Medication Errors on a Surgery Service: Addressing the Gap with a Medication Prescribing Curriculum for Surgery Residents

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Abstract

Background

Medication prescribing errors are a source of morbidity and mortality on surgical wards, however educational interventions with proven effectiveness to reduce these errors are lacking. Our objective was to design, implement, and assess the effectiveness of a curriculum designed to reduce medication prescribing errors on a surgery service at an academic hospital without electronic order entry.

Methods

This was a prospective observational cohort study at a Canadian academic hospital. A medication prescribing curriculum for surgery residents was developed and implemented in July 2019. All general surgery residents (n = 16) at our institution were eligible; 13 (81%) participated. Medication prescribing errors were tracked pre-curriculum implementation (July 1, 2018-June 30, 2019) and post-curriculum (July 1-December 31, 2019). Medication prescribing errors were classified as prescription-writing (PW) or decision-making (DM).

Results

There were 87.5 (14.6) total medication prescribing errors per month in the pre-implementation period with 51.3 (11.9) PW and 36.3 (6.0) DM errors. Post-implementation, there were 78.7 (10.3) total errors monthly with 43.3 (9.5) PW and 35.3 (4.2) DM errors. There were significantly fewer total errors monthly in the first quarter (July–September) of the academic year post-curriculum implementation versus pre-implementation (77.7(12.7) vs. 107.3(8.1); p = 0.035) with significantly fewer PW errors monthly (40.7(13.2) vs. 68.7(9.3); p = 0.046) and no difference in DM errors monthly (37.0(2.0) vs. 38.7(5.7); p = 0.671).

Conclusions

Medication prescribing errors on a surgical service occurred both from prescription-writing and decision-making. Educational interventions, such as our medication prescribing curriculum, can decrease errors related to prescription writing, however the effect appears diminish over time.

Background

Medication prescription errors are a source of morbidity and occasionally mortality in the hospital setting[1]; previously shown to account for 8–16% of all adverse events on Canadian surgery wards[2,3]. One to two percent of in-patients have experienced harm as a result of a medication error[4,5]; however, the

actual proportion of medication prescription errors is much greater as only 20% actually reach the patient[6]. The causes of medication prescription errors are numerous, with distraction from multiple simultaneous tasks, lack of feedback on errors, and writing orders for patients not well known to the prescriber as some of the contributing factors[7,8].

Medication prescribing errors can be classified into prescription writing (PW) or decision making (DM) errors[17]. Medication prescribing errors in a non-electronic order entry (paper-based) system have been shown to be associated with 'knowledge deficits' and 'other' factors, such as mistakes made during the process of order writing [9]. In a pilot study of medication prescribing errors in a Canadian academic hospital, without an electronic order entry (EOE) system, we demonstrated that post-graduate surgery trainees made errors in 3–9% of medication prescription orders with 1/3 of errors related to DM and 2/3 to PW[17]. Electronic order entry (EOE) systems can decrease adverse events related to medication prescription errors by 48–50%[10,11], however, EOE systems do not appear to address all types of medication prescribing errors as medication prescribing errors can occur during both decision making and prescription writing phases[12]. This suggests that educational interventions aimed at improving prescribing practices of health care providers are needed irrespective of the method of order entry.

Numerous educational interventions aimed at improving prescribing competency have been described in post-graduate family medicine training programs[8,13–16]. These include online modules, didactic or case-based teaching sessions[14,15], pharmacist feedback [16], or longitudinal programs with reduced prescribing privileges until completed[13]. However, similar educational interventions have yet to be described, implemented or evaluated in post-graduate surgery training programs. As prescribed medications classes often vary by discipline, it is important to develop a curriculum that improves the prescribing competency of surgery trainees.

The objectives of our study were: (1) to develop and implement a pharmacist-led medication prescribing curriculum for a general surgery post-graduate training program, (2) to evaluate its effectiveness by examining medication prescribing errors pre and post-curriculum implementation on a general surgery service, and (3) to identify specific times during the academic year where post-graduate trainees are more susceptible to making medication prescribing errors.

Methods

We conducted a prospective, observational cohort study on a general surgery service at a tertiary academic hospital without electronic order entry system in Ontario, Canada between July 1st, 2018 and December 31st, 2019. Research Ethics Board approval was obtained prior to commencement of the study from Queen's University (#6020195).

