

Medical record-keeping educational interventions for medical students and residents: A systematic review

Emre Emekli, MD, PhD^{1,2}

Özlem Coşkun, MD³

Işıl İrem Budakoğlu, MD³

¹Department of Radiology, Eskişehir Osmangazi University, Faculty of Medicine, Eskişehir, Türkiye

² Department of Medical Education, Gazi University, Institute of Health Sciences, Ankara, Türkiye

³ Medical Education and Informatics, Gazi University, Faculty of Medicine, Ankara, Turkey

Corresponding Author: Assist. Prof. Emre Emekli, Eskişehir Osmangazi University Faculty of Medicine, Health Practice and Research Hospital, Büyükdere Mah, Meşelik Kampüsü, 26040 Odunpazarı/Eskişehir/Türkiye. e-mail: emreemekli90@gmail.com

Abstract

Background: Medical records, encompassing patient histories, progress notes, and more, play a crucial role in patient care and treatment, healthcare communication, medico-legal matters, and supporting financial documentation. **Objective:** Despite their significance, literature suggests inconsistencies in record quality and insufficient formal medical record-keeping education for medical students and residents. The study aimed to identify and evaluate the effectiveness of educational interventions by conducting a systematic review. **Method:** A literature search covering 2003-2023 and review following PRISMA guidelines was undertaken. **Results:** The literature search identified 44 relevant studies for inclusion. Educational methods, including lectures, feedback, workshops and discussions, addressed different components of the clinical record. The review revealed positive impacts on participant satisfaction, skills, and attitudes related to record-keeping. However, some studies reported no significant positive outcomes, emphasising the need for higher-level evidence. Most studies adopted a single-group pretest-posttest design, presenting challenges in control group implementation. The Kirkpatrick evaluation levels were primarily at level 2, with few studies reaching levels 3. The absence of studies at level 4 suggested the need for more robust evidence. Studies targeted medical residents more frequently than medical students, with a lack of interventions during the first year of medical education. **Conclusion:** Despite limitations including language bias and methodological variations, the review revealed diverse educational strategies and highlighted the necessity for more randomised controlled trials and studies providing higher-level evidence to enhance clinical record-keeping skills among medical students and residents. **Implications:** Medical record-keeping educational interventions can significantly improve the documentation skills of medical students and residents, thereby enhancing patient care, communication, and medico-legal compliance.

Keywords: MeSH: hospital records; systematic review; efficiency; health information management

Supplementary keywords: medical education; medical records

Introduction

Medical records in healthcare institutions, usually utilised by medical practitioners and healthcare teams, are used in patient management. Medical records can be defined as any material that can be kept in a printed or electronic format regarding patients who attend hospitals or healthcare institutions (Emekli et al., 2024). Components of medical records include patient histories, progress notes, discharge summaries, operation notes, referrals, and multiple other important notations. In short, any notes containing medical information about a patient can be referred to as a medical record (Clynch and Kellett, 2015). Maintaining high-quality medical records is crucial for the proper functioning of the healthcare system and has many implications for the education of students in medical faculties (Kuhn et al., 2015). One of the most important features of medical records is that they serve as a communication tool. Medical records function as a means of communication among team members, with the patient, and with teams in other hospitals that the patient may visit in the future (Alkureishi et al., 2016). Medical records are important for medico-legal purposes and serve as clinical documents that provide critical evidence to support an organisation's finance-related functions, forming the basis for billing in many countries (Seo et al., 2016; Jackson, 2014). Recognising the overall importance of medical records, many international organisations provide recommendations and publish guidelines related to records. From an educational perspective, the Association of American Medical Colleges expects medical students to have effective documentation skills for clinical encounters before graduation. This skill is regarded as a fundamental entrustable professional activity for admission into any specialty program (Association of American Medical Colleges, 2014). Likewise, effective communication is underscored as essential by both the International Institute for Medical Education and Medical Education in Europe (Kyaw et al., 2019; Cumming and Ross, 2007).

