6)	16	(4.2)	0.65
Category D - error reached patient, required monitoring <sup>b</sup> and/or intervention <sup>c</sup> to preclude harm <sup>a</sup>	72	(29.9)	53	(38.4)	125	(33.0)	0.11
Category E - error resulting in temporary patient harm <sup>a</sup> which required intervention <sup>c</sup>	37	(15.4)	20	(14.5)	57	(15.0)	0.87
Category F - error resulting in temporary patient harm <sup>a</sup> which required initial or prolonged hospitalisation	2	(0.8)	0	0	2	(0.5)	**
Error reached patient - patient impact/outcome not documented	104	(43.2)	57	(41.3)	161	(42.5)	
<b>Incident dose outcome (patient reached)</b>							
Opioid underdose	134	(60.1)	53	(40.8)	187	(53.0)	0.001
Opioid overdose	66	(29.6)	64	(49.2)	130	(36.8)	<.001
Could not determine	23	(10.3)	13	(10.0)	36	(10.2)	

<sup>a</sup> Harm: Impairment of physical, emotional, or psychological function or structure of the body and/or pain resulting from error (Hartwig et al., 1991)

<sup>b</sup> Monitoring: observation or recording of relevant physiological or psychological signs (Hartwig et al., 1991)

<sup>c</sup> Intervention: change in therapy or active medical treatment (Hartwig et al., 1991)

\*df=1; \*\*Count not strong enough to provide statistical evidence

### *Error contributory factors*

Active failures, described as errors made by the clinician, were identified as contributing to opioid errors in over half (59%, n=222) of incident reports, primarily due to non-compliance with medication handling policy (36%, n=80) (Table 4.5). Notably, one-third (30%, n=111) of incident reports did not have a contributory factor documented, limiting accurate analysis. Poor clinical communication contributed to 17% of opioid errors, due to ambiguous or illegible opioid orders (n=41), and deficits in clinical hand-over (n=23). Additionally, staff workload and/or sub-optimal skill mix was noted to have contributed to 9% of opioid errors (n=34), while clinician inexperience contributed to 8% (n=31). At an organisational level, drug supply issues (n=6), absence of medical personnel (n=3), and issues with medication chart access (n=2) contributed to 3% of errors.

**Table 4.5 Opioid error contributory factors identified in incident reports per the Yorkshire Contributory Factors Framework (Lawton et al., 2012)**

	Palliative Care		Cancer Care		Total	
Factor	N=241	(100%)	N=138	(100%)	N=379	(100%)
<b>Active failures</b>	<b>143</b>	<b>(59.3)</b>	<b>82</b>	<b>(59.4)</b>	<b>222</b>	<b>(59.4)</b>
- violation (non-compliance with medication handling policy)	52	(36.4)	28	(34.1)	80	(36.0)
- slip, lapse or mistake	28	(19.6)	6	(7.3)	34	(15.3)
- unable to determine	63	(44.1)	48	(58.5)	111	(50.0)
<b>Situational factors</b>	<b>25</b>	<b>(10.4)</b>	<b>9</b>	<b>(6.5)</b>	<b>34</b>	<b>(9.0)</b>
Individual factors - inexperience	23	(92.0)	8	(88.9)	31	(91.2)
Patient factors	2	(8.0)	1	(11.1)	3	(9.8)
Task characteristics			<i>Nil identified</i>			
Team factors			<i>Nil identified</i>			
<b>Local working conditions</b>	<b>26</b>	<b>(10.8)</b>	<b>13</b>	<b>(9.4)</b>	<b>39</b>	<b>(10.3)</b>
Staff workload	17	(65.4)	11	(84.6)	28	(71.8)
Management of staff and staffing levels (skill mix)	5	(19.2)	1	(7.7)	6	(15.4)
Equipment and supplies – device malfunction (syringe driver)	4	(15.4)	1	(7.7)	5	(12.8)
Lines of responsibility			<i>Nil identified</i>			
Supervision and leadership			<i>Nil identified</i>			
<b>Latent/organisational factors</b>	<b>5</b>	<b>(2.1)</b>	<b>6</b>	<b>(4.3)</b>	<b>11</b>	<b>(2.9)</b>
Support from central functions	5	(100)	6	(100)	11	(100)
Physical environment			<i>Nil identified</i>			
Policies and procedures			<i>Nil identified</i>			
Scheduling and bed management			<i>Nil identified</i>			
Training and education			<i>Nil identified</i>			
<b>Latent external factors</b>	<b>6</b>	<b>(2.5)</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>(1.6)</b>
Design of equipment and supplies - transdermal patch adhesion	6	(100)	0	0	6	(100)
External policy context			<i>Nil identified</i>			
<b>General factors</b>						
Communication systems	<b>36</b>	<b>(14.9)</b>	<b>28</b>	<b>(20.3)</b>	<b>64</b>	<b>(16.9)</b>
- Written communication	25	(69.4)	16	(57.1)	41	(64.1)
- Clinical handover	11	(30.6)	12	(42.9)	23	(35.9)
Safety culture			<i>Nil identified</i>			

## 4.6 Discussion – Study 2

This retrospective review study has provided insights into the characteristics of reported medication errors with opioids in palliative and cancer care services at a state-wide level. As acknowledged previously, when analysing clinical incident notifications multiple sources of data/information are required to understand the context. Given the wide variation between services and facilities in NSW Health, accurate comparisons cannot be made based on incident notification numbers alone as many variables can influence incident reporting.

During the four year reporting period, palliative and cancer care services in NSW reported significantly more incidents with hydromorphone and morphine compared to all other services combined. These data may reflect that the patient population in palliative and cancer care services are more likely to be using opioids (in particular hydromorphone and morphine) for pain than other services. This also highlights the risk of patient harm in an already vulnerable patient population (Myers & Lynn, 2001). In contrast, incidents with oxycodone and morphine are the most frequently reported in other services in the NSW public health system (Clinical Excellence Commission, 2019).

