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ORIGINAL RESEARCH

Variables associated with completeness of medical record documentation in the emergency department

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Abstract

Objective: The completeness of ED medical record documentation is often suboptimal. We aimed to determine the variables associated with documentation completeness in a large, tertiary referral ED.

Methods: We audited 1200 randomly selected medical records of patients who presented with either abdominal pain, cardiac chest pain, shortness of breath or headache between May–July 2013 and May–July 2016. Data were collected on patient and treating doctor variables. Documentation completeness was assessed using a 0–10 point scoring tool designed for the study. A maximum score was achieved if each of 10 pre-determined important items, specific to the presenting complaint, were documented (five medical history items, five physical examination items). Data were analysed using multivariate regression.

Results: The presenting year, day and time, patient age and gender, preferred language, interpreter requirement, discharge destination and doctor gender were not associated with documentation completeness ($P > 0.05$). Patients with triage category 3 or pain score of 6–7 had higher documentation scores ($P < 0.05$). Compared to interns, registrars (effect size −0.72, 95% CI −1.02 to −0.42, $P < 0.01$) and consultants (−1.62, 95% CI −1.95 to −1.29, $P < 0.01$) scored significantly less. The headache patient subgroup scored significantly less than the other patient subgroups (−0.35, 95% CI −0.63 to −0.08, $P = 0.01$). For all presenting complaint subgroups, examination findings were less well documented than history items ($P < 0.001$).

Conclusion: Documentation completeness is less among senior doctors, headache patients and for examination findings. Research should determine if the supervision responsibilities of senior doctors affects documentation and if medico-legal and patient care implications exist.

Key words: *documentation, emergency department, medical record.*

Key findings

- Incomplete medical record documentation is common.
- Registrar and consultant documentation is less complete than that of interns.
- History items are better documented than examination items.

Introduction

The medical record can be defined as documentation that contains information about a patient's medical history, symptoms, clinical findings, diagnoses, therapies and prognosis.[1] It serves as a means to track the progress of a patient through the healthcare system and allows communication between healthcare providers. In addition, the medical record is important in medico-legal settings and for administration, education, research, healthcare planning and budgeting.[1–3] Despite its many functions, documentation quality is often suboptimal. Suboptimal documentation is evident across multiple healthcare disciplines including nursing, pharmacy, inpatient services, outpatient services and the ED.[4–9]

For many patients, the ED medical record represents the beginning of the patient's journey through different settings. Medical record entries are frequently copied from previous notes. One study reported the frequency of copied notes to be as high as 82%.[10] This highlights the importance of good quality ED documentation. However, the time-pressured environment and high patient turnover are reported as reasons why documentation often suffers in the ED.[11] Other reasons include illegible handwriting, inaccuracy, incomplete information and poor concordance.[7,12–14] A number of methods have been proposed to assess documentation quality. These include the PDQI[15] and QNOTE tools,[16] although neither has been validated in the ED setting nor adequately examine documentation completeness.

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There is a paucity of reports on the potential impact of doctor, patient and environmental factors on documentation quality, especially in the ED. We aimed to determine the variables associated with completeness (an element of quality) of medical record documentation in the ED. These variables may inform interventions aimed at improving documentation completeness in this setting.

Methods

We undertook a retrospective audit of electronic medical records (EMRs) of the Austin Hospital ED between February and May 2017, inclusive. The Austin Hospital is a tertiary referral, metropolitan centre and the ED has a mixed (adult and paediatric) annual census of approximately 85 000. The study was approved by the Austin Health Human Research Ethics Committee.

Prior to the audit, we developed a 'Completeness Scoring Tool' in order to evaluate the completeness of documentation in the medical record. Twelve ED consultants were independently asked to nominate the five most important items of both medical history and physical examination that should be documented for each of four common presenting complaints: abdominal pain, cardiac chest pain, shortness of breath or headache. The most commonly nominated important items informed the development of the scoring tool (Box 1). If a medical record had all 10 of these important items recorded, it received a 'documentation score' of 10. If no item was documented, the documentation score was 0.

The reproducibility of the scoring tool, when used by different assessors, was examined. Training was provided for the assessors in the use of the MEDTRAK® and CERNER® systems. A random sample of 20 patients was selected from the 1200 patients who met the study entrance criteria. The four assessors independently scored the documentation completeness of these patients. Their mean documentation scores were 5.5, 5.7, 5.8 and 5.9.