Despite the importance of medical records and the recommendations of many organisations, numerous published studies indicate that medical records are often not maintained with consistent quality, information not recorded in a timely manner, and that students do not receive sufficient formal education on this matter (Lai and Tillman, 2021; Emekli et al., 2023; Dawson et al., 2010). Studies have also noted that this lack of formal education can lead students to seek alternative resources, such as YouTube, which may lack reliable instructional quality (Emekli and Kıyak, 2024). Numerous interventions aimed to improve the overall quality of medical records or specifically addressing certain types of records have been explored (Sayyah-Melli et al., 2017; Wagoner et al., 2022; Kusnoor et al., 2022; Richardson et al., 2022). Reviews of the literature have also highlighted research examining training in the area of record-keeping, conducted via electronic record systems or focused on a specific clinical record type (Samadbeik et al., 2020; Rajaram et al., 2020; Keifenheim et al., 2015). While the outcomes of these studies suggested that training interventions of various types are generally beneficial, they also pointed to a need for further randomised controlled trials to support the findings with evidence. There was also, to our knowledge, no systematic review in the research literature that focused specifically on the application of medical record education for medical undergraduate students and residents.

Aim

The purpose of our study was to access all publications that focused on any of a diverse range of medical record types, such as history notes, discharge summaries, radiography reports, progress notes, admission and discharge notes, operation notes, and informed consent documents. The aim was to conduct a systematic literature review following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to address the following objectives: (i) identify educational interventions designed to provide medical

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3 students or residents with knowledge or skills related to clinical record management; (ii)
4 summarise and, whenever possible, integrate the quantitative and qualitative findings of
5 formal evaluations conducted on these training interventions; and (iii) compare the objectives
6 or outcomes of these initiatives with the competencies outlined for undergraduate and
7 postgraduate medical education.
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10 11 **Method**

12 This review protocol was registered with PROSPERO (CRD42023481681) and conducted in
13 accordance with the PRISMA guidelines (Page et al., 2021).
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15 16 ***Literature search***

17 A systematic search was conducted on PubMed, Scopus, Web of Science, ERIC, and
18 Cochrane Library, covering the period from January 1, 2003, to November 6, 2023. Only
19 English-language articles were included in the search. The key search terms were
20 predetermined as resident, intern, medical student, medical document, clinical record, medical
21 record, education, training, teaching, curriculum, and syllabus. Specific search terms for each
22 database are detailed (see Box 1). All retrieved references were downloaded and imported
23 into the EndNote reference manager.
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26 **Insert Box 1 about here**
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28 29 ***Eligibility criteria***

30 Inclusion criteria were established using the PICO framework:

- 31 • Population: Undergraduate medical students, residents
 - 32 • Intervention: Medical record education
 - 33 • Comparison: None
 - 34 • Outcome: Kirkpatrick level
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37 Studies involving medicine students and residents and related to any medical record education
38 were included in the review. Studies of educational interventions involving other participants,
39 in addition to residents and students, were also included in the review. Only articles targeting
40 medical education were included in the study. The study excluded non-English articles,
41 studies targeting healthcare professionals other than medicine students and residents, studies
42 lacking educational interventions related to the improvement of medical records (such as only
43 adding note templates or distributing reminder cards), review articles, studies focusing on the
44 more effective use of electronic record systems without including a medical educational
45 intervention, and studies evaluating only billing systems as an outcome.
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48 49 ***Study screening***

50 The titles of the saved studies were independently reviewed by two reviewers (EE, ÖC).
51 Titles that had the potential to be included in the study but for which a definite decision could
52 not be made were recorded for abstract screening. Similarly, during the abstract screening,
53 two independent reviewers reviewed the articles (EE, ÖC). Any discrepancies at all stages
54 were discussed and resolved, if necessary, by consulting third observer (İİB).
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56 57 ***Data extraction***

58 The final inclusion of studies in the review involved recording the following information:
59 author names, study title, publication year, country of publication, study type, participant
60 demographics, number of participants, type of course (compulsory/voluntary), educational

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3 intervention, department where the education was conducted, aim/objective of the study,
4 educational method, clinical record type/subject, evaluation of effectiveness methods,
5 outcomes, and Kirkpatrick Level (Frye and Hemmer, 2012). Each study article was assigned
6 to two reviewers (EE, ÖC) for completion of the data extraction form. These reviewers
7 convened to deliberate and achieve consensus for consistency. Subsequently, any lingering
8 disagreements were resolved by the third reviewer (IİB).
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10 11 ***Assessment and determination of Kirkpatrick levels***