Opioid administration and prescribing errors were the most frequently reported problem type, consistent with opioid error reporting trends in other health care settings (Carson, Jacob, & McQuillan, 2009; Desai et al., 2013; Dy, Shore, Hicks, & Morlock, 2007). However, opioid prescribing error reporting was slightly lower in palliative and cancer services than identified in other acute care units (15% vs. 21%) (Dy et al., 2007). The complexity of patients, interpretation of error, differing drug utilisation between settings, and variability in staff reporting, are other factors that may contribute to this finding.

There were notable differences in reported administration error types and subsequent dose errors between services. Of note, and somewhat unexpectedly, palliative care services reported significantly more omitted dose errors than cancer services, with a correspondingly significant rate of opioid under dose directly due to error. This is in contrast to opioid dose outcomes in another study where over half (53%) of all reported opioid errors in acute care settings resulted in opioid overdose (Dy et al., 2007).

Conversely, in this study, the reporting of opioid overdose due to error in cancer services was significantly greater than reported in palliative care services, likely attributable to the significantly higher number of wrong route errors, most of which involved hydromorphone given subcutaneously instead of orally. While wrong route errors, both with opioids (Dy et al., 2007) and other drugs (Barker, Flynn, Pepper, Bates, & Mikeal, 2002), are relatively infrequent in other adult healthcare settings, hydromorphone is over three-times more potent when delivered subcutaneously compared to orally (eviQ Cancer Treatments Online, 2018), considerably adding to the risk of patient harm from opioid overdose.

Patients over 65 are more likely to be exposed to, and experience harm from, medication errors (Myers & Lynn, 2001). Over half of patients who experienced an opioid error in this study were aged 65 years over; however, there were no significant differences in the degree of patient harm following an error for these patients, compared to those aged under 65 years. These findings warrant further investigation, as almost half the incident reports did not document patient outcome following the error, limiting data analysis.

Initial analysis of factors contributing to opioid errors suggest active failures underpinned errors in almost half of all incident reports. Importantly, contributory factors are identified by the clinician completing the incident report and have not been validated. Error contributory factors skewed towards human error in this study, which may be due to the notifiers' limited understanding of latent causes of error and the tendency to report the error or individual factor itself as the cause (Lawton et al., 2012; Mahajan, 2010). All reported error contributory factors were adequately represented by the Yorkshire Contributory Factors Framework (Lawton et al., 2012) in this study. A comprehensive analysis of opioid error contributory factors, combining data from incident reports and clinicians' perceptions, is warranted to identify individual, organisational and/or latent factors that may be contributing to opioid errors in cancer and palliative care services.

Based on the results of this retrospective review of opioid error data across NSW, further exploration of opioid error prevalence, error contributory factors, and patient impact at a local level, and in the context of specialist palliative care inpatient service delivery, are essential next steps to better understand these results.

#### 4.6.1 Limitations

NSW Health clinicians and managers maintain a culture of reporting clinical incidents to ensure action is taken to improve the safety and quality of care provided to patients. However, comprehensive and timely reporting is reliant on the clinician notifying, leading to potential for variation in reporting patterns. Though counts or rates have been used in this study it is acknowledged that when analysing clinical incident notifications multiple sources of data/information is required to understand the context, the safety and quality issues, and opportunities for improvement. Given the wide variation between services and facilities in NSW Health, accurate comparisons cannot be made based on incident notification numbers alone. Many variables can influence incident reporting. Lower rates of reporting are not a reliable indicator of safer care. Further qualitative, rather than quantitative, interpretation of the data is also required (Clinical Excellence Commission, 2018).

The incident analysis is based only on information contained in the 'incident description' 'contributing factors' and 'review of incident' section in the Incident Information Management System (IIMS) notifications. If the information was not documented in these sections, or the selected search terms were not used or were spelt differently, the incidents will not have been captured during this review. It should be noted that all reviews of incident data are retrospective and can reflect both hindsight and outcome bias.

Data from this study relied solely on opioid errors reported via clinical incident management systems, which identify significantly fewer medication errors than measurement by audit and/or observation, suggesting opioid errors are likely to occur more frequently than is currently being reported (Australian Commission on Safety and Quality in Health Care and NSW Therapeutic Advisory Group Inc., 2013; Levinson, 2012; Munzner, Welch, & Richardson, 2012; Westbrook et al., 2015). Medication errors are known to be widely under-reported, with great variations in reporting practices across services (Institute of Medicine, 2007). Additionally, data analysis was predicated on the incident narrative as reported by the incident notifier, which may not capture all relevant information pertaining to the incident (Vincent, 2007). Incident notifications are the notifier's perception and not necessarily a true interpretation of facts or reality and as the incident narrative is completed

retrospectively it may reflect both hindsight and outcome bias. The incident narrative also does not contain any context (e.g. complexity of patients or services, drug utilisation by patient group or setting) and the variation in reporting patterns (as timely reporting is reliant on the notifier) limits the ability to use this data to make any accurate comparisons between services and settings. Finally, contributing factors are identified by the clinician completing the incident report making reporting subject to interpretation and bias.

The de-identified nature of the datasets precluded calculation of opioid error prevalence and limited in-depth statistical analysis, as service and patient characteristics were not available. Despite these limitations, this study has provided valuable insights into reported opioid error characteristics and patient impact of opioid error in cancer and palliative care services, which, to our knowledge, has not been previously reported.

It should be noted that at the time of this study the majority of NSW health services were using hand written medication charts. Since the study electronic medication management systems that are improving the reliability of medication management have been implemented and significant investment has been made by NSW Health and the Clinical Excellence Commission to address errors and to improve systems in relation to medication management.

#### **4.7 Summary – Study 2**

Identifying the prevalence, characteristics and patient impact of reported opioid errors is a crucial first step in better understanding and addressing opioid errors clinically, and establishing a baseline of opioid error data against which local opioid incident data can be compared. Results from this study will be used to inform retrospective reviews of reported opioid errors in local palliative care services.