BOX 1. *History and examination items that comprise the documentation completeness scoring tool*

Presenting complaint	History items	Examination items
Abdominal pain	Past history	General appearance
	Duration	Local tenderness
	Location	Peritonism
	Bowel motions	Distension
	Vomiting	Bowel sounds
Cardiac chest pain	Past history	General appearance
	Duration	Lung auscultation
	Nature	Heart auscultation
	Precipitating/ exacerbating factors	Jugular venous pressure
	Associated symptoms	Peripheral oedema
Shortness of breath	Past history	Lung auscultation
	Duration	Heart auscultation
	Fever	Jugular venous pressure
	Cough	Peripheral oedema
	Associated pain	Accessory muscle use
Headache	Past history	General appearance
	Duration	Meningism
	Site	Cranial nerve exam
	Fever	Peripheral neurological exam
	Associated symptoms	Eye exam

Patients were eligible for inclusion if they were aged 18 years or more and presented in May–July 2013 or May–July 2016, inclusive, with one of the four presenting complaints of interest. They were excluded if they self-discharged before being assessed by an ED doctor, were reviewed by another team (not an ED doctor), or had previously been enrolled in the same 3 month period. They were also excluded if their medical record or demographic details were missing or if they had no ED doctor notes (the patient was seen by a nurse practitioner or physiotherapist). From each year's list, 600 eligible patients (150 patients for each of the four presenting complaint groups) were randomly selected, using the Excel randomisation function.

In both the MEDTRAK® (introduced in 2001) and CERNER® (introduced in 2014) ED information systems, all medical records were typed into the computer directly by the treating doctor. No records were handwritten. A single investigator (FWYL) extracted all data from the medical records. These data included presenting year, day and time, patient age and gender, triage category, pain score, preferred language, interpreter requirement, discharge destination, presenting complaint, doctor gender and designation. A document with the definitions and inclusions for the scoring criteria assisted data extraction (Appendix S1). Any uncertainty on the definition of the nominated items was clarified with an ED consultant.

Following data collection, a sample of 10% of enrolled patients was randomly selected and their medical record scored by a second assessor. Any discrepancy in completeness scores between the original and second assessors was re-checked against the definitions document to inform the final scoring. Scores between any

two assessors were concordant in 82.5% of cases. In all but one of the discordant cases, the assessor scores differed by 1. For the other case, the scores differed by 2.

Data were entered into an Excel spreadsheet without identifying information. All patients were assigned a study ID number. A password protected master list linking the patient's name and UR number to the study ID number was generated to enable a subsequent data extraction accuracy exercise.

The primary outcome of the study was documentation completeness as measured by the scoring tool (range 0–10). Secondary outcomes included a comparison of completeness between the presenting complaint and doctor subgroups, and history and examination item completeness.

A difference of 1, in the mean documentation scores of related variable subgroups (e.g. male *vs* female patients), was considered to be clinically significant. In order to demonstrate a statistically significant difference between the mean documentation scores of two variable subgroups, at least 141 patients were needed in each subgroup (difference in means of 1, SD 3, level of significance 0.05, two-sided, power 0.8). However, some variables had four subgroups (e.g. age classification) and it was expected that patient numbers in each subgroup would differ. To account for these issues, we set the total sample size at 1200 patients (300 from each of the four presenting complaint groups).

Most analyses were descriptive, for example, mean (SD), proportion (95% CI). Multivariate regression was employed to determine which doctor, patient or environmental variables were associated with the documentation completeness score. Intercooled Stata 6.0 for Windows 98/95/NT (Stata Corporation, College Station, TX, USA) was employed for all analyses (level of significance 0.05).

Results

A total of 1200 EMRs completed by 195 doctors was analysed. A description of the variables of interest are reported in Table 1. There were few differences in the following variables: presenting year, patient gender, presenting complaint and doctor gender. There was a higher proportion of weekday than weekend presentations and a lower proportion of presentations during the time 00.00–07.59 h and among patients aged over 80 years. Most patients spoke English and did not require an interpreter. There were also small differences in the number of interns and residents compared to registrars and consultants. Presentations that were classified as triage category 3 were most common. Additionally, there were slightly fewer patients with mild and severe pain (as opposed to moderate pain) and fewer who were transferred to the short stay ward.

The univariate and multivariate regression results are reported in Table 1. The designation of the doctor was significantly associated with documentation completeness. As seniority increased, documentation completeness decreased. Doctor gender was associated with completeness in the univariate but not the multivariate analyses.