Setting:

Academic hospital with 440 inpatient beds, over 22,000 inpatient and over 9,000 outpatient operations per year. Post-graduate residency training programs in general surgery, orthopaedic surgery and urology, as well as most medical specialties.

Process for Ordering Medications:

In our institution, routine medication orders are written on carbon-copy papers, which are processed by the hospital pharmacy, and a copy of the original order remains in the patient's paper chart. Free-text fillable, computer-based forms are used in specific situations, such as admission orders and post-operative orders; however, these forms do not auto-populate medication doses and do not provide any clinical decision support. As such, the prescriber is allowed to omit dose, route, or frequency of medications on the computer-based forms. Medication orders (carbon-copy paper and computer-based forms) are reviewed by the pharmacists, who document any concerns on a medication memorandum (MM). The MM is sent back to the ward and placed in the patient's medical record (paper chart).

Medication Prescribing Errors:

We defined any medication order which resulted in the generation of a MM as a medication prescribing error. We classified each error using our previously described taxonomy as either errors in decision-making (DM) or prescription-writing (PW)[17], and recorded the general class of the medication (i.e. antibiotic, anticoagulant). For medication prescriptions with more than one type of error (i.e. omitting both route and frequency), we classified both errors separately. We included all admission, in-patient and post-operative orders written by residents, clinical clerks (co-signed by resident), attending surgeons, and co-signed suggest orders on patients who were admitted under the care of a general surgeon as the most responsible physicians (MRP). We did not have any restrictions on the time of day the medication order was written. We excluded orders written by surgery residents on patients admitted to a non-general surgery service, such as the intensive care unit. We also excluded verbal orders, orders written by non-surgery services such as the Advanced Pain Management Service (APMS), orders for intravenous (IV) fluids, total parenteral nutrition (TPN), oxygen, diet, and activity, orders for an automatic therapeutic interchange (TI) of a prescribed medication, as well as MMs informing of limited supply or backorder medications. Lastly, we excluded MMs informing that a patients' home medication is non-formulary at our institution.

We did not collect prescriber information, such as name, year and level of training, or residency program. We also did not collect patient identifying data, including the name, birthday, and medical identification number.

Pre-Curriculum Implementation (Baseline) Data Collection:

Two independent reviewers (JR, JM) classified and recorded medication prescribing errors documented in MMs on patients admitted to a general surgery service from July 1, 2018 to June 30, 2019. All MMs were reviewed by a minimum of one reviewer, with randomly selected months reviewed by both reviewers to identify any discrepancies in classification. Discrepancies in classification of errors as either PW or DM

between the two independent reviewers were resolved by consensus. We also recorded the number of trainees (general surgery and off-service) rotating on the general surgery service each month.

Development and Implementation of a Medication Prescribing Curriculum:

We modified (with permission) a prescribing curriculum developed by Ginzburg et al[13] and used the results from the baseline data collection to develop the Medication Prescribing Curriculum for surgery residents at our institution. This curriculum was designed to specifically address different types of medication prescribing errors and strategies to mitigate these errors, as well as to provide specific examples of common prescribing errors in surgery. The Medication Prescribing Curriculum discussed the information to include in a mediation prescription, inappropriate abbreviations and other habits to avoid, and how to correctly adjust medication dosing by weight and renal function. It addressed specific areas of identified weakness, such as respiratory inhaler prescriptions, and provided resources such as antibiograms, electronic drug-drug interaction tools, and contacts for hospital pharmacists. The Medication Prescribing Curriculum was delivered in person by two pharmacists during academic half-day over two days (2-hours per day) to all residents rotating on the general surgery service in July 2019. There were no other curricula focused on medication prescribing during the study period.

Post-Curriculum Implementation Data Collection:

Two independent reviewers (JR, JM) classified and recorded all medication prescribing errors documented in MMs on patients admitted to a general surgery service post-curriculum implementation (July 1, 2019 to December 31, 2019) using the same methodology as for pre-curriculum implementation data collection. Information on the number of trainees (general surgery and off-service) rotating on the general surgery service each month was also recorded.