#### **4.8 Context for Study 3**

Study 2 identified the characteristics and patient impact of opioid errors reported in palliative and cancer care services in NSW over approximately three years. The study indicated that in palliative care services: i) errors with hydromorphone and morphine were the most frequently reported, ii) opioid administration errors were the leading problem type reported, iii) omitted dose errors accounted for the majority of

reported administration errors, and iv) patients were more likely to experience an opioid under dose, than overdose, as a direct result of an opioid error, adversely impacting pain management. Study 3 sought to further explore the scope of opioid errors in local specialist palliative care inpatient services and compare the findings to those reported in NSW palliative care services in Study 2.

Study 3 was a retrospective review of reported opioid errors in three specialist palliative care inpatient services in metropolitan NSW. In addition to identifying opioid error characteristics and patient impact at a local level, Study 3 sought to establish the volume of opioid use and opioid error incidence within the participating services, as this could not be identified from the data sets in Study 2. Study 3 continues to scope the extent and patient impact of opioid errors, specifically in local specialist palliative care inpatient services.

#### **4.9 Publication reference - Study 3**

The results of Study 3 were published as a short report in *BMJ Supportive and Palliative Care*, a peer reviewed scholarly journal targeting clinicians and healthcare workers undertaking clinical work in palliative medicine, specialist or generalist palliative care, supportive care, psychosocial-oncology and end-of-life care. This chapter contains an edited version of the published short report (Appendix 1) and additional data from a 7-day snapshot audit, undertaken to quantify the frequency of opioid delivery in inpatient palliative care services.

Heneka, N., Shaw, T., Rowett, D., Lapkin, S. & Phillips, J. (2018).  
Opioid errors in inpatient palliative care services: a retrospective  
review. *BMJ Supportive and Palliative Care*, 8(2), 175-179.

*BMJ Supportive and Palliative Care*: Impact factor: 2.385; ISI JCR Ranking 2017: 35/94 (Health Care Sciences & Services).

The published short report was picked up by the Australian Science Media Centre and included on the Scimex (Scientific Media Exchange) website, an online news portal aimed at helping journalists cover science and research (Appendix 1). As a result, Fairfax Media featured an article on the short report, in both print and online news nationally (Appendix 1), and ABC News Breakfast, a national radio broadcast,



interviewed the PhD Candidate (NH) on January 8, 2018. The short report was also promoted by BMJ Supportive and Palliative Care, as the ‘best article to read this month’ (Appendix 1).

#### **4.10 Objectives – Study 3**

The objectives of Study 3 were to:

- i) quantify the number of opioids ordered and administered in specialist palliative care inpatient services;
- ii) identify the number of opioid errors reported by specialist palliative care inpatient services;
- iii) determine the impact of opioid errors on palliative patient outcomes; and
- iv) identify reported opioid error characteristics.

#### **4.11 Methods – Study 3**

Study methods have been described in Chapter 3. As outlined in Chapter 3, this study includes two parts: i) a retrospective seven-day snapshot audit of opioid orders and administrations (Study 3a), and ii) a retrospective audit of reported opioid errors from three specialist palliative care inpatient services in NSW over 24 months (Study 3b).

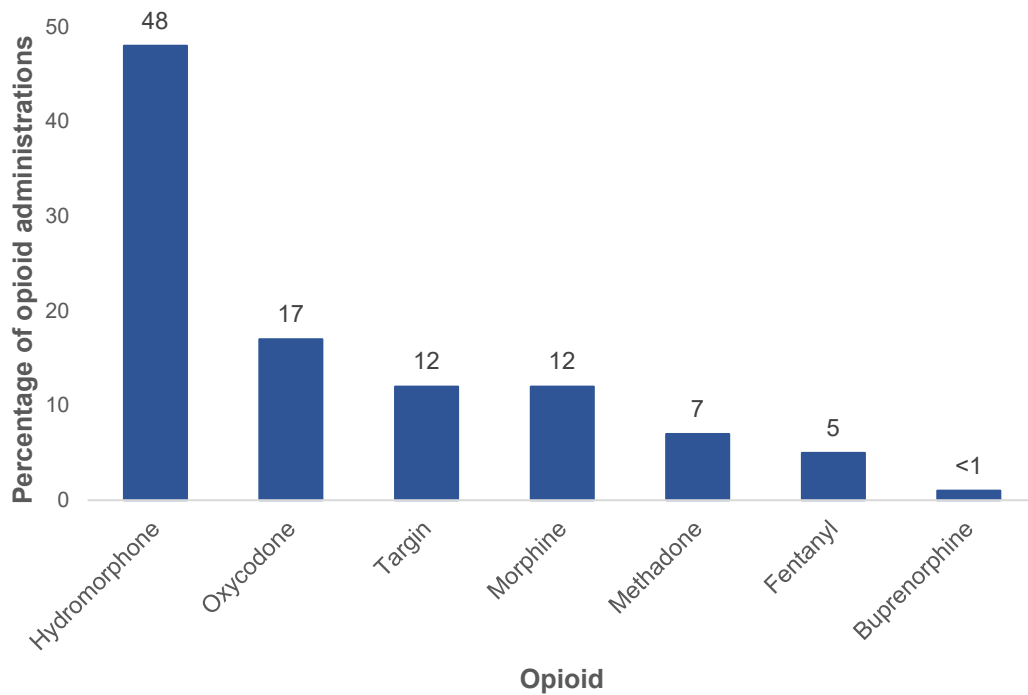
#### **4.12 Results - Study 3a (snapshot audit)**

The seven-day snapshot audit captured opioid orders and administrations for 120 palliative inpatients in three specialist palliative care inpatient services (Table 4.6). Patients spent an average of 5.4 days ( $\pm 2.4$ ) in the palliative care unit in the audit period. Almost all (98%) palliative inpatients had at least one opioid order (regular, PRN or STAT). One-third of patients (29%) had two or more regular opioid orders, and almost half (44%) had two or more PRN orders. Hydromorphone accounted for almost half (48%) of all opioid administrations (Figure 4.4).

