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Title: Exploring factors contributing to medication errors with opioids in Australian specialist palliative care inpatient services: a multi-incident analysis.

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ABSTRACT

BACKGROUND

Opioid errors have the potential to cause significant patient harm. These high risk medications are used in high volumes in palliative care services to manage pain and other symptoms. Palliative patients are at greater risk of harm from opioid errors as they are generally older and taking numerous medications to manage multiple co-morbidities. Understanding factors contributing to opioid errors in inpatient palliative care services is a largely underexplored, yet essential, aspect of patient safety.

OBJECTIVES

To explore and identify the characteristics and associated contributing factors of reported opioid errors in palliative care inpatient services using a multi-incident analysis framework.

DESIGN

A multi-incident analysis of opioid errors reported over three years in two Australian specialist palliative care inpatient services.

RESULTS

A total of 78 opioid errors were reported. The majority (76%) of these errors occurred during opioid administration, primarily due to omitted dose (34%) and wrong dose (17%) errors. Eighty-five percent of reported errors reached the patient resulting in opioid under-dose for over half (59%) of these patients. Over one-third (37%) of errors caused patient harm which required clinical intervention. Error contributing factors included: non-compliance with policy; individual factors such as distraction; poor clinical communication systems; and workload.

CONCLUSIONS

This multi-incident analysis has provided initial insights into factors contributing to opioid errors in palliative care inpatient services. Further exploration is warranted to understand palliative care clinicians' perspectives of systems, individual, and patient factors that influence safe opioid delivery processes.

BACKGROUND

Medication errors in hospitals are common and occur at all steps of the medication delivery process.[1] While most drugs have a wide margin of safety, 'high-risk' medicines can cause significant harm if incorrectly prescribed or administered, or if other systems errors occur.[2, 3] The error rate of high-risk medicines is not necessarily higher than with other medicines, however, the patient consequences of a high-risk medicine error can be catastrophic.[3]

Opioids are one example of high-risk medicines frequently implicated in medication errors causing patient harm, including fatal outcomes.[4-9] Opioids are widely used by palliative care patients to manage their pain, and other end-of-life symptoms.[10-12] Palliative care inpatients are particularly vulnerable to medication errors, and adverse outcomes, primarily because they are likely to be: older,[11] have multiple co-morbidities,[13, 14] advanced illness,[11] receiving numerous medications,[15, 16] including multiple opioid administrations each day, and have longer lengths of stay.[11] Each of these factors increases their risks of medication harms making medication safety an essential component of quality palliative and end of life care.

A quarter of palliative care clinicians report medication errors occur frequently in the palliative care setting and consider them to be a leading cause of error.[17] Medication safety with opioids has been identified as a palliative care patient safety priority.[17-19] Despite the high volume of opioid use in this speciality,[11] and the heightened risk of exposure to and harm from opioid errors in this patient population, medication errors with opioids in palliative care services is a relatively unexplored area of patient safety.[19-21]

The aims of this study were to explore and identify the characteristics and associated contributing factors of reported opioid errors in palliative care inpatient services using a multi-incident analysis framework.

METHODS

Design: Multi-incident analysis study.

Setting: Two adult palliative care inpatient services ('service') in metropolitan New South Wales, Australia. Both service 1 (n=43 beds) and service 2 (n=20 beds), provide complex end of life care[22]; and utilize a standardized, paper-based medication chart for opioid prescribing and administration.[23]

Ethics: Approval to conduct the study was granted by the hospital and University Human Research Ethics Committees.

Data collection and analysis

Data collection and analysis was undertaken in accordance with a multi-incident analysis framework (Figure 1).[24] Multi-incident analysis enables the simultaneous reviewing of multiple clinical incidents with a common, pre-defined theme, to identify previously unrecognized patterns and/or trends in incident characteristics and contributing factors, which may not be apparent when incidents are investigated in isolation.[24] Multi-incident analysis involves four distinct stages: 1) preparation for analysis (Stage 1); quantitative analysis of clinical incidents to understand the scope of the problem (Stage 2); qualitative analysis of incident data to determine incident contributing factors (Stage 3); and development of recommended actions based on study findings (Stage 4).[24] This paper reports the results of Stages 1 to 3 of the multi-incident analysis framework.