Data Analysis:

Descriptive statistics were calculated for the number and types of medication prescribing errors per month pre- and post-curriculum implementation. Normality testing was conducted on all data prior to analysis. Data was grouped into 3-month intervals as quarters of the academic year (Q1:July to September, Q2: October to December, Q3:January to March, and Q4: April to June) for comparisons within and between academic years (pre- and post-curriculum implementation). Independent sample t-tests were used to compare pre vs post-curriculum implementation data using 3-month interval data. One-way ANOVA and post-hoc Tukey tests were used to compare 3-month interval data within the academic year pre-curriculum implementation (July 2018 to June 2019). All statistics were performed using SPSS Version 26. Statistical significance was set to $P < 0.05$.

Results

The Medication Prescribing Curriculum was delivered to 13 out of possible 16 (81%) general surgery trainees in post-graduate year (PGY) one to four (Table 1). The breakdown of general surgery and off-

service post-graduate trainees on a general surgery service per month in shown in Table 2. There were no significant differences in the number of general surgery and off-service trainees on a general surgery service each month pre and post-curriculum implementation (Table 2).

Pre-Curriculum Implementation (Baseline) Data:

There were a total 1050 medication prescribing errors made over 12 months between July 1, 2018 to June 31, 2019 with 615 (59%) prescription-writing errors and 435 (41%) decision-making errors (Table 3). The mean number of errors per month was 87.5 (14.6), with significantly more PW compared to errors as DM errors per month (51.3 (11.9) vs 36.3 (6.0); p=0.001).

The most common PW errors were 'Omission of frequency/not specifying PRN orders' with 12.7 (5.5) errors per month, followed by 'Prescribing one tab/ 1 puff of a drug that is available in more than one strength' with 11.6 (4.4) errors per month (Table 4). The most common DM errors were 'Prescribing a dose not recommended for the formulation prescribed' with 7.5 (2.3) errors per month followed by 'pharmaceutical issues' with 7.0 (2.8) errors per month, such as prescribing medication only available in intravenous (IV) formulation to be given orally. The highest number of medication errors per month was recorded in July (n = 116) and August (n = 106), while the lowest was recorded November (n = 66).

The mean number of errors per month for each quarter of the academic year were 107.3 (8.08) for Q1 (July to September), 83.3 (15.0) for Q2 (October to December), 77.7 (4.7) for Q3 (January to March), and 81.7 (7.1) for Q4 (April to June) (Figure 1). The mean number of errors per month was significantly higher in Q1 versus Q3 (p=0.02) and Q4 (p=0.04). The most common classes of medications involved in medication prescribing errors were "other", "gastrointestinal", "respiratory" and "narcotic" medications (Table 5).

Post-curriculum Implementation Data:

There were a total 472 medication prescribing errors made over 6 months between July 1, 2019 and December 31, 2019 with 212 (45%) DM and 260 (55%) PW errors (Table 3). The mean number of total errors per month was 78.7 (10.3), with no significant difference between PW and DM errors per month (43.3 (9.8) vs 35.3 (4.2); p=0.13).

The most common PW errors were 'Omission of frequency/not specifying PRN orders (i.e. morphine 2 mg PRN instead of q4h prn)', with 10.8 (6.2) errors per month, followed by 'Prescribing one tab/ 1 puff of a drug that is available in more than one strength' with 10.3 (5.1) errors per month. The most common DM errors were 'Pharmaceutical issues' with 10 (2.7) errors per month, and 'Prescribing two drugs for the same indication when only one is necessary' with 7.5 (4.1) errors per month. The highest number of medication errors per month was recorded in August (n = 92) and October (n = 87), while the lowest was recorded in July (n=68) and December (n = 68) (Table 3).

The mean number of errors per month for each Q1 and Q2 of the academic year were 77.7 (12.7) for Q1 and 79.7 (10.2) for Q2 with no significant difference between Q1 and Q2 (p=0.84) (Figure 1). The most

common classes of medications involved in medication prescribing errors post-curriculum implementation were “gastrointestinal”, “respiratory” and “other (Table 5)”.

Effectiveness of the Medication Prescribing Curriculum:

There were significantly fewer medication prescribing errors committed per month in Q1 post-curriculum implementation versus pre-curriculum implementation (77.7(12.7) vs. 107.3(8.1); p=0.04). There were also significantly fewer PW errors committed per month in Q1 post-curriculum implementation as compared to pre-curriculum implementation (40.7(13.2) vs. 68.7(9.3); p<0.05); however, there was no significant difference in DM errors committed per month in Q1 pre- and post-curriculum implementation (37.0(2.0) vs. 38.7(5.7); p=0.67).