**Table 4.6 Overview of service characteristics and opioid orders per patient in seven-day snapshot audit of three specialist palliative care inpatient services**

	<b>Service 1</b>	<b>Service 2</b>	<b>Service 3</b>	<b>Total</b>
<b>Service characteristics</b>				
Number of available beds in audit period (n)	39	38	20	97
Number of patients in audit period (n)	48	45	27	120
Percentage occupancy in audit period (%)	83.9%	98.1%	87.9%	92.0%
Mean number of days patient on ward in audit period ( $\pm$ SD)	5.0 ( $\pm$ 3.4)	6.0 ( $\pm$ 2.1)	5.0 ( $\pm$ 2.7)	5.4 ( $\pm$ 2.4)
<b>Opioid orders per patient in snapshot audit period</b>				
Total number of patients with an opioid order (regular, PRN and/or STAT) n (%)	48 (100%)	44 (97.8%)	25 (92.6%)	117 (97.5%)
<b>Regular opioid orders in audit period n (%)</b>				
Number of patients with nil regular opioid order	12 (25.0%)	6 (13.6%)	11 (44.0%)	29 (24.8%)
Patients with one regular opioid order only	23 (47.9%)	21 (47.7%)	11 (44.0%)	55 (47.0%)
Patients with two regular opioid orders	8 (16.7%)	10 (22.7%)	3 (17.9%)	21 (17.9%)
Patients with three regular opioid orders	2 (4.2%)	5 (11.4%)	0 (6.0%)	7 (6.0%)
Patients with four regular opioid orders	1 (2.1%)	1 (2.3%)	0 (1.7%)	2 (1.7%)
Patients with five regular opioid orders	2 (4.2%)	1 (2.3%)	0 (2.6%)	3 (2.6%)
<b>PRN and stat opioid orders in audit period n (%)</b>				
Patients with nil PRN order	1 (2.1%)	0	0	1 (0.9%)
Patients with one PRN order	20 (41.7%)	29 (65.9%)	16 (64.0%)	65 (55.6%)
Patients with two PRN orders	16 (33.3%)	8 (18.2%)	8 (32.0%)	32 (27.4%)
Patients with three PRN orders	7 (14.6%)	5 (11.4%)	1 (4.0%)	13 (11.1%)
Patients with four PRN orders	4 (8.3%)	2 (4.5%)	0	6 (5.1%)
Patients with STAT opioid order	3 (6.3%)	0	4 (16.0%)	7 (6.0%)

**Figure 4.4 Percentage of opioid administrations in seven-day snapshot audit, provided to 120 inpatients in the participating specialist palliative care inpatient services (n=3)**



In total, there were 10,031 opioid doses ordered (regular, PRN and/or STAT) and 1,732 opioid doses administered across the three specialist palliative care inpatient services in seven days (Table 4.7). This equates to 86 opioid orders per patient over seven days, or 12 opioid orders per patient, per day. Opioids were administered 247 times per day, equating to one opioid administration approximately every six minutes in the specialist palliative care inpatient service.

**Table 4.7 Overview of opioid orders and administrations in seven-day snapshot audit for three specialist palliative care inpatient services**

	Service 1	Service 2	Service 3	Total
<b>Opioid orders and administrations in snapshot audit period</b>				
<b>Regular opioids</b>				
Total regular opioid doses ordered in audit period (n)	444	698	100	1242
Total regular opioid doses administered in audit period n (%) <sup>a</sup>	377 (84.9%)	690 (98.9%)	83 (83.0%)	1150 (92.6%)
<b>PRN opioids</b>				
Total PRN opioid doses ordered in audit period	2928	1783	4070	8781
Total PRN opioid doses administered in audit period n (%)	141 (4.8%)	225 (12.6%)	208 (5.1%)	574 (6.5%)
<b>STAT opioids</b>				
Total STAT opioid doses ordered in audit period (n)	4	0	4	8
Total STAT opioid doses administered in audit period n (%)	4 (100%)	0	4 (100%)	8
<b>Total opioid doses ordered in audit period</b>	<b>3376</b>	<b>2481</b>	<b>4174</b>	<b>10,031</b>
<b>Total opioid doses administered</b>	<b>522</b>	<b>915</b>	<b>295</b>	<b>1732</b>

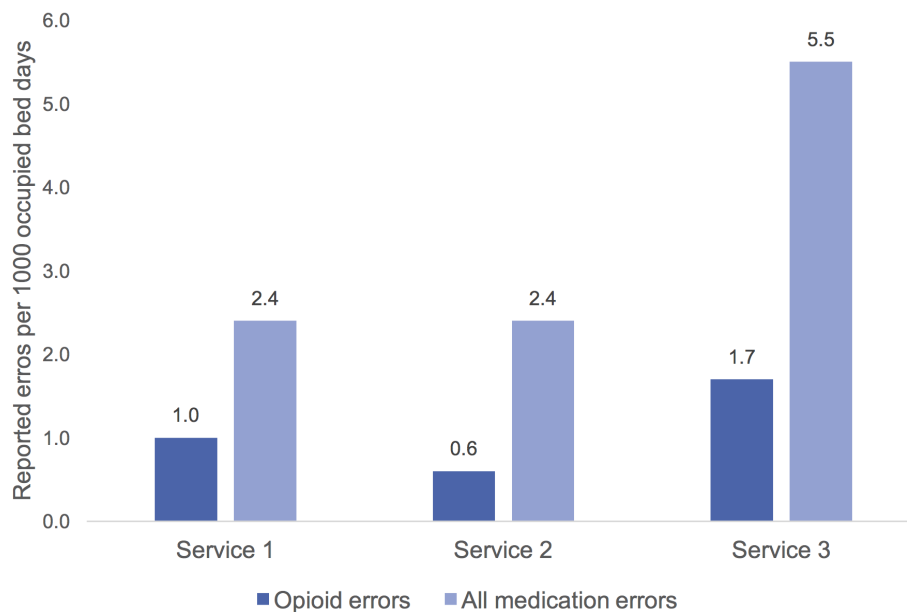
<sup>a</sup> All omitted doses were therapeutic omissions or dose omissions due to the patient being off the ward (e.g., for investigation/treatment).

### 4.13 Results – Study 3b (local retrospective review)

Study 3b was a retrospective review of consecutive clinical incidents with opioids reported by three NSW specialist palliative care inpatient services.