[Insert Figure 1]

Figure 1: Multi-incident analysis framework employed for project [24]

Stage 1: Prepare for analysis

A systematic literature review[20] and series of workshops investigating clinicians' perceptions of opioid errors was undertaken to explore the scope and impact of opioid errors in specialist palliative care services, and inform the analysis plan. Consultation with service managers, senior palliative care clinicians (medical and nursing), hospital pharmacists and quality and safety managers ('site team') at each service established the following inclusion criteria: 1) all clinical incidents reported via the services' internal incident management system which involved: Schedule 8 opioids ('opioids'); and 2) occurred in the inpatient palliative care service during the pre-defined timeline (January 1, 2013 – December 31, 2015). A clinical incident was defined as *any unplanned event which causes, or has the potential to cause, harm to a patient*, [4] and included 'near misses' (i.e., when an incident is intercepted before causing patient harm).[25]

Stage 2: Understand what happened

A custom dataset was created in consultation with the site teams to capture clinical incidents with opioids. Data was extracted by the services' Quality and Safety team and provided to the external research team for analysis.

Reported incidents were initially categorized by: problem type (e.g. prescribing) and opioid involved. The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) taxonomy, was used to further categorize the opioid incident to provide a

descriptive overview of the problem type (e.g. wrong drug).[26] The NCC MERP Index for Categorizing Medication Errors ('index') was used to describe the patient impact of the opioid error.[27]

Differences in patient demographics between services were analyzed using Chi-square tests, test of normality and homogeneity of variance, and univariate one-way analysis of variance (ANOVA**)** by General Linear Model. Descriptive statistics and percentage analysis were used to identify incident characteristics. Pearsons' Chi Square and Correlation were applied to determine relationships between patient and opioid error characteristics. Quantitative data analysis was undertaken with the IBM SPSS Statistics V25 software package.

Stage 3: Determine how and why it happened

A case report summary was completed for each opioid incident, combining incident narrative from both the incident report and details of the incident documented in the patient's medical record ('incident summary'). Incident contributing factors, defined as circumstances or actions that may have played a part in the origin or development of the incident,[28] were identified and classified according to the Yorkshire Contributory Factors Framework[29] ('framework'). This framework was specifically developed for application in a healthcare context, and identifies multiple levels of contributory factors to clinical incidents in accordance with a systems approach to patient safety.[29-31] The framework comprises 20 factor domains representing active failures (i.e. any failure in performance or behavior of the person in direct contact with the patient[32]), situational factors, (patient, individual, task or team) and latent factors (e.g. physical environment, training and education, policies and procedures) that influence patient safety.[29]

Incident summaries were initially coded inductively to identify contributing factor themes and descriptive sub-themes. Contributing factor themes were then coded against the Yorkshire Contributory Factors Framework factor domains.[29] Incidents coded as "active failures" were further categorized into slips, lapses, mistakes, and/or violations (Textbox 1).[32] Violations were considered in the context of compliance with the State medication handling policy[33] which mandates general principles for medication charting/orders and safe medication administration, including scheduled/high-risk medications. Qualitative data was managed using the NVivo software package V10.2.1.

[insert Textbox 1]

Textbox 1: Definition of active failure types[32]

Stage 4: Develop recommended actions

Development of service specific recommendations in collaboration with participating sites is currently in progress and will be reported elsewhere.

RESULTS

Incident characteristics

A total of 78 opioid incidents met the inclusion criteria, with an equal number of incidents identified in each service (n=39), representing an incidence of 1.7 reported opioid incidents per 1000 occupied bed days. The majority of incidents involved patients with cancer (86%, n=63), admitted for symptom management (59%, n=43), and who died during their admission (70%, n=51). Patients had a mean age of 72.2 years (±11.1) and mean length of stay of 23.3 (±20.0) days (Table 1). Patients in Service 1 were significantly older than those in Service 2 (p=0.018), however length of stay between services was not significantly different with age as a covariate. No statistically significant relationships between patient characteristics and opioid error characteristics were identified.