There were no significant differences between medication prescribing errors committed per month in Q2 post-curriculum implementation versus pre-curriculum implementation (79.7(10.2) vs. 83.3(15.0); p=0.75). There were no significant differences in PW errors per month (46.0(6.6) vs. 49.3(5.0); p=0.53) and DM errors per month (33.7(5.7) vs. 34.0(10.4); p=0.96) in Q2 pre- and post-curriculum implementation.

There were significantly fewer errors per month related to antibiotic prescribing post-curriculum implementation versus pre-curriculum implementation (3.8 (1.7) vs 8.0 (3.1), p<0.01).

Discussion

In this study we created and implemented a pharmacist-led medication prescribing curriculum for a general surgery service in a tertial academic hospital without electronic order entry system, and evaluated the effectiveness of this curriculum using a prospective observational cohort study design. We also identified specific times during the academic year where trainees are most susceptible to making medication prescribing errors. We observed that the total number of medication errors per month and prescription-writing (PW) errors per month were significantly reduced post-curriculum implementation for the first quarter (Q1) of the academic year (July - September); however, there was no change in the number of DM errors per month. The number of medication prescribing errors were the highest in July and August pre-curriculum implementation and decreased significantly post curriculum implementation suggesting that implementation of the two-day (2-hours per day) *Medication Prescribing Curriculum* in July mitigated the usual increase in medication prescribing errors seen in the first quarter of the academic year.

We observed significant reduction in PW error post-curriculum implementation and no change in DM errors. DM errors likely result from lack of knowledge or familiarity with a given medication or clinical condition, and may require more intensive and prolonged educational interventions to address. PW errors, by definition, result from mistakes in prescription writing (medication ordering) rather than a knowledge deficit, which were effectively addressed by our two-day educational intervention - *Medication Prescribing Curriculum*. As post-graduate trainees residents progressed through the academic year, the effectiveness

of the curriculum was diminished over time. This was an expected finding as educational interventions often need to be repeated or refreshed on multiple occasions to avoid degradation in knowledge, skills and attitudes over time[19]. We suggest administering a "refresher" *Medication Prescribing Curriculum* every 3 months during the academic year, as knowledge and skills of surgery trainees have been shown to degrade after a 3 month period[19].

Baseline data for 12 months prior to the implementation of the *Medication Prescribing Curriculum* demonstrated that the greatest number of errors occurred in July with significantly greater number of errors per month in Q1 versus Q3 and Q4. This result is consistent with what Phillips termed the 'July Effect' where an increase in fatal prescribing errors was observed in American teaching hospitals in July[20]. Chaitoff et al. showed a similar trend in errors throughout the academic year on a general surgery service[12]. As such, our finding of the absence of an expected increase in the number of errors per month in the first quarter of the academic year post-curriculum implementation suggests that our *Medication Prescribing Curriculum* may help mitigate the 'July Effect'.

Implementation of the *Medication Prescribing Curriculum* did not change the number of DM errors committed per month. While PW errors can be reduced with implementation of an electronic order entry (EOE) system [10–11], potentially serious DM errors such as failing to adjust dosing for weight or renal function continue to occur frequently in institutions with EOE[12]. As such, implementation of EOE should not be expected to eliminate DM errors and future research efforts should focus on developing educational intervention to specifically reduce DM errors. Our results regarding the general classes of medications implicated in prescription writing errors (Table 5) can be used to inform future educational interventions by identifying high yield topics to focus on. One approach may be using examples of DM errors from our study to create vignettes for online case-based learning, which can be delivered longitudinally over the duration of the academic year.

The classes of medications involved in prescribing errors were compared on a monthly basis in the pre and post-curriculum years. We found that mean monthly errors in prescribing antibiotics were reduced post-curriculum from 8.0 (3.1) to 3.8 (1.7) ($p = 0.007$). As antibiotic selection, dosing and, and stewardship were specifically addressed in the *Medication Prescribing Curriculum* this suggests that targeted teaching about common classes of drugs, in addition to general prescribing principles, is effective. No significant differences for other classes of medications were observed.