#### 4.13.1 Opioid error prevalence

Opioid errors accounted for 32% (n=55) of all reported medication errors (N=174), equating to 0.9 ( $\pm 1.5$ ) opioid errors per 1000 occupied bed days (Figure 4.5).



**Figure 4.5 Comparison of reported opioid errors and all reported medication errors per 1000 occupied bed days in specialist palliative care inpatient services (n=3)**

#### 4.13.2 Patient impact

Eighty four percent (n=46) of reported opioid errors reached the patient. The mean age of the affected patients was 71.3 years ( $\pm 10.7$ ). Most patients (84%, n=46) had cancer and almost two-thirds (62%, n=54) of patients died during this admission. The mean length of stay for these patients was 27.2 days ( $\pm 20.0$ ) (Table 4.8).

**Table 4.8 Patient demographics – patients involved in reported opioid errors (N=55)**

Demographics		Service 1		Service 2		Service 3		Total	
		N=22	(100%)	N=14	(100%)	N=19	(100%)	N=55	(100%)
<b>Gender</b>	Male	14	(63.6)	5	(36.0)	9	(47.4)	28	(50.9)
	Female	8	(36.4)	9	(64.0)	10	(52.6)	27	(49.1)
<b>Age (years)</b>	Mean (SD)	76.3 ( $\pm$ 9.2)		67.3 ( $\pm$ 9.9)		68.0 ( $\pm$ 10.5)		71.3 ( $\pm$ 10.7)	
	Median (IQR)	77.5 (15)		68.5 (18)		65.0 (18)		72.0 (18)	
<b>Cancer diagnosis</b>	Yes	16	(72.7)	12	(85.7)	18	(94.7)	46	(83.6)
	No	6	(27.3)	2	(14.3)	1	(5.3)	9 <sup>a</sup>	(16.4)
<b>Primary reason for admission</b>	Symptom management	11	(50.0)	5	(35.7)	15	(78.9)	31	(56.4)
	End of life care	4	(18.2)	3	(21.4)	1	(5.3)	8	(14.5)
	Pain control	3	(13.6)	4	(28.6)	1	(5.3)	8	(14.5)
	Respite	2	(9.1)	1	(7.1)	2	(10.5)	5	(9.1)
	Palliative rehab	2	(9.1)	0	0	0	0	2	(3.6)
	Supportive care	0	0	1	(7.1)	0	0	1	(1.8)
<b>Length of stay (days)</b>	Mean (SD)	19.9 ( $\pm$ 13.5)		30.9 ( $\pm$ 24.6)		32.8 ( $\pm$ 20.3)		27.2 ( $\pm$ 20.0)	
	Median (IQR)	15.5 (14)		25.0 (32)		30.0 (22)		22.0 (24)	
<b>Died during admission</b>	Yes	12	(54.5)	8	(57.1)	14	(73.7)	34	(61.8)
	No	10	(45.5)	6	(42.9)	5	(26.3)	21	(38.2)

<sup>a</sup>Other than cancer diagnosis: COPD (n=2- 1), heart failure (n=1), cardiac amyloidosis (n=1), end stage liver failure (n=1), end stage renal disease (n=1), lung function failure (n=1), motor neuron disease (n=1), sepsis (n=1).

One-third (33%, n=18) of opioid errors resulted in patient harm (Table 4.9), requiring clinical intervention as a direct consequence of the error. An additional one-fifth (20%, n=11) of patients required monitoring and/or a clinical intervention to preclude harm following an opioid error.

**Table 4.9 Impact of reported opioid errors on patient outcomes**

<b>National Coordinating Council for Medication Error Reporting and Prevention error category (Hartwig et al., 1991)</b>	<b>N=55 (100%)</b>
Category B - error occurred, did not reach patient	9 (16.4)
Category C - error reached patient, no patient harm <sup>a</sup>	11 (20.0)
Category D - error reached patient, required monitoring <sup>b</sup> and/or intervention <sup>c</sup> to preclude harm <sup>a</sup>	11 (20.0)
Category E - error resulting in temporary patient harm <sup>a</sup> which required intervention <sup>c</sup>	18 (32.7)
Error reached patient - patient impact/outcome not documented	6 (10.9)

<sup>a</sup> Harm: Impairment of physical, emotional, or psychological function or structure of the body and/or pain resulting from error; <sup>b</sup> Monitoring: observation or recording (Hartwig et al., 1991) of relevant physiological or psychological signs; <sup>c</sup> Intervention: change in therapy or active medical treatment.

Over half of patients (57%, n=26), received an opioid underdose as a direct consequence of an opioid administration error (Table 4.10). Almost half of these patients (42%, n=11) subsequently required PRN opioids to manage their increased pain (n=9) or shortness of breath (n=2).

**Table 4.10 Reported opioid error underdose characteristics**

<b>Administration error type</b>	<b>Opioid ordered</b>	<b>Opioid administered</b>	<b>Under-dosage (% of ordered dose)<sup>a</sup></b>
<b>Wrong dose</b>	Morphine s/c 40 mg regular	Morphine s/c 4 mg	10%
	Hydromorphone PO 80 mg regular	Hydromorphone PO 8 mg	10%
	Morphine PO 120 mg regular	Morphine PO 60 mg	50%
	Oxycodone/Naloxone 10/5 regular	Oxycodone/Naloxone 5/2.5	50%
<b>Wrong drug</b>	Hydromorphone s/c 5 mg regular	Morphine s/c 5 mg	12%
	OxyContin PO 10 mg regular	MS Contin PO 5 mg	33%
	Hydromorphone s/c 1.5 mg PRN	Fentanyl s/c 60 mcg	50%
<b>Omitted dose</b>	<b>Number of doses omitted</b>		<b>Frequency</b>
	1		9
	2		3
3		2	0%

Thirty nine percent (n=18) of patients experienced an opioid overdose due to the opioid error, ranging from 1.5 to 11-fold higher doses of the intended opioid order being administered (Table 4.11). Opioid toxicity was documented in 39% (n=7) of these patients; however, administration of an opioid reversal agent was not required for any of these patients.