Patients with triage category 3 or in moderate pain had slightly higher documentation scores when compared to their respective reference subgroups. However, the differences between the mean scores between the groups were not clinically significant (0.2 and 0.1, respectively). Patients in the headache subgroup had slightly lower scores than the abdominal pain subgroup. However, the differences in the mean scores for these complaints (<1) were not clinically significant. The presenting year, day and time, patient age and gender, triage category, pain score, preferred language, interpreter requirement, discharge destination were not associated with documentation completeness.

For each presenting complaint, a maximum of 1500 history and 1500 examination items could have been documented (5 items × 300 patients). For each of the presenting complaint groups, documentation of examination items was significantly less than history items (Table 2). The most poorly documented history items were precipitating/exacerbating factors of chest pain and fever in headache, both of which were documented less than 55% of the time (Table 3). The most poorly documented examination items were abdominal distension, jugular venous pressure and eye examination, where each item was documented less than 30% of the time.

Discussion

This study demonstrates that seniority of the doctor is significantly and negatively associated with completeness of the ED medical record, a component of documentation quality. This finding is consistent with other reports. Chong *et al.*[17] examined the effect of an EMR system on documentation quality and reported that senior doctors performed more poorly on a template EMR system than junior doctors. Soto *et al.*[18] examined variables affecting documentation quality and reported that more senior physicians were less likely to document drug allergies or immunisation status.

Explanations for these consistent findings are difficult to determine. Although speculation, it may be that interns are more diligent and record more information, including lists of negative findings. Interns usually see fewer patients and may spend more time on documentation. Moreover, they may have better typing and computer skills that allows them time to record more information. All doctors in our ED see new patients. However, senior doctors have more responsibilities, including managing patient flow, supervision of junior doctors and medical students, management plans, administration and teaching. These may limit their time available for more complete documentation.

Importantly, this study explored only documentation in the medical record. It is possible that the senior doctors did, in fact, ascertain and use information on most or all of the important history and examination items. Indeed, they may have performed better in this regard than the junior staff. So, no association can be drawn between documentation