12 The effectiveness of educational interventions was evaluated using Kirkpatrick's training
13 evaluation model. This model consists of four levels: reaction, learning, behaviour, and results
14 (Kirkpatrick and Kirkpatrick, 2016). The reaction level measures participants' responses to the
15 training program. This level includes studies that assess participants' post-training satisfaction
16 levels, perceptions of the usefulness of the training, and opinions on the training materials
17 (Kirkpatrick 1). The learning level measures participants' acquisition of knowledge, skills, and
18 abilities after training. This level includes studies that assess participants' skills in correcting
19 clinical records, their understanding of record-keeping standards, and their proficiency in
20 preparing clinical documents accurately (Kirkpatrick 2). The behaviour level assesses whether
21 learning translates into behavioural changes, evaluating whether participants apply the
22 knowledge and skills gained after training in a clinical setting, and the sustainability of these
23 changes (Kirkpatrick 3) (Frye and Hemmer, 2012).
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28 **Results**

29 ***Study selection***

30 A total of 5,147 citations were identified, 4,503 citations as a result of literature search, and
31 644 citations as a result of citation search. After evaluating the titles and abstracts, 181 of
32 these studies were evaluated for full text analysis. As a result, 44 studies were included in the
33 review (Figure 1).
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36 **Insert Figures 1 & 2 about here**

37 38 ***Study characteristics***

39 Of the 44 in-scope articles, 30 reported studies conducted in the United States (US). Other
40 countries where the studies were conducted include six in Iran, three in Ireland, and two in
41 Australia. Additionally, one study each was conducted in Pakistan, Canada, and China (see
42 Appendix 1). The year 2017 accounted for the highest number of publications (7 in total) (see
43 Figure 2).
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46 Of the studies included in our investigation, 32 were designed as single-group pretest-posttest
47 interventions, eight were designed as control group pretest-posttest interventions (Nadeem et
48 al., 2017; Glisson et al., 2011; Yu et al., 2018; Isoardi et al., 2015; Weber et al., 2022; Olvet
49 et al., 2022; Haist et al., 2004; Leeper-Majors et al., 2003), three were two-group pretest-
50 posttest interventions (Wagoner et al., 2022; Kusnoor et al., 2022; Kim and Spellberg, 2014),
51 and one was a three-group pretest-posttest intervention with a control group (Myers et al.,
52 2006). Out of the studies, 39 were planned as compulsory, and five were planned as
53 voluntary.
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56 57 ***Participant characteristics***

58 In 28 studies, participants were residents, in 10 studies interns, and in 17 studies
59 undergraduate students. In one study, participants included both residents and interns (Axon
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3 et al., 2014). Four studies included consultants or physicians working in the relevant
4 department along with residents (Cromwell et al., 2018; Guerges et al., 2017; Carlson et al.,
5 2015; Momin et al., 2016). Among the studies targeting students, three had participants from
6 the second year, four from the third year, and two from the fourth year. In two studies,
7 students from multiple years were included. When examining the departments where the
8 training was provided, the department with the most organised training was the internal
9 medicine department, with 17 studies. Some studies were organised in multiple departments.
10 The findings are presented in Table 2.
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13 **Insert Table 1 about here**
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16 In 42 studies, the number of participants was specified, while in two studies it was not
17 mentioned (Tinsley, 2004; Owen et al., 2015). Among the studies that included participants
18 other than residents, two studies separately reported the number of residents who participated
19 in the training (Carlson et al., 2015; Momin et al., 2016). In these 40 studies with specified
20 participants, the median number of participants was 38 (IQR: 24.5-91). The highest number of
21 participants in these studies was 365 (Kusnoor et al., 2022), lowest was eight (Leeper-Majors
22 et al., 2003).
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25 ***The type of records and education methods***