**Table 4.11 Reported opioid error over dose characteristics**

<b>Opioid over-dose characteristics</b>				
<b>Problem type</b>	<b>Error type</b>	<b>Opioid ordered</b>	<b>Opioid administered</b>	<b>Over-dosage<sup>a</sup></b>
<b>Prescribing</b>	Charting – duplicated dose	Morphine s/c 20 mg PRN	Additional morphine s/c 20 mg PRN	2-fold
	Charting	Hydromorphone PO 0.5 mg regular	Hydromorphone PO 2 mg	4-fold
	Conversion error	Morphine PO	Hydromorphone s/c	1.5-fold
		Fentanyl transdermal	Hydromorphone s/c	2-fold
<b>Administration</b>	Wrong dose	Oxycodone PO 20 mg PRN	Additional oxycodone PO 20 mg	2-fold
		Morphine PO 20 mg regular	Morphine PO 40 mg	2-fold
		Oxycodone PO 10 mg PRN	Oxycodone PO 20 mg <sup>b</sup>	2-fold
		Hydromorphone PO 5 mg regular	Hydromorphone PO 10 mg	2-fold
		Morphine s/c 60 mg via syringe driver	Morphine s/c 60 mg via two syringe drivers	2-fold
	Wrong drug	Morphine s/c 5 mg regular	Hydromorphone s/c 5 mg	6-fold
		Morphine s/c 10 mg regular	Hydromorphone s/c 10 mg	6-fold
		Fentanyl s/c 350 mcg (via syringe driver)	Morphine s/c 400 mg (via syringe driver)	11-fold
	Transdermal patch – not removed	Fentanyl 12 mcg	Fentanyl 12 mcg patch insitu 7 days	Unable to determine
		Fentanyl 25 mcg	Buprenorphine 5 mg patch insitu 6 days	Unable to determine
		Fentanyl 25 mcg	Buprenorphine 25 mg patch insitu 3 days	Unable to determine
		Fentanyl 37 mcg	Patch insitu 3 days following order to remove	Unable to determine
	Wrong patient	Endone PO 5 mg regular	Oxynorm PO 10 mg	Two-fold

s/c – subcutaneous; PO – per oral;

<sup>a</sup> dose calculations using EviQ opioid conversion calculator (eviQ Cancer Treatments Online, 2018)

<sup>b</sup> two instances of same wrong dose error in different patients



### 4.13.3 Opioid error characteristics

Two thirds of reported opioid errors involved morphine (35%, n=19) or hydromorphone (29%, n=16). Opioid errors were more likely to occur with regular (78%, n=43) PRN orders (27%, n=10), and occurred more frequently with oral (49%, n=27) than subcutaneous (36%, n=20) or transdermal opioid administration (15%, n=8). The peak time for opioid errors was between 08:00 and 08:59 hours (20%, n=10), reflecting main medication delivery times in all participating services.

#### *Administration errors*

Opioid administration errors accounted for three-quarters (76%, n=42) of reported opioid errors, and were the most frequently reported opioid error type at each service (Table 4.12). Omitted opioid doses (33%, n=14) were the leading administration error reported. All omitted doses were non-therapeutic omissions, rather than doses withheld based on clinical judgement. Wrong dose errors (24%, n=10) occurred primarily with oral opioids (82%, n=9). One-fifth (19%, n=8) of administration errors occurred due to missing transdermal patch errors (n=4) or non-removal of original transdermal patch (n=4) (Table 4.12).

#### *Prescribing and other errors*

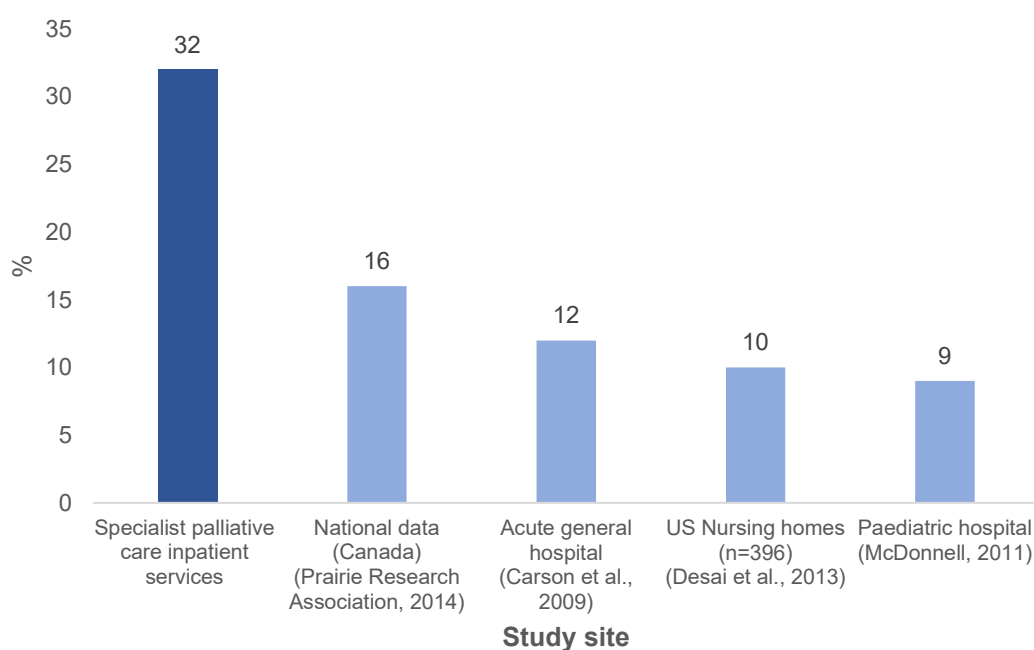
Opioid prescribing errors comprised 15% (n=8) of reported opioid errors and were most frequently reported with regular hydromorphone (63%, n=5). Prescribing errors were primarily due to medication charting errors (50%, n=4), opioid conversion (25%, n=2), or wrong drug errors (25%, n=2). A very small number of 'near miss' (wrong patient) (5%, n=3) and dispensing errors (4%, n=2) were reported (Table 4.12).