[Insert Table 1]

Table 1: Patient demographics – clinical incidents with opioids

All incidents fell into NCC MERP Categories B (error occurred, did not reach patient) to E (temporary patient harm, requiring intervention) (Table 2). The majority of incidents (85%, n=66) reached the patient. Clinical intervention was necessary for 42% (n=29) of patients following an opioid incident. Sub-optimal pain and/or symptom management as a result of an opioid under-dose was evident in 59%, (n=17) of patients.

Signs and symptoms of opioid toxicity were noted in 41% (n=12) of patients following an opioid error. The majority (83%, n=10) of these patients required additional monitoring and/or medical review within the service due to the opioid over-dose, and one patient required oxygen. Administration of an opioid reversal agent was not required for any patient following errors leading to opioid over-dose.

[Insert Table 2]

Table 2: Patient outcome of clinical incidents

Three quarters of incidents were due to administration errors (76%, n=59), with a smaller number of prescribing errors (19%, n=15) and near miss incidents (5%, n=4) reported (Table

3). Nearly two-thirds (61%, n=40) of reported errors resulted in missed opioid administration ('under-dose'). The most common administration errors were omitted opioid doses (34%, n=20), accounting for one-third of all administration errors, followed by wrong dose errors (17%, n=10). Prescribing errors were predominately related to medication charting errors (33%, n=5). Almost half of all errors occurred at times which coincide with peak medication administration and/or change of shift, namely between: 08:00-08:59 (13%, n=10); 20:00-20:59 (13%, n=10); 14:00-14:59 (10%, n=8); or 22:00-22:59 (10%, n=8).

Collectively, two-thirds of reported incidents involved hydromorphone (37%, n=29) or morphine (28%, n=22). The remaining errors involved fentanyl (15%, n=12), oxycodone (9%, n=7), methadone (6%, n=5), and oxycodone/naloxone (4%, n=3). Administration errors occurred most frequently with hydromorphone (34%, n=20), morphine (25%, n=15), and fentanyl (20%, n=12), whereas the majority of prescribing errors (n=9, 60%) involved hydromorphone.

[Insert table 3]

Table 3: Opioid incidents by problem type (N=78)

Trends/patterns in opioid incident contributing factors

Analysis of the 78 incident case report summaries identified four primary factor domains per the Yorkshire Contributory Factors Framework[29]: i) active failures; ii) individual factors; iii) communication systems; and iv) staff workload (Table 4). For a number of incidents (n=8), multiple contributory factor domains applied.

Active failures

Active failures were identified in two-thirds (n=53) of reported opioid incidents, of which 42% (n=22) were violations, specifically, non-compliance with medication management policies.

[Insert Table 4]

Table 4: Opioid incident contributing factors categorized by Yorkshire Contributory Factors Framework domains[29]

Active failures - violations

Non-compliance was identified in three policy areas: safe medication administration, second person checks prior to administration, and medication charting. Violations of safe medication administration policy (n=14) included: failure to correctly document opioid administrations

(n=5); and failure to check medication charts between and during shifts (n=4). Failure to fully implement a second person check prior to opioid administration was noted in four incidents, and led to wrong dose or wrong route errors, all of which resulted in opioid overdose. Non-compliance with medication ordering/prescribing policies was relatively infrequent (n=2) comprising medication charting errors only (Table 4). Two incidents reported challenges to practices when non-compliance with medication administration policy was identified. In both cases the nurse being challenged proceeded with the incorrect administration procedure and the challenging nurse reported the violation.

Active failures – slips, lapses and mistakes

Slips, lapses and mistakes collectively comprised half (51%, n=27) of active failures. Slips (n=11), and lapses (n=5) occurred more frequently during opioid administration processes (n=15, 94%), whereas mistakes (n=11) were predominantly identified in the prescribing process (n=8, 73%). Slips resulted primarily in wrong dose (n=3) and wrong drug (n=2) errors. All lapses resulted in omitted doses. Mistakes during prescribing comprised opioid conversion errors (n=3), wrong dose (n=3) and wrong drug (n=2) errors (Table 4).

Individual factors

Individual factors were identified as contributing factors by the notifier in 12% (n=9) of incidents. In one third of individual factors (n=3), staff workload also underpinned the incident. Inattention and/or distraction were the primary individual factors identified (n=4) followed by inexperience (n=3) and fatigue (n=2). All incidents linked with individual factors occurred during the opioid administration process.