26 In four studies, it was not specified which types of records the intervention targeted (Wagoner
27 et al., 2022; Carlson et al., 2015; Tinsley, 2004; Owen et al., 2015). In two studies, general
28 documentation knowledge was addressed (Lee et al., 2017; Varacallo et al., 2017) and in one
29 study, training was provided on all types of records (Sayyah-Melli et al., 2017). Among the
30 remaining 37 studies, training was conducted on a total of 15 different types of records, with
31 eight focusing on the discharge summary (Myers et al., 2006; Axon et al., 2014; Ming et al.,
32 2019; Meidani et al., 2017; McLean et al., 2015; Finn et al., 2007; Talwalkar et al., 2012;
33 Bischoff et al., 2013) and eight on history notes (Kusnoor et al., 2022; Yu et al., 2018; Isoardi
34 et al., 2015; Olvet et al., 2022; Meidani et al., 2017; Vahedi et al., 2018; Patel et al., 2018;
35 Liang and Shanker, 2017).
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39 More than one training method was utilised in 24 of the 44 studies reported in the in-scope
40 articles. Of these, 25 studies employed lectures, 12 used feedback, and nine provided clinical
41 record training through workshops. Eight studies incorporated discussion sessions, with five
42 in a small group format (Wagoner et al., 2022; Kusnoor et al., 2022; Weber et al., 2022; Lee et
43 al., 2017; Talwalkar et al., 2012) and one utilising personal discussion sessions (Glisson et al.,
44 2011). Other frequently used methods included standardised patient encounters in four studies
45 (Haist et al., 2004; Leeper-Majors et al., 2003; Thompson et al., 2015; Wagner et al., 2006)
46 simulated history and physical exercises in two studies (Lee et al., 2017; Patel et al., 2018)
47 and patient encounters in one study (Yu et al., 2018). To enhance the quality of clinical
48 records, one study used educational posters (Ryan et al., 2020), and four studies employed
49 mnemonic education tools (Cromwell et al., 2018; Momin et al., 2016; Tinsley, 2004; Hyde
50 et al., 2018). Additionally, peer or near-peer education (Kusnoor et al., 2022; Olvet et al.,
51 2022) and case-based learning were each used in two studies (Leeper-Majors et al., 2003;
52 Loeb et al., 2010), while clinical record drafts were employed in three studies (Axon et al.,
53 2014; Carlson et al., 2015; Bischoff et al., 2013). Other individual training methods included
54 mock deposition exercise (Guerges et al., 2017), payroll feedback simulation (Liang and
55 Shanker, 2017), interviews (Nadeem et al., 2017), and article reading (Wagner et al., 2006),
56 each used in a single study.
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Evaluation of effectiveness

The authors of the in-scope articles evaluated the effectiveness of their educational interventions using various methods and tools. In 30 studies, records in the clinical setting were assessed, and a clinical record evaluation tool was utilised. These tools aimed to assess the quality of clinical records and identify any deficiencies. In many studies, these evaluation forms were developed by authors based on various guidelines (Cromwell et al., 2018; Owen et al., 2015; Ryan et al., 2020; Loeb et al., 2010), quality assessment scales (Nadeem et al., 2017; Bischoff et al., 2013) or clinical experience (Eichholz et al., 2004; Collard et al., 2014). Only one study examined the validity and reliability of the assessment forms (Olvet et al., 2022). Another commonly used evaluation method was surveys, which were employed in 15 studies. In addition, standardised patient encounter assessment was used in four studies (Lai and Tillman, 2021; Thompson et al., 2015; Wagner et al., 2006, Comeau and Craig; 2014), while objective structured clinical exams (Kusnoor et al., 2022; Olvet et al., 2022), multiple-choice questions (Lee et al., 2017; Varacallo et al., 2017), and written assessments (Farzandipour et al. 2013; Shenavar Masooleh et al., 2021), were each used in two studies. Correct identity of signatures (Glisson et al., 2011), completeness time (Carlson et al., 2015), and assessment by patients (Yu et al., 2018) were each used in one study.

When evaluating the highest Kirkpatrick level reached by the studies, 35 out of 44 studies assessed the outcome at Kirkpatrick level 2, five at level 1, and four at level 3. In one study that reached level 3, it was reported that the quality of clinical records increased after the intervention but did not continue to improve in the ninth month after the intervention (Meidani et al., 2017). Another study at level 3 stated that near-peer teaching improves student documentation of the history and physical exam, but this effect continued only in the physical examination during the clinical period (Olvet et al., 2022). In the other two studies, it was mentioned that the quality improvement obtained after the training persisted (Momin et al., 2016; Tinsley, 2004).