**Table 4.12 Overview of reported opioid incidents by problem type**

Problem type	Incident type	Service 1		Service 2		Service 3		Total	
		N=22	(100%)	N=14	(100%)	N=19	(100%)	N=55	(100%)
<b>Administration</b>	<b>Total</b>	<b>13</b>	<b>(59.1)</b>	<b>12</b>	<b>(86.7)</b>	<b>17</b>	<b>(89.5)</b>	<b>42</b>	<b>(76.4)</b>
	Omitted dose	9	(69.2)	0	0	5	(29.4)	14	(33.3)
	Wrong dose	3	(23.1)	4	(33.3)	3	(17.6)	10	(23.8)
	Transdermal patch error – missing or not removed	0	0	3	(25.0)	5	(29.4)	8	(19.1)
	Wrong drug	1	(7.7)	3	(25.0)	2	(11.8)	6	(14.3)
	Wrong patient	0	0	1	(8.3)	2	(11.8)	3	(7.1)
	Device – wrong rate	0	0	1	(8.3)	0	0	1	(2.4)
	<b>Total</b>	<b>7</b>	<b>(31.8)</b>	<b>1</b>	<b>(7.1)</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>(14.5)</b>
<b>Prescribing</b>	Medication charting	3	(42.9)	1	(100)	0	0	4	(50.0)
	Opioid conversion error	2	(28.6)	0	0	0	0	2	(25.0)
	Wrong drug	2	(28.6)	0	0	0	0	2	(25.0)
	<b>Total</b>	<b>2</b>	<b>(9.1)</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>(5.3)</b>	<b>3</b>	<b>(5.4)</b>
<b>Near miss</b>	Wrong patient	2	(100)	0	0	1	(100)	3	(100)
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>(7.1)</b>	<b>1</b>	<b>(5.3)</b>	<b>2</b>	<b>(3.6)</b>
<b>Dispensing</b>	Drug preparation error	0	0	0	0	1	(100)	1	(100)
	Expired medicine dispensed	0	0	1	(100)	0	0	1	(100)
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>(7.1)</b>	<b>1</b>	<b>(5.3)</b>	<b>2</b>	<b>(3.6)</b>

### 4.14 Discussion - Study 3

This local retrospective review has identified the percentage of reported opioid errors in specialist palliative care inpatient services was almost three-times higher than reported in other inpatient settings (Carson et al., 2009; Desai et al., 2013; Mc Donnell, 2011), and double that reported by hospitals, individual practitioners, and community pharmacies collectively (Prairie Research Association, 2014). These differences are visually represented in Figure 4.6. Comparatively, opioid errors made up: 9% (n=507) of medication related safety reports in a Canadian paediatric hospital over four years (Mc Donnell, 2011); 10% (n=3105) of medication errors reported in 396 USA nursing homes over 12 months (Desai et al., 2013); 12% (n=54) of medication errors reported over five years in a 620 bed acute general hospital in Ireland (Carson et al., 2009); and 16% (n=6076) of all medication incidents based on national incident data (inpatient, outpatient, community) reported over six years in Canada (Prairie Research Association, 2014).



**Figure 4.6 Comparison of rate of reported opioid errors as percentage of all reported medication errors types**

The higher percentage of opioid error reporting may be due to the frequency of opioid delivery, and the volume of opioid orders, in specialist palliative care inpatient services. As identified in the seven-day snapshot audit, an opioid is

delivered approximately every six minutes in this specialist setting . However, it may also reflect differences in error reporting culture in the specialist palliative care inpatient services compared to other healthcare settings. While this could not be ascertained from the incident reports in this study, further exploration from the perspective of palliative care clinicians may provide further insights into the prevalence of reported opioid errors in specialist palliative care inpatient services.

### *Patient impact*

Over half of palliative inpatients in this review required clinical intervention and/or monitoring to preclude or manage iatrogenic harm(s) as a direct consequence of an opioid error. The majority of opioid errors in this review resulted in opioid underdosing, which is over double the rate reported in other hospital settings (57% vs 23%), where opioid overdose is a more likely error outcome (Dy et al., 2007). Although wrong drug and wrong dose administration errors caused opioid underdosing in this review, omitted opioid doses were the primary contributor to opioid underdosing and subsequent adverse impact on patients' previously well managed pain.

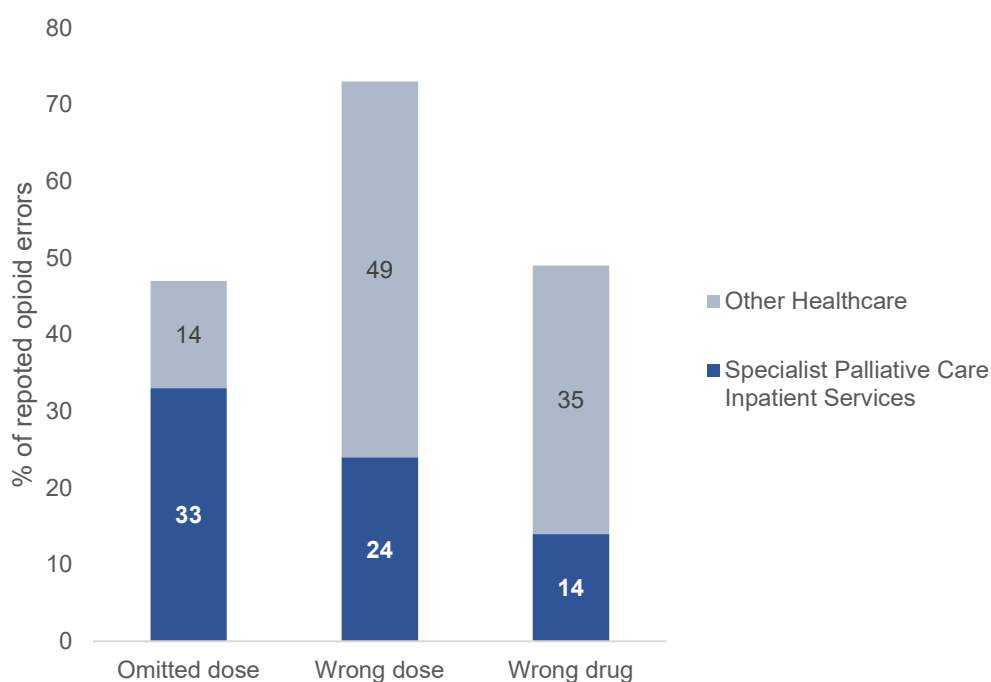
Unrelieved pain is a major issue in specialist palliative care (Pidgeon et al., 2016) and it appears opioid errors, particularly omitted dose errors, may be contributing to the burden of palliative patients' pain. Better understanding of the factors that contribute to or mitigate opioid errors, including systems factors and the impact of error reporting culture, and developing strategies to prevent iatrogenic pain occurring as a result of opioid errors, is a priority for this clinical setting and population.