Communication systems

Communication related factors were evident in 17% (n=13) of incidents, all of which resulted in opioid errors that reached the patient. Deficiencies were primarily identified in communication during clinical handover (n=8), and in written communication (n=5). Poor clinical handover caused dose omissions for multiple patients which adversely impacted patients' previously well managed pain. Failure of medical staff to document and/or handover changes to route of opioid administration, also contributed to omitted doses. Nurses' interpretation of written opioid orders was affected by ambiguous written orders (n=3), and poorly handwritten orders (n=2).

Staff workload

Work environment factors at the time of the incident, such as increased workload due to staffing levels and/or high unit workload, were explicitly identified in 10% (n=8) of incidents, predominantly resulting in omitted doses. Multiple incident reports cited the '…*busy nature of the ward*' as a contributing factor to opioid incidents, at times underpinning non-compliance with policy, such as failing to implement a two-person medication check. Increased workload contributed to opioid errors regardless of staff experience (Table 4).

Error mitigating factors

A number of incidents highlighted the nurses' role in preventing opioid errors (Textbox 2). Nurses instigated additional checks of opioid orders that were considered 'unusual', for example, very high doses, by cross-referencing with what had been recorded as dispensed and administered in the drug register previously, before administering the opioid. Adherence to medication management policy, such as second person checks prior to administration, was noted in a small number of incident narratives (n=4) to have prevented errors from reaching the patient, or mitigated patient impact following an error (Textbox 2).

[Insert Textbox 2]

Textbox 2: Examples of error mitigating factors identified in incident narrative

DISCUSSION

This multi-incident analysis has provided valuable insights into the characteristics of, and factors contributing to, reported opioid errors in palliative care inpatient services. Opioid errors were primarily reported during the administration process, consistent with findings from other health care services.[34-36] While none of the errors resulted in serious adverse events or death, opioid errors impacted adversely on patients' symptom management, with almost half of patients affected requiring clinical intervention as a direct consequence of an opioid error, largely due to omitted dose errors.

Local working conditions and clinical communication failures appear to play a role in facilitating opioid errors, however, the focus on contributing factors, in this multi-incident analysis, tended towards active failures. Active failures were most often due to violations, primarily during the administration process. Unlike slips and lapses, which are unintentional, violations are an intentional, behavioral choice.[32] Given the number of opioid errors due to violations of medication management policy, clinicians' attitudes towards routine use of high-

risk opioids, and whether this fosters complacency related to policy adherence warrants further examination.[37] Understanding the factors that prompt non-compliance with policy, and strengthening adherence to these policies, is essential to reducing opioid errors and patient symptom burden in palliative care inpatient services.

Slips and lapses (skill based errors), were readily identified during the administration process, however, in-depth analysis was restricted, as information provided in the incident summary was often limited. Errors in prescribing were more likely to be knowledge based (mistakes), than a result of a slip or lapse. However, whether the errors were due to rule-based, knowledge-based, or other mistakes,[32] could not be determined from the incident summary. These deficiencies in the analysis, highlight the need to further explore the systems factors and/or conditions which prompt slips, lapses and mistakes throughout the opioid delivery process. Given both services utilized paper-based medication charts, the implementation of digital health solutions, such as electronic medication management systems and clinical decision support tools, which have been shown to reduce these error types,[38] warrants consideration.

Despite the predominance of active failures, several latent, or 'systems' factors contributed to opioid errors in this analysis. Similar to factors contributing to medication errors in other hospital settings,[39-42] a combination of sub-optimal communication systems and local working conditions, directly contributed to, and/or facilitated opioid errors in specialist palliative care services. Poor clinical communication has been associated with increased administration errors of all drug types,[39] as has the quality of written prescriptions.[40] Identifying opportunities to improve clinical handover, particularly when changes to opioid orders are made, and encouraging nurses to question and report ambiguous written opioid orders, are key considerations to address the clinical communication gaps identified in this study.

[Insert Figure 2]

Figure 2: Opioid error contributing factors categories[29, 32]

The relationship between clinical staff workload and rates of opioid error in specialist palliative care services warrants further investigation. Increased workload has been linked with higher rates of medication administration and prescribing errors in acute care settings.[39, 41, 43] In this analysis, high unit workload at the time of the incident was identified as an error contributing factor, reflecting the complexity of patient care and corresponding medication regimens in palliative care service provision.[11] However, it could not be conclusively

determined if additional latent factors, such as management of staffing levels or patient scheduling, contributed to increased workload.