Discussion

This systematic review was conducted to evaluate clinical record training interventions for medical students and residents. The main objective was to analyse existing interventions in the literature and to identify effective strategies to enhance medical recording skills. A total of 44 studies published between January 1, 2003 and November 6, 2023 were identified in the review. These studies employed various methods, teaching and training strategies and approaches. However, primarily, methods such as didactic lectures, workshops, and discussion sessions were used. In addition, feedback was used as an educational strategy. Similar diverse training methods were reported for both medical residents and students. The majority of the training, as reported in 17 studies, was conducted in the internal medicine department (Richardson et al., 2022; Glisson et al., 2011; Weber et al., 2022, Haist et al., 2004, Kim and Spellberg, 2014; Myers et al., 2006; Axon et al., 2014; Guerges et al., 2017; Farzandipour et al., 2013; Lee et al., 2017; Finn et al., 2007; Talwalkar et al., 2012; Bischoff et al., 2013; Patel et al., 2018; Loeb et al., 2010; Shenavar Masooleh et al., 2021, Davaridolatabadi et al., 2013), with a diverse range of medical departments also hosting training sessions (Nadeem et al., 2017; Momin et al., 2016; Ryan et al., 2020; Comeau and Craig; 2014).

The studies focused on different types of clinical records and various parameters within the content of clinical records, resulting in significant level of diversity that made it challenging to evaluate all studies on the same basis. Generally, the data indicated that participant

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3 satisfaction, skills, and attitudes related to clinical record-keeping were positively affected.
4 However, a few studies reported no positive outcomes from the record-keeping training
5 (Sayyah-Melli et al., 2017; Comeau and Craig, 2014; Davaridolatabadi et al., 2013).
6 Importantly, none of these studies were evaluated at Kirkpatrick level 4. Among the four
7 studies evaluated at level 3, two mentioned the continued impact of training in the future
8 (Momin et al., 2016; Tinsley, 2004). These findings highlight the need for improved levels of
9 evidence regarding the effectiveness of clinical record-keeping training. Future research
10 should aim to achieve more robust and sustained improvements in clinical record-keeping
11 skills among medical professionals.
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15 Of the conducted studies, 17 targeted medical students, while 10 were directed towards
16 interns. Considering the importance of early clinical experience for cultivating skills,
17 providing these training sessions from the pre-clinical period is crucial for skill acquisition
18 and sustainability. However, there were only seven studies specifically targeting medical
19 students (Lai and Tillman, 2021; Wagoner et al., 2022; Kusnoor et al., 2022; Olvet et al.,
20 2022; Haist et al., 2004; Ming et al., 2019; Wagner et al., 2006). None of these studies were
21 conducted in the first year. All seven studies reported positive student perceptions and
22 positive development. In one study, it was mentioned that some of the positive outcomes
23 could not be sustained during the clinical period (Olvet et al., 2022).
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27 The majority of the studies were planned in the form of a single-group pretest-posttest
28 intervention. This could be considered as a possible outcome, especially when considering
29 that the studies were conducted in clinical settings. In these environments, determining
30 control groups and preventing interaction can be challenging. However, it is crucial to note
31 that in clinical settings, learning by residents or students can occur informally in various
32 ways, including clinical record-keeping, even without formal intervention (Weber et al.,
33 2022). This being the case, informal learning may have been overlooked in studies conducted
34 in clinical settings with a single-group design. Therefore, researchers need to take informal
35 training into consideration, especially when conducting studies in populations where
36 participants are already keeping clinical records in a clinical environment. Another point is
37 that similar assessment tools were used in the clinical study environment as evaluation tools,
38 and various checklists were also used. Although these tools were created using data from
39 research literature and quality control tools, validity and reliability studies were not
40 conducted. Only one study conducted a validity and reliability assessment (Olvet et al.,
41 2022), which makes the evaluations of these studies open to discussion. With these potential
42 drawbacks in mind for studies conducted in clinical settings, researchers should be aware that
43 assessments with established validity and reliability and controlled studies with control groups
44 will yield clearer results.
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49 While the majority of studies were conducted in the US, there were also educational
50 intervention studies in different geographical locations such as Iran, Ireland, Australia,
51 Pakistan, Canada, and China. The common issues motivating these studies included
52 deficiencies in formal education in medical record-keeping, students not receiving adequate
53 training, and challenges in maintaining clinical records of sufficient quality (Axon et al.,
54 2014; Talwalkar et al., 2012; Patel et al., 2018; Liang and Shanker, 2017). There is also very
55 substantial evidence of a massive increase, in recent years, in the publication of research
56 studies in the international peer-reviewed literature; therefore, this is also likely to be a reason
57 for the increase in studies relevant to the current systematic review.
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3 The study had some limitations. First, our literature review included only English
4 publications, excluding studies in other languages, which may have led to potentially
5 important information being overlooked. Second, in some studies, the education method and
6 assessment methods were not clearly stated. Thus, our evaluation of these studies might not
7 have accurately reflected reality in terms of the methods and assessment tools employed.
8 Finally, despite a common focus on the quality of clinical records in these studies, their
9 heterogeneity, involving various types and components of clinical records, made synthesis
10 and comparison of these records challenging.
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13 **Conclusion**