TABLE 1. *Regression analysis of variables on documentation scores*

	n (%)	Documentation score, mean (SD)	Univariate analysis			Multivariate analysis		
			Effect	95% CI	*P*	Effect	95% CI	*P*
Presenting year								
2016	600 (50)	6.5 (1.7)	0			0		
2013	600 (50)	6.4 (1.8)	−0.1	−0.29 to 0.10	0.35	−0.06	−0.25 to 0.13	0.54
Presenting day								
Weekday	902 (75)	6.4 (1.8)	0			0		
Weekend	298 (25)	6.4 (1.7)	−0.07	−0.30 to 0.16	0.54	−0.16	−0.38 to 0.06	0.16
Presenting time								
00.00–07.59 h	237 (20)	6.6 (1.6)	0			0		
08.00–15.59 h	565 (47)	6.3 (1.8)	−0.29	−0.56 to −0.03	0.03	−0.09	−0.34 to 0.17	0.50
16.00–23.59 h	398 (33)	6.5 (1.9)	−0.13	−0.41 to 0.15	0.36	−0.01	−0.28 to 0.26	0.94
Patient age (years)								
18–39	320 (27)	6.4 (1.6)	0			0		
40–59	343 (29)	6.4 (1.7)	−0.07	−0.34 to 0.20	0.61	−0.06	−0.32 to 0.20	0.65
60–79	340 (28)	6.4 (1.8)	−0.07	−0.34 to 0.20	0.61	0.001	−0.29 to 0.29	0.995
80+	197 (16)	6.7 (1.8)	0.22	−0.09 to 0.54	0.16	0.29	−0.06 to 0.65	0.10
Patient gender								
Male	488 (41)	6.4 (1.8)	0			0		
Female	712 (59)	6.4 (1.7)	−0.02	−0.23 to 0.18	0.82	0.13	−0.19 to 0.21	0.90
Presenting complaint								
Abdominal pain	300 (25)	6.6 (1.6)	0			0		
Cardiac chest pain	300 (25)	6.5 (1.8)	−0.05	−0.32 to 0.23	0.74	0.23	−0.12 to 0.60	0.20
Shortness of breath	300 (25)	6.5 (2.0)	−0.11	−0.39 to 0.17	0.44	0.12	−0.25 to 0.49	0.52
Headache	300 (25)	6.2 (1.6)	−0.38	−0.66 to −0.10	0.01	−0.35	−0.63 to −0.08	0.01
Triage category								
1–2	335 (28)	6.3 (1.7)	0			0		
3	638 (53)	6.5 (1.8)	0.15	−0.08 to 0.39	0.19	0.27	0.002 to 0.53	0.048
4–5	227 19)	6.3 (1.8)	−0.13	−0.31 to 0.28	0.93	0.3	−0.06 to 0.65	0.10
Preferred language								
English	1079 (91)	6.4 (1.7)	0			0		
Other	121 (9)	6.5 (1.9)	0.08	−0.25 to 0.41	0.63	−0.31	−0.81 to 0.18	0.22
Interpreter required								
No	1122 (94)	6.4 (1.8)	0			0		
Yes	78 (6)	6.7 (1.8)	0.26	−0.14 to 0.66	0.2	0.54	−0.05 to 1.13	0.07
Pain intensity at triage								
None (pain score 0)	347 (29)	6.4 (2.0)	0			0		
Mild (1–3)	230 (19)	6.5 (1.8)	0.05	−0.24 to 0.34	0.73	0.26	−0.06 to 0.58	0.11
Moderate (4–7)	449 (37)	6.5 (1.7)	0.05	−0.20 to 0.29	0.71	0.35	0.03 to 0.67	0.03
Severe pain (8–10)	174 (15)	6.4 (1.5)	−0.04	−0.35 to 0.28	0.81	0.36	−0.05 to 0.77	0.08
Discharge destination†								
Home	545 (45)	6.5 (1.8)	0			0		
Short stay unit	271 (23)	6.4 (1.7)	−0.12	−0.38 to 0.13	0.36	−0.002	−0.26 to 0.25	0.99
Inpatient ward	383 (32)	6.4 (1.7)	−0.09	−0.32 to 0.14	0.45	−0.11	−0.35 to 0.14	0.39
Doctor gender								
Male	684 (57)	6.3 (1.8)	0			0		
Female	516 (43)	6.7 (1.7)	0.39	0.19 to 0.59	<0.01	0.16	−0.04 to 0.35	0.11
Doctor designation								
Intern	156 (13)	7.2 (1.6)	0			0		
Resident	192 (16)	7.0 (1.4)	−0.22	−0.57 to 0.13	0.22	−0.23	−0.58 to 0.13	0.21
Registrar	544 (45)	6.5 (1.6)	−0.74	−1.03 to −0.44	<0.01	−0.72	−1.02 to −0.42	<0.01
Consultant	308 (26)	5.6 (1.9)	−1.66	−1.98 to −1.34	<0.01	−1.62	−1.95 to −1.29	<0.01

†*n* = 1199.

TABLE 2. *Difference in proportions of documented history and examination items*

Complaint	History items n† = 1500	Examination items n† = 1500	Difference in proportions % (95% CI)	*P*
Abdominal pain, *n* (%)	1254 (83.6)	719 (47.9)	35.7 (32.5, 38.9)	<0.001
Cardiac chest pain, *n* (%)	1125 (75.0)	823 (54.9)	20.1 (16.7, 23.5)	<0.001
Shortness of breath, *n* (%)	1133 (75.5)	787 (52.5)	23.1 (19.7, 26.5)	<0.001
Headache, *n* (%)	1227 (81.8)	639 (42.6)	39.2 (36.0, 42.4)	<0.001

†n = 5 important items/patient × 300 patients = 1500 items should have been documented.

completeness and the actual quality of patient assessment.

Although we did not find an association between doctor gender documentation completeness, Soto *et al.*[18] showed that female physicians have better smoking history documentation than males and that female paediatricians are more likely to document drug allergies. They also reported that documentation completeness varied with specialisation of the doctor. As our study was confined to the ED setting, we were unable to investigate this variable. However, it is logical to assume that with different specialties, the focus of the history and examination is skewed to the specialty of interest.

Daphtary *et al.*,[19] using the PDQI-9 tool, reported no association between documentation quality and the time of presentation to a paediatric intensive care unit (ICU). This was consistent with our findings where time and day of presentation were not associated with documentation completeness. Conversely, another ICU study showed that