Latent organizational and/or external factors, such as physical environment, scheduling and bed management, and/or external policy context, did not appear to contribute to error producing conditions in this analysis. However, further investigation is required to confirm or refute this finding.

Beyond error contributing factors, the role of palliative care nurses in identifying and intercepting opioid errors was evident in the incidents reported. An important next step in addressing opioid errors in specialist palliative care services, is to better understand the factors that empower, or disempower, nurses to challenge opioid orders and practices they perceive to be incorrect.

Also critical to addressing opioid errors in palliative care, is an understanding of palliative services' safety and error reporting culture. While numerous guidelines and strategies exist to safeguard against opioid errors,[2, 44, 45] exploring specific strategies palliative services have implemented to reduce opioid errors is essential to inform service recommendations. Similarly, the relationship between error reporting culture and whether the frequency and types of opioid errors reported reflects actual errors requires consideration. These factors cannot be ascertained from incident reports alone, rather, require input from clinicians and other stakeholders involved in patient and/or medication safety within palliative care services.

Limitations

This analysis reports opioid errors from two palliative care inpatient services in one Australian state and may not be generalizable. Medication incidents are consistently under-reported[46] and dependent on clinicians recognition that an incident has occurred, and their willingness to report the incident.[47] While this study has provided initial insights into factors contributing to opioid errors in specialist palliative care inpatient services, further research is necessary to confirm or refute the study findings.

CONCLUSION

In order to support safe opioid medication processes in inpatient palliative care services, it is essential to better understand the factors and conditions which may give rise to error, beyond the errors made by clinicians at the front line of medication delivery. This study has provided a starting point from which further exploration of the conditions which may underpin

active failures, and the latent factors impacting safe opioid delivery processes can be undertaken. An essential next step is identifying and understanding palliative care clinicians' and service managers' perceptions of factors contributing to opioid errors in their service, and the impact of service safety culture on opioid incident reporting. Strategies to minimize opioid errors and resultant adverse patient outcomes in specialist palliative care services can hence be developed, implemented and evaluated.

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AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

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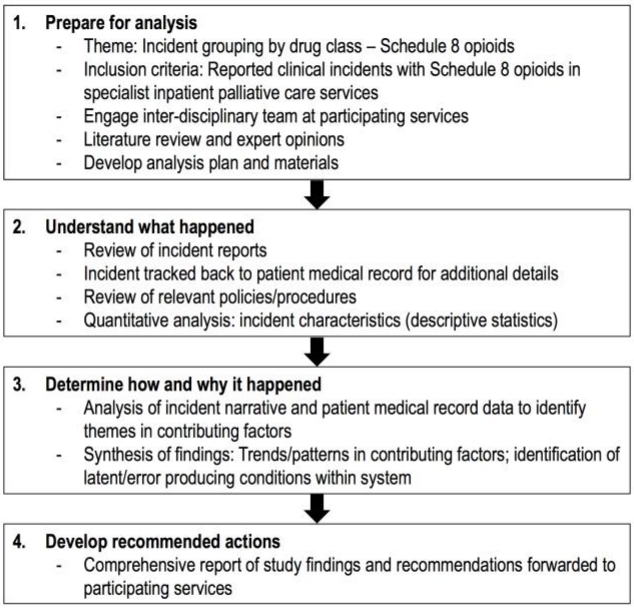

Figure 1: Multi-incident analysis framework employed for project

Textbox 1: Definition of active failure types[32]

Slip: failure to execute an action due to misdirection of a routine behavior (skill based, unintentional), e.g., drawing the wrong drug into an infusion.
Lapse: failure to execute an action due to a lapse in memory, resulting in the omission of a routine behavior (skill based, unintentional), e.g., forgetting to administer a dose of regular analgesia.
Mistake: an error originating from an incorrect thought process or analysis (knowledge or rule based, unintentional), e.g., ordering morphine for a patient with a known allergy to morphine.
Violation: a deliberate deviation from rules, protocols, policies/procedures etc., (behavioral choice), e.g., failing to undertake a second person check before administering a high risk medicine.