14 A wide range of educational interventions for clinical record-keeping designed for
15 undergraduate students and medical residents was captured in this systematic review.
16 However, many of the included studies assessed outcomes primarily at the skill and attitude
17 levels, most reporting positive effects. As well, the majority of included studies were planned
18 in clinical settings and in the form of single-group interventions. This systematic review has
19 highlighted important gaps in the research literature, pointing to the need for more
20 randomised controlled trials involving pre-clinical students, and for additional research
21 studies to provide a stronger and more robust evidence base. Further research in this field will
22 contribute towards the development of more effective educational methods and strategies for
23 improving clinical record-keeping skills in the future.
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27 **Declarations**

28 **Competing Interest:** The authors declare no competing interests.
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Box 1. Search strategy

Pubmed	((residen*[Title/Abstract]) OR ("medical student"*[Title/Abstract]) OR (intern*[Title/Abstract])) AND (("medical record"*[Title/Abstract]) OR ("medical document"*[Title/Abstract]) OR ("clinical record"*[Title/Abstract])) AND ((education[Title/Abstract]) OR (train*[Title/Abstract]) OR (teach*[Title/Abstract]) OR (curricul*[Title/Abstract]) OR (syllabus[Title/Abstract]))
WOS	TS=((residen* OR intern* OR "medical student*") AND ("medical document*" OR "clinical record*" OR "medical record*") AND (education* OR train*OR teach* OR curricul* OR syllabus))
Scopus	TITLE-ABS-KEY ((residen* OR intern* OR "medical student*") AND ("medical document*" OR "clinical record*" OR "medical record*") AND (education* OR train*or AND teach* OR curricul* OR syllabus))
ERIC	abstract:((residen* OR intern* OR "medical student*") AND ("medical document*" OR "clinical record*" OR "medical record*") AND (education* OR train*or AND teach* OR curricul* OR syllabus))
Cochrane	((residen* OR intern* OR medical NEXT student*) AND (medical NEXT document* OR clinical NEXT record* OR medical NEXT record*) AND (education* OR train*or AND teach* OR curricul* OR syllabus)):ti,ab,kw

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4 **Figure Legends**

5 **Figure 1:** PRISMA flow diagram of study selection.
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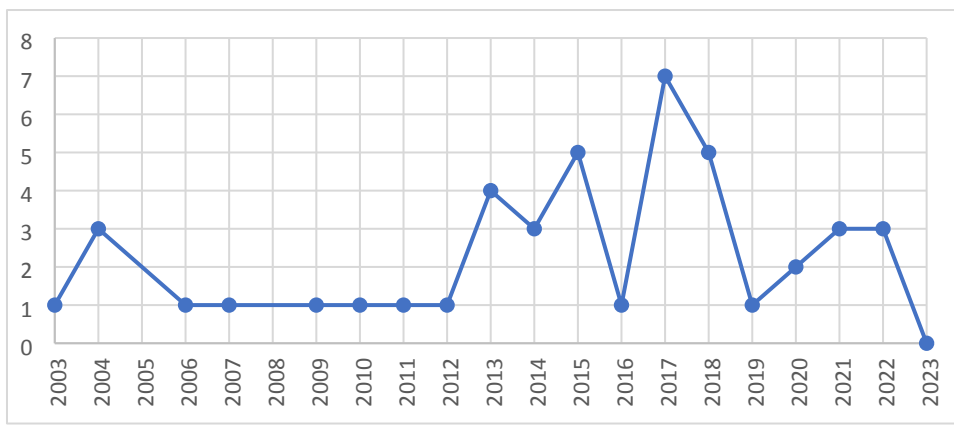