### *Opioid error characteristics – administration errors*

Opioid administration errors accounted for the majority (76%) of all reported opioid errors in this study, reflecting trends in opioid error prevalence reported in other health care settings (Carson et al., 2009; Desai et al., 2013; Dy et al., 2007; Mc Donnell, 2011). However, administration error types in this study differed from other healthcare settings (Figure 4.7).

Wrong dose (13%-49%) and wrong drug (27%-35%) errors are the most commonly reported opioid administration errors in healthcare settings internationally (Desai et al., 2013; Dy et al., 2007; Mc Donnell, 2011; Prairie Research Association, 2014) as

illustrated in Figure 4.7. Whereas, these administration error types were reported far less frequently in the specialist palliative care inpatient services in this study. Further



**Figure 4.7 Comparison of opioid administration error types as percentage of all reported opioid administration errors in specialist palliative care inpatient services in the PERISCOPE project and other healthcare settings**

exploration of these differences in error types is warranted in the specialist palliative care inpatient context.

In contrast, the specialist palliative care inpatient services in this study reported 2.5 times more omitted dose errors, compared to other healthcare settings (Prairie Research Association, 2014), with omitted dose accounting for one-third of reported opioid administration errors. All reported omitted dose errors in this study were non-therapeutic omissions (i.e., a reason for dose omission was not documented) (Latimer, Chaboyer, & Hall, 2011), not doses withheld based on clinical judgement, patient refusal, or drug unavailability (Australian Commission on Safety and Quality in Health Care, 2016). Comparatively omitted dose errors (all drug types) have been shown to account for up to 25% of all reported medication errors internationally (National Patient Safety Agency, 2010) and up to 11% in Australian studies (Latimer et al., 2011; Lawler, Welch, & Brien, 2004; O'shea, Spalding, & Carter, 2009).

Given the relationship between the high rate of omitted dose errors and the degree of iatrogenic patient harm in specialist palliative care inpatient services identified in this study, it is critical to better understand the underlying factors contributing to omitted dose errors in this care setting.

One factor may be related to the use of electronic versus paper medication management systems in specialist palliative care inpatient services. In this study, the lowest overall prevalence of both reported opioid errors and omitted dose errors came from the service utilising the electronic medication management system. In contrast, omitted doses comprised up to two-thirds of reported administration errors in the two services using paper medication charts. Electronic medication management systems have been shown to reduce medication errors in other clinical settings (Ammenwerth, Schnell-Inderst, Machan, & Siebert, 2008), which may account for the differences observed in this review; however, further investigation is warranted to confirm this observation.

Another difference between the services was the proportionally greater number of prescribing errors reported by the service without an onsite clinical pharmacist. The presence of an onsite pharmacist may help identify and avert opioid prescribing errors before they are administered (Herndon et al., 2016), and this factor warrants further exploration in the palliative care service context. While the percentage of reported opioid prescribing errors in this study is similar to that reported in inpatient acute care (Carson et al., 2009; Dy, 2016) and nursing homes (Desai et al., 2013), the small number of prescribing errors reported in this study limits meaningful comparisons with other healthcare services. Further investigation from the perspective of palliative care clinicians is required to better understand these results.

#### *Frequency of opioid delivery in specialist palliative care inpatient services*

The seven-day snapshot audit identified a high volume of opioid orders per palliative inpatient and a high frequency of opioid administrations in specialist palliative care inpatient services. To our knowledge, this is the first report to quantify opioid delivery in specialist palliative care inpatient services. Hence, as comparable data could not be identified in the literature, these results will be explored in more depth with palliative care clinicians in a future study.

#### **4.14.1 Strengths and limitations**

A major strength of this review is that it examined reported opioid errors across three similar specialist palliative care inpatient services, identified opioid error prevalence, quantified opioid delivery, and characterised reported opioid errors in accordance with accepted taxonomies (Hartwig et al., 1991; National Coordinating Council for Medication Error Reporting and Prevention, 1998). A limitation of this review is that as medication errors are consistently under-reported it is conceivable that the actual number of medication errors patients experienced during their admission may have been higher than those reported (Westbrook et al., 2015). The variations in opioid error reporting practices noted between services may reflect differences in service systems and/or error reporting cultures across services; however, this could not be confirmed by this review alone.

The seven-day snapshot audit does not account for different bed-occupancy rates, variations in patient opioid needs and opioid delivery practices. Therefore, the seven-day snapshot audit data needs to be interpreted with some caution. Without a larger scale assessment of opioid errors as a proportion of opioid involved, further conclusions cannot be drawn. However, this seven-day snapshot audit does provide some insights into the volume and frequency of opioid delivery across specialist palliative care inpatient services.

The impact of broader systems factors that may be contributing to opioid errors, irrespective of the opioid involved, warrants further consideration.

#### **4.15 Summary**

Establishing a baseline profile of opioid error characteristics and prevalence in palliative care inpatient services is an important first step to quantifying the burden of this problem. Like most errors, opioid errors in this specialist setting occur as a result of a complex interplay of systems, health professional and patient factors. Better understanding these factors and their role in opioid errors is required. Given the variations in reporting practices between services in this review, further exploration of service characteristics and error reporting culture is also warranted.

The following chapter reports the final retrospective review (Study 4) undertaken in the PERISCOPE project, which sought to explicitly explore opioid error contributory

factors documented in clinical incident reports in two specialist palliative care inpatient services.



## 4.16 References

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