Table 1: Patient demographics – reported clinical incidents with opioids

Demographics		Service 1		Service 2		Total		p-value
		N=37	(100%)	N=36	(100%)	N=73	(100%)	
Gender	Male	20	(54.1)	18	(50.0)	38	(52.1)	0.816
	Female	17	(45.9)	18	(50.0)	35	(46.7)	
Age (years)	Mean (*SD*)	75.2 *(±10.9)*		69.1 *(±10.6)*		72.2 *(±11.1)*		0.018
	Median (IQR)	76.0 (13)		71.0 (18)		74.0 (18)		
Cancer diagnosis	Yes	29	(78.4)	34	(94.4)	63	(86.3)	0.085
	No	8	(21.6)	2	(5.6)	10[b]	(13.7)	
Primary reason for admission	Symptom management	20	(54.1)	23	(63.9)	43	(58.9)	0.329
	End of life care	8	(21.6)	4	(11.1)	12	(16.4)	
	Pain control	5	(13.5)	6	(16.7)	11	(15.1)	
	Respite	2	(5.4)	3	(8.3)	5	(6.8)	
	Palliative rehab	2	(5.4)	0	0	2	(2.7)	
Length of stay (days)	Mean (*SD*)	18.9 (*±14.1*)		27.9 (*±24.0*)		23.3 *(±20.0)*		0.206*
	Median (IQR)	14.0 (21)		20.5 (26)		17.0 (23)		
Died during admission	Yes	22	(59.5)	29	(80.6)	51	(69.9)	0.074
	No	15	(40.5)	7	(19.4)	22	(30.1)	

[a] Three patients experienced more than one incident during admission; two near miss incident were not linked to a specific patient in the incident report. [b] Other than cancer diagnosis: heart disease/failure (n=3), COPD (n=2), end stage renal disease (n=1), ischemia (n=1), motor neuron disease (n=1), pulmonary fibrosis (n=1), sepsis (n=1).

*Adjusted with age as covariate.

Table 2: Patient outcome of clinical incidents

National Coordinating Council for Medication Error Reporting and Prevention Index error category[26]	N=78	(100%)
Category B - error occurred, did not reach patient	12	(15.4)
Category C - error reached patient, no patient harm[a]	15	(19.2)
Category D - error reached patient, required monitoring[b] and/or intervention[c] to preclude harm[a]	16	(20.5)
Category E - error resulting in temporary patient harm[a] which required intervention[c]	29	(37.2)
Error reached patient - patient impact/outcome not documented	6	(7.7)

[a] *Harm: Impairment of physical, emotional, or psychological function or structure of the body and/or pain resulting from error.*
[b] *Monitoring: observation or recording of relevant physiological or psychological signs.*
[c] *Intervention: change in therapy or active medical treatment.*

Table 3: Opioid incidents by problem type (N=78)

Problem type	Incident type	Service 1		Service 2		Total	
		N=39	(100%)	N=39	(100%)	N=78	(100%)
Administration	**Total**	**26**	**(66.7)**	**33**	**(84.6)**	**59**	**(75.6)**
	Omitted dose	10	(38.5)	10	(30.3)	20	(33.9)
	Wrong dose	4	(15.4)	6	(18.2)	10	(16.9)
	Transdermal patch – missing or not removed	-	-	7	(21.2)	7	(11.9)
	Wrong patient	3	(11.5)	2	(6.1)	5	(8.5)
	Wrong drug	4	(15.4)	-	-	4	(6.8)
	Wrong route	1	(3.8)	3	(9.1)	4	(6.8)
	Syringe driver error	1	(3.8)	2	(6.1)	3	(5.1)
	Incomplete administration	2	(7.7)	1	(3.0)	3	(5.1)
	Challenge – non-compliance with policy	-	-	2	(6.1)	2	(3.4)
	Clinical management	1	(3.8)	-	-	1	(1.7)
Prescribing	**Total**	**11**	**(28.2)**	**4**	**(10.3)**	**15**	**(19.2)**
	Medication charting	4	(36.4)	1	(25.0)	5	(33.3)
	Opioid conversion error	3	(27.3)	-	-	3	(20.0)
	Wrong dose	2	(18.2)	1	(25.0)	3	(20.0)
	Wrong drug	2	(18.2)	-	-	2	(13.3)
	Illegible order	-	-	1	(25.0)	1	(6.7)
	Delayed order	1	(14.3)	1	(25.0)	1	(6.7)
Near miss – arrested or interrupted sequence	**Total**	**2**	**(5.1)**	**2**	**(5.1)**	**4**	**(5.2)**
	Wrong patient	2	(100)	1	(50.0)	3	(75.0)
	Wrong dose	-	-	1	(50.0)	1	(25.0)
	Total	**39**	**(100)**	**39**	**(100)**	**78**	**(100)**