Figure 2. Publication years of the selected studies

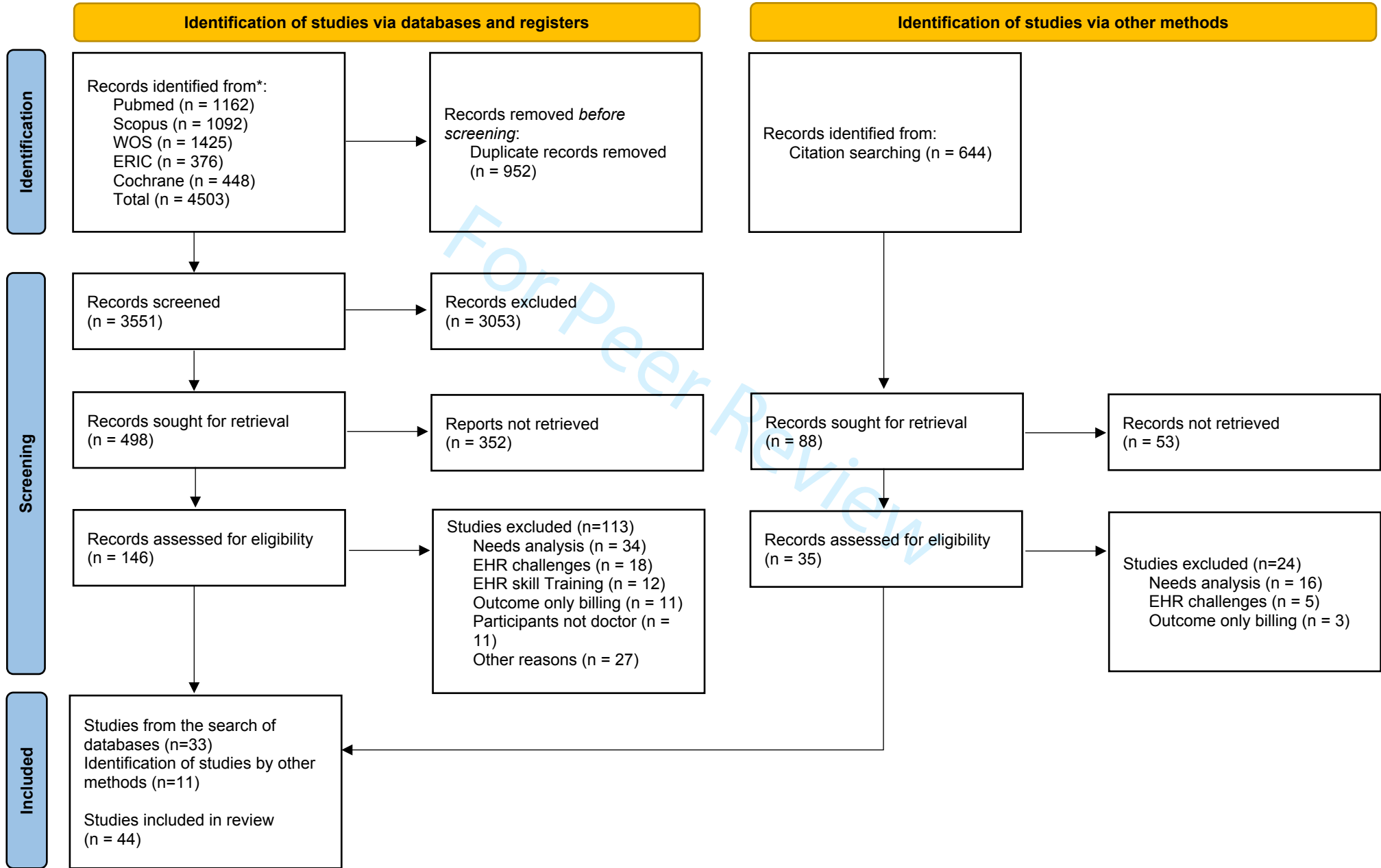
For Peer Review

Table 1.**Distribution of studies by medical specialty and training level**

Resident	28
Internal Medicine*	12
Radiology	2
Surgery	8
Obstetrics and Gynaecology	6
Otolaryngology	2
Pediatrics	1
Emergency Medicine	1
Orthopedy	2
Neurology	1
Psychiatry	1
Anesthesiology	1
Neurosurgery	1
Urology	1
Intern	10
Internal Medicine*	5
Surgery	1
Pediatrics	1
Emergency Medicine	3
Student	7
Second grade	3
Third grade	4
Fourth grade	2

* Note: One study included both medical residents and interns.