Our study has several limitations. First, we were not able to capture medication prescribing errors that were of a highly acuity as such errors in our institution are communicated directly by the pharmacist to the post-graduate trainee by telephone without completing a medication memorandum. As such, the incidence of such errors at our institution is currently unknown; however, the potential influence of this practice on our results was likely minimal as this practice occurred both pre and post-curriculum implementation. Second, although the *Medication Prescribing Curriculum* was delivered only to general surgery trainees, orders written by off-service residents and attending surgeons were also included in our study. We were not able to separate orders written by general surgery and off-service residents due to

institutional limitations, however the proportion of off-service residents rotating on the general surgery service was not significantly different pre- and post-curriculum implementation (Table 2). Third, it is possible that a Hawthorne effect contributed to the reduction in errors observed in Q1 of the academic year as trainees may have been aware of our study and may have adjusted their prescribing practices. Lastly, we were not able to calculate error rates (number of errors divided by the total number of orders written), as we did not know total number of orders that were written per month on a general surgery service due to lack of EOE in our institution. We did, however, confirm that there was no significant difference in the average number of orders processed per month by pharmacy for the general surgery service pre and post-curriculum implementation (4405.0 ±141.4 vs 4314.7 ±240.6; p = 0.659). These numbers represent all orders processed by the pharmacy, including orders for total parenteral nutrition (TPN), and therapeutic interchanges (TI) which were excluded in our study.

Conclusions

Implementation of a structured Medication Prescribing Curriculum in a general surgery training program was associated with a reduction in the total number of medication prescription errors and prescription-writing errors in the first quarter of the first quarter of the academic year. The effectiveness of the Medication Prescribing Curriculum decreased over time, and a “refresher” curriculum should be offered at regular intervals during the academic year. Further research is needed to develop and evaluate educational interventions targeting decision-making errors in prescription writing.

Abbreviations

DM: Decision making

PW: Prescription writing

PGY: Post-graduate year

EOE: Electronic order entry

Declarations

Ethics approval and consent to participate: Research Ethics Board approval was obtained prior to commencement of the study from Queen’s University (#6020195).

All methods were carried out in accordance with relevant guidelines and regulations.

Informed consent was obtained from all participants

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and/or analysed during the current study are not publicly available due to confidentiality concerns (unedited data contains specific information regarding prescription medications and our institution is located in a relatively small community) but are available from the corresponding author on reasonable request.

Competing interests: none

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Authors Contributions:

Study conception and design: Ring, Zhang, Methot, Zevin

Acquisition of data: Ring, Maracle

Analysis and interpretation of data: Ring, Maracle, Zhang, Zevin

Drafting of manuscript: Ring, Zevin

Critical revision: Ring, Maracle, Zhang, Methot, Zevin

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Tables

Table 1: Demographics of post-graduate trainees eligible to participate and participated in the Medication Prescribing Curriculum.

Year of Training	Eligible	Participated
PGY 1	5	5
PGY 2	3	2
PGY 3	3	2
PGY 4	5	4
PGY 5	0	0
Total	16	13

Table 2: Complement of post-graduate trainees on a general surgery service pre and post-curriculum implementation.

Month	Pre-curriculum implementation		Post-curriculum implementation		P-value
	General Surgery Residents	Off-Service Residents	General Surgery Residents	Off-Service Residents	
July	13	0	8	2	0.92
August	11	1	8	2	0.43
September	10	1	8	2	0.48
October	9	4	6	4	0.65
November	8	4	7	3	0.87
December	8	3	10	1	0.27

Table 3: Number of medication prescription errors per month pre and post-curriculum implementation.

	Pre-Curriculum			Post-Curriculum		
Month	**Total Errors**	**PW Errors**	**DM Errors**	**Total Errors**	**PW Errors**	**DM Errors**
July	116	79	37	68	29	39
August	106	61	45	92	55	37
September	100	66	34	73	38	35
October	93	54	39	87	47	40
November	66	44	22	84	52	32
December	91	50	41	68	39	29
January	83	48	35	-	-	-
February	74	39	35	-	-	-
March	76	42	34	-	-	-
April	74	43	31	-	-	-
May	88	46	42	-	-	-
June	83	43	40	-	-	-
Total	**1050**	**615**	**435**	**472**	**260**	**212**

Table 4: Number and types of medication errors per month pre and post-curriculum implementation.