TABLE 3. *History and examination items recorded in the medical record*

Complaint	History items, n† (%)		Examination items, n† (%)	
Abdominal pain	Past history	267 (89.0)	General appearance	151 (50.3)
	Duration (onset)	283 (94.3)	Local tenderness	278 (92.7)
	Location	267 (89.0)	Peritonism	96 (32.0)
	Bowel motions	233 (77.7)	Distension	42 (14.0)
	Vomiting	204 (68.0)	Bowel sounds	152 (50.7)
Cardiac chest pain	Past history	273 (91.0)	General appearance	134 (44.7)
	Duration (onset)	292 (97.3)	Lung auscultation	258 (86.0)
	Nature	202 (67.3)	Heart auscultation	237 (79.0)
	Exacerbating factors	99 (33.0)	Jugular venous pressure	77 (25.7)
	Associated symptoms	259 (86.3)	Peripheral oedema	117 (39.0)
Shortness of breath	Past history	288 (96.0)	Lung auscultation	274 (91.3)
	Duration (onset)	269 (89.7)	Heart auscultation	192 (64.0)
	Fever	184 (61.0)	Jugular venous pressure	85 (28.3)
	Cough	206 (69.0)	Peripheral oedema	139 (46.3)
	Associated pain	186 (62.0)	Accessory muscle	97 (32.3)
Headache	Past history	269 (89.7)	General appearance	130 (43.3)
	Duration (onset)	292 (97.3)	Meningism	115 (38.3)
	Site	222 (74.0)	Cranial nerve exam	185 (61.7)
	Fever	280 (54.7)	Peripheral neuro exam	186 (62.0)
	Associated symptoms	130 (93.3)	Eye exam	23 (7.7)

†n = number of times an item was documented out of a maximum of 300 for each presenting complaint in 300 patients.

transcription of laboratory results was more accurate when recorded in the morning.[20]

Documentation of headache items was slightly less complete than the other presenting complaint subgroups. In particular, the eye examination was the least well documented. As the examination items for this complaint are more time consuming than the other complaints, this may have contributed to this finding. Overall, in each patient subgroup, history items were more frequently documented. This may reflect the perception that history is often more important than examination in patient assessment.

Given the important role medical records have for communication between healthcare providers, it is important that all the relevant information is documented and accurate. Most investigators agree that documentation quality is associated with quality of care.[21,22] Zeger *et al.*[21] reported that poor documentation quality is associated with the adverse event rate. Poor documentation has also been found to hinder assessment of the quality of care delivered to patients.[23]

In addition to implications for patient care, poor documentation quality may have medico-legal implications.[24,25] Medical records are legal documents and good documentation is the most concrete defence when proving whether something was done. Documentation is less fallible and less subjective than an individual's testimony.[26]

There are recommendations on what to include in medical records and how to improve documentation.[25,27,28] Doctors, regardless of seniority, should endeavour to document well and include all important items relevant to the presenting complaint. Professional development workshops and individualised feedback have been shown to improve medical record quality[29,30] and could be considered by institutions and individual EDs. Furthermore, there is scope for the Australasian College for Emergency Medicine to determine documentation benchmarks within our EDs and means of achieving these.

Limitations

Only electronic records on MEDTRAK and CERNER were assessed and they may not be representative of other EMR systems. We examined only ED documentation so our findings may not be relevant to other healthcare settings, for example, inpatient or outpatient encounters. Furthermore, the findings are only applicable to the four common presenting complaints examined. Also, the completeness scoring tool was designed specifically for this study and has not been used or validated elsewhere. However, when used by different assessors for the same records, the score reproducibility was good. The tool was comprised of items as determined by 12 emergency physicians and their responses often varied. As such, they may not have been the most important items within a medical record. However, the tool was applied consistently and was able to compare documentation completeness, regardless of the absolute importance of all tool items. In some cases, an item may not have been documented if it was not of relevance to that particular presentation (e.g. a straight forward case not requiring a complete evaluation). Hence, a low documentation score does not necessarily mean poor documentation. Our study did not capture other measures of quality such as accuracy and reliability and did not address whether documentation quality affects quality of care. Finally, as a single centre study, the external validity of the findings may be questionable.

Conclusion

Registrar and consultant documentation is less complete than that of interns. History items are better documented than examination items for each of the four presenting complaints. Headache items were documented slightly less well than those for the other presenting complaints. Further research should determine the extent of medico-legal and patient care implications of poor documentation and whether the documentation of senior doctors needs to be improved.

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The authors will make the study data available on request to the corresponding author.

Author contributions

FWYL and DMT designed the study protocol and wrote the ethics committee application. FWYL, JAK, MHKD and AH collected all data. DMT and AU undertook the statistical analysis. All authors contributed to preparing the study manuscript. DMT supervised the study overall.

Competing interests

None declared.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix S1. Definitions of presenting complaint history and examination items.