Table 4: Opioid incident contributing factors categorised by Yorkshire Contributory Factors Framework domains[29]

Contributory factor and domain[29] (proximal to latent)	N =78	(100%)	Key Subthemes	Incident example (from incident narrative)
Active failures (proximal)	**53**	**(67.9)**		
Violation	22	(41.5)	Non-compliance with medication management policy	**Administration error – missing transdermal patch**: *'Patient fentanyl 50mcg patch was due for change/administration. Nursing staff were unable to locate previous patch on patient for removal. The palliative care plan was signed to say that the patch was sighted on the morning shift on [date] but not the (previous) afternoon or night shift. Care plan states that fentanyl patches should be sighted on all shifts, had this occurred on the afternoon and night shifts the patch may have been identified as loose or missing sooner.'* ID_18 **Prescribing error – order not ceased resulting in wrong dose**: '*Whilst checking patient's syringe driver it was discovered that the contents of the syringe differed from the order given. There were two medication orders for a syringe driver, one had not been cancelled from the previous day when the next one was written. Order for [date] was hydromorphone 5mg, new order was hydromorphone 6mg. The correct medication was reloaded on [date]. Contents of incorrect syringe driver discarded. The Medical Officer has been advised to be sure to cancel orders when another is* written.' ID_49
Slip	11	(20.8)		**Administration error - wrong drug**: *'Hydromorphone 2mg subcutaneous given at regular drug round instead of morphine 2 mg subcutaneous. I discussed this error with the two nurses involved. Both are experienced in palliative care nursing and both understand the difference in strength between the two drugs. Neither could offer an explanation for the error.'* ID_42 **Prescribing error – wrong dose**: '*Rechart of medications done, oxycodone 40mg bd re-charted (unintentionally) as oxycodone 40mg d, with 0800 the only time entered. No oxycodone given at 2000 on [date]*.' ID_21
Mistake	11	(20.8)		**Prescribing error – wrong dose**: '*Patient had been taking 4/24 9mg oral morphine, yesterday this was changed to bd 60mg MS Contin. Medical staff had made an error in calculating dosage when changing MS Contin, however, as the dosage was within the normal range of MS Contin given frequently in the unit this was not picked up, and the higher dose was given on two occasions*.' ID_41
Lapse	5	(9.4)		**Administration error – omitted dose**: *'During regular drug round, noted three doses of regular 4/24 10 mg oral morphine had not been given overnight. Nurses on shift unable to explain or recall why dose omitted, other than agreeing that morphine not given.'* ID_56

Contributory factor and domain[29] (proximal to latent)	N =78	(100%)	Key Subthemes	Incident example (from incident narrative)
Could not be determined	4	(7.5)		
Situational factors	**9**	**(11.5)**		
Individual factors	9	(100)	Inattention/distraction Inexperience Fatigue	**Administration error – wrong drug**: *'Regular subcutaneous morphine 10 mg due, subcutaneous hydromorphone 10 mg given instead. The incident was discussed with the nurses concerned who are both experienced palliative care nurses. They stated they had given several subcutaneous hydromorphone injections prior to this patient and did not pay sufficient attention to this (patient's medication order).'* ID_43
Patient factors Task characteristics Team factors	Nil identified			
Local working conditions	**8**	**(10.3)**		
Staff workload	8	(100)	Staffing levels at time of incident High unit workload	**Administration error – omitted dose**: *'Patient stated this morning that nocte Oxycontin 70 mg had not been administered. Oxycontin PM dose not signed for in medication chart. Patient requiring 1 x breakthrough subsequent AM. Reviewed roster - 3 x staff had taken sick leave, with 1 x hospice casual and 1 x Permanent RN on the PM shift (sick leave replaced with 1 x Agency RN & 1x agency EEN).'* ID_31 **Administration error – wrong drug**: *'Suspected wrong drug used in subcutaneous infusion pump – morphine instead of fentanyl. Two regular staff involved in incident, neither staff member had a history of medication errors. Ward extremely busy at time of incident with more than normal requirements of breakthrough analgesia required for multiple patients.'* ID_19
Equipment and supplies Lines of responsibility Management of staff and staffing levels Supervision and leadership	Nil identified			
Latent organisational factors – nil identified				
Physical environment Policies and procedures Scheduling and bed management Support from central functions Training and education				