	Errors per month (Pre-curriculum implementation)	Errors per month (Post-curriculum implementation)
Total Errors	**87.5 (14.6)**	**78.7 (10.3)**
Decision making	**36.3 (6.0)**	**35.3 (4.2)**
Pharmaceutical issues	7.0 (2.8)	10.0 (2.7)
Prescribing two drugs for the same indication when only one is necessary	5.3 (2.3)	7.5 (4.1)
Prescribing a dose not recommended for the formulation prescribed	7.5 (2.3)	7.3 (2.8)
Dosing of drug with a narrow therapeutic index outside of the predicted range (above or below)	3.3 (2.6)	4.0 (2.3)
Dosing of drug below what is recommended for patient's clinical condition	4.1 (2.0)	2.3 (1.5)
Documented significant allergy	1.7 (1.2)	1.3 (1.2)
Prescription inappropriate for patient concern	1.7 (1.3)	0.7 (0.8)
Drug is contraindicated for a co-existing condition of a patient	1.8 (1.2)	0.7 (1.2)
Prescribing a drug without adjusting for weight / body size	1.0 (1.0)	0.7 (0.8)
Dosing of drug inappropriate for patient's renal function (both overdosing / underdosing)	2.2 (1.9)	0.5 (0.5)
Continuing a drug in the event of a clinically significant adverse drug interaction	0.0 (0.0)	0.2 (0.4)
Continuing a prescription for longer duration than necessary	0.0 (0.0)	0.2 (0.4)
Prescribing a drug without adjusting for age	0.2 (0.4)	0.0 (0.0)
Prescribing a drug when there is no indications to	0.1 (0.3)	0.0 (0.0)
Prescribing a drug at a concentration greater than recommended for peripheral IV administration	0.3 (0.7)	0.0 (0.0)
Not taking to account a significant drug interaction	0.3 (0.6)	0.0 (0.0)
Total (prescription writing)	**51.3 (11.9)**	**43.3 (9.8)**
Omission of frequency/not specifying PRN orders (i.e. morphine 2 mg PRN instead of q4h prn)	12.7 (5.5)	10.8 (6.2)
Prescribing one tab/ 1 puff of a drug that is available in	11.6 (4.4)	10.3 (5.1)

more than one strength		
Writing an ambiguous medication order	7.5 (4.4)	7.2 (1.5)
Wrong unit (milligrams vs. micrograms)	4.8 (1.6)	5.0 (2.4)
Omission of route for a drug that can be given by more than one route	6.8 (2.8)	3.3 (1.8)
Error in prescribing a home medication on admission	1.5 (1.6)	2.3 (1.4)
Gross misspelling of medication names	1.8 (1.5)	1.7 (1.5)
Writing prescriptions using non-standard nomenclature / abbreviations/ trailing zero, not putting zero in front of decimal	2.3 (1.9)	1.5 (1.2)
Prescribing a drug, dose, or route that is not intended	1.3 (1.6)	0.8 (1.6)
Writing illegibly	0.3 (0.6)	0.2 (0.4)
Omission of duration over drug to be infused via IV	0.4 (0.9)	0.2 (0.4)
Omission of signature	0.2 (0.4)	0.0 (0.0)
Drug intended for wrong patient	0.0 (0.0)	0.0 (0.0)
Transcription errors	0.1 (0.3)	0.0 (0.0)
Unintentionally not prescribing a drug patient was taking prior to admission	0.0 (0.0)	0.0 (0.0)

Table 5: General classes of medications implicated in prescription writing errors.

Medication Class	Errors per Month (Pre-curriculum)	Errors per Month (Post-curriculum)	P-value
Other	14.5 (4.4)	10.2 (3.5)	0.054
Gastrointestinal	11.6 (2.9)	11.3 (5.2)	0.90
Respiratory	9.3 (4.9)	10.5 (6.9)	0.67
Narcotic	8.8 (2.9)	7.3 (3.7)	0.36
Cardiac	8.4 (4.1)	7.5 (2.1)	0.62
Antibiotic	8.0 (3.1)	3.8 (1.7)	0.007
Psychiatric	6.6 (2.7)	7.0 (1.4)	0.74
Non-narcotic pain	5.4 (2.7)	4.2 (3.1)	0.41
Electrolytes	5.1 (3.3)	6.7 (3.1)	0.39
Anticoagulants /antiplatelet	5.1 (3.1)	4.5 (1.8)	0.67
Vitamins	4.8 (2.8)	5.7 (3.3)	0.55

Figures

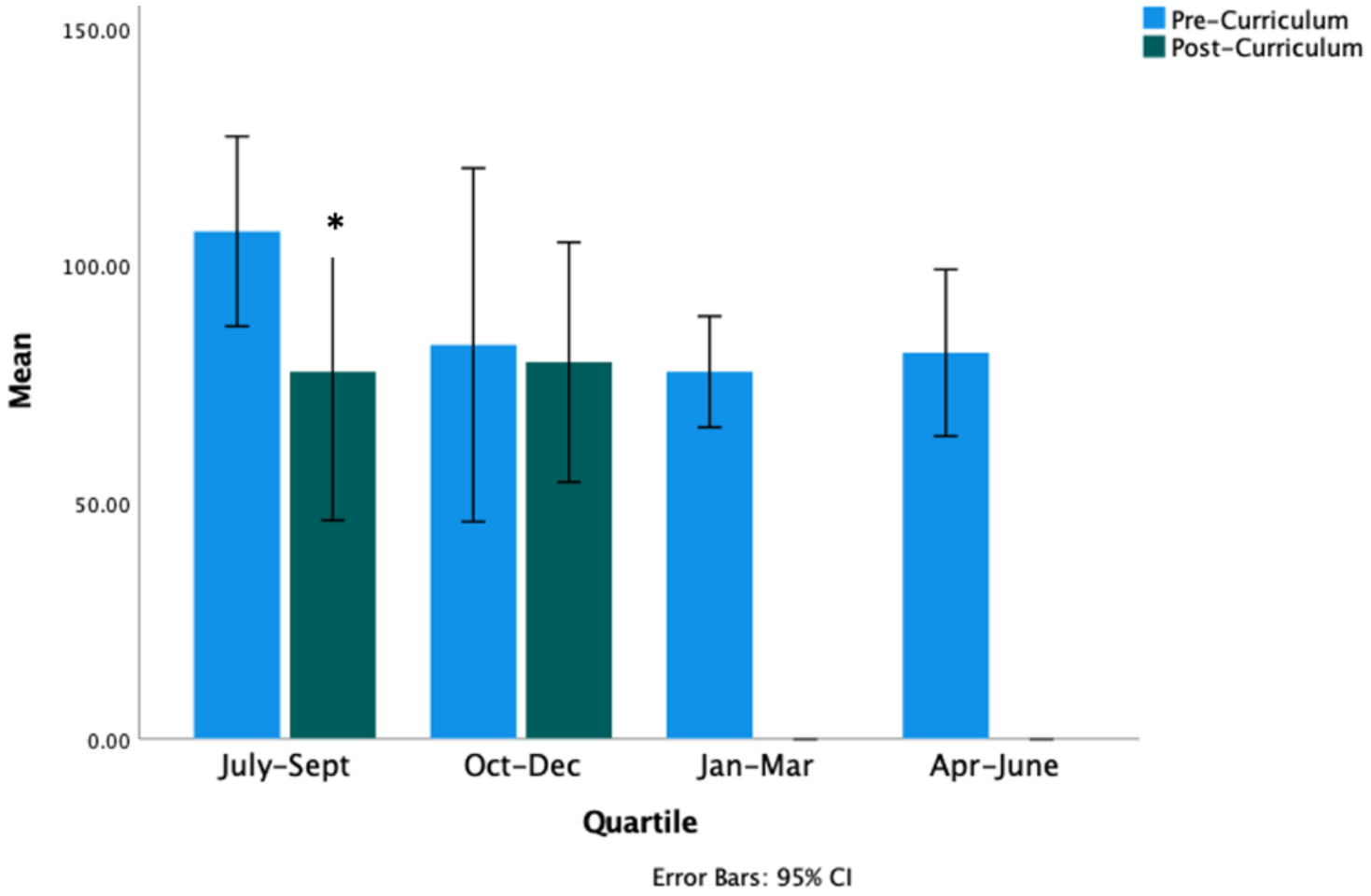

Figure 1

Mean number of monthly errors per quarter of the academic year; pre-curriculum and post-curriculum.