Contributory factor and domain[29] (proximal to latent)	N =78	(100%)	Key Subthemes	Incident example (from incident narrative)
Latent external factors – nil identified				
Design of equipment and supplies External policy context				
Applies across all factor types (proximal to latent)	**13**	**(16.6)**		
Communication systems	13	(100)	Poor clinical handover Written communication	**Administration error – omitted dose:** *'Patient seen by Medical team at 1600 [date]. Subcutaneous infusion pump (SCIP) ordered and team handed instruction over to afternoon shift nursing staff. Team noted in progress notes that patient was a high falls risk and should be transferred to different bed. Nursing staff failed to hand over instructions regarding SCIP order to Pt's accepting nursing staff and as a result the SCIP was not commenced. At 0200 night staff found the SCIP order and commenced same.'* ID_34 **Administration error – transdermal patch not removed**: *'Patient presented to unit with fentanyl patches insitu. Medical review indicated that the patient was becoming intolerant to fentanyl and was rotated to another oral opioid, however nil documentation in progress notes of request to remove fentanyl patch noted. Found to still have patches on body when there was a verbal order to remove. On review of medication chart, order to remove patch was written over initial order, the modified request is unclear.'* ID_20 **Administration error – wrong dose due to poorly written order**: *'(Nurse A) and I gave patient subcutaneous hydromorphone at 1000. When I went to give another dose later, Nurse B checking it with me said that the order was 5 mgs to 6 mgs. Nurse A and I had given 3mgs for the dose before instead of 5 mgs as we read the order as 3 mg. It was a new (as-required/PRN) re-chart and Nurse B knew it was 5 mg from the previous order, and the patient was generally having a 6 mg dose.'* ID_39
Safety culture	Nil identified			
Multiple	**8**	**(10.2)**		
• **Active failure: violation** • **Situational factors: individual factors** • **Local working conditions: staff workload**	**8**	**(100)**	Non-compliance with medication management policy Fatigue High unit workload	**Administration error – wrong** dose: 'At 2300 patient was given 20mg breakthrough of oxycodone instead of 10mg. The wrong strength of medication was taken out of the cupboard and used. The shift was busy and the medication was not checked correctly against the order as outlined in the policy. Was also night shift and staff were fatigued.' ID_30

Textbox 2: Examples of error mitigating factors identified in incident narrative

Nurses' role in preventing opioid error:

'Patient was admitted to ward from [external service], according to the medical discharge summary and medication chart from [external service], patient was on regular hydromorphone 0.75 mg per oral q4h, however, regular hydromorphone 7.5 mg per oral q4h was ordered by doctor. Nurse A and I double checked the dose given at [external service] and advised doctor who corrected the order on the medication chart.' (ID_54)

Adherence to medication management policy:

'When checking patient to locate the fentanyl patch on the afternoon shift, patch was found to be missing. Medication chart indicated that patch had been applied to Right side of patient's chest. On the morning shift (of the same day), per the patient's care plan, fentanyl patch had been checked and recorded to say it was insitu. Nurses contacted the morning shift who confirmed patch was insitu on patients right chest when showered that morning. Medical staff notified and a stat order given to replace fentanyl patch. Fentanyl patches are sighted and recorded on the patients care plan each shift this is an example of how well this process works, the patient didn't suffer unnecessary pain as the missing patch was identified quickly.' (ID_04)

Figure 2: Opioid error contributing factors categories