Figure 1: PRISMA flow diagram of study selection.



Appendix 1. The reviewed studies

Authors	Country	Year	Participants	Number of Participants	Intervention Type	Compulsatory/Voluntary	Course Section	Aim / Objectives	Method	Clinical Record Type/Subject	Evaluation of Effectiveness Methods	Outcomes	Kirkpatrick Level
Leeper-Majors et al.	USA	2003	Resident	8	Control-Intervention	Compulsatory	Surgery	To determine the effectiveness of using feedback from a standardized patient to teach a surgical resident informed consent protocol.	1) Case-based learning 2) Standardized Patient Encounter	Informed Consent	Standardized Patient Encounter Assessment	Standardized patient feedback is an effective modality in teaching the informed consent protocol.	2
Haist et al.	USA	2004	Student (Third grade)	85	Control-Intervention	Compulsatory	Internal Medicine	To evaluate a standardized patient educational intervention teaching sexual history taking and HIV counseling.	Workshop	Sexual History Note	Standardized Patient Encounter Assessment	A sexual history and HIV counseling curriculum were associated with students asking more thorough sexual histories and providing more HIV counseling.	2
Tinsley	USA	2004	Resident	Unspecified	Intervention	Compulsatory	Psychiatry	To improve psychiatry residents' inpatient charting skills.	1) Lecture 2) Reminder Cards	1) Admission Note, 2) Progress Note, 3) Medication Changes	Frequency of Documenting Items	Resident documentation improved, with gains maintained after six months, and documentation of newly emphasized items continued to improve with only minimal ongoing instruction.	3
Eichholz et al	USA	2004	Resident	16	Intervention	Compulsatory	Obstetrics and Gynaecology	To determine the extent of formal education regarding operative dictation and prospectively evaluate the effectiveness of formal teaching regarding operative dictation.	Lecture	Operative Note	Assesment Tool	A brief teaching session was effective and may be useful during residency training.	2
Myers et al.	USA	2006	Intern	59	Control-Intervention (two group)	Compulsatory	Internal Medicine	To improve the quality (completeness, organization, succinctness, internal consistency, and readability) of interns' discharge summaries.	Lecture	Discharge Summary	1) Survey 2) Discharge Summary Evaluation Tool	Positive student perceptions were noted. There was a significant increase in the quality of interns' discharge summaries. Additional improvements in certain aspects of discharge summary quality were observed with individualized feedback.	2

1	Fin et al.	USA	2007	Intern	36	Intervention	Compulsatory	Internal Medicine	To develop a formal curriculum, including lectures and structured feedback, for effective documentation by interns.	1) Lecture 2) Feedback	Admission Note, Progress Note, Discharge Summary	Survey	Interns found the feedback useful, noted a change in understanding effective notes, and expressed a desire for more feedback.	1
2	Wagner et al	USA	2009	Student	94	Intervention	Compulsatory	Unspecified	To describe the evaluation of a sexual history-taking curriculum and correlates of student performance during a clinical skills assessment.	1) Small Group Discussions 2) Workshop 3) Article Reading 4) Standardized Patient Encounters	Sexual History Note	1) Survey 2) Standardized Patient Encounter Assesment	The curriculum is successful, as judged by the vast majority of students, with positive student perceptions.	2
3	Loeb et al.	USA	2010	Resident	25	Intervention	Compulsatory	Internal Medicine	To assess the rates of sexual history documentation, rates of documentation of specific components of the sexual history, and the effect of an educational intervention on sexual history documentation.	Case-based Learning	Sexual History Note	Sexual Chart Review Guidelines Checklist	Statistically significant increases in the documentation of sexual histories were observed, though these improvements were of modest clinical significance.	2
4	Glisson et al.	USA	2011	Resident	63	Control-Intervention	Compulsatory	Internal Medicine	To improve the legibility of resident signatures on clinical notes.	Discussion (Individual Session)	Clinical Note (Signature)	Correct Identity of Signatures	The legibility of resident signatures improved.	2
5	Talwalkar et al	USA	2012	Resident	20	Intervention	Compulsatory	Internal Medicine	To implement an educational program on chart documentation skills and determine if it results in improvements in the quality of hospital discharge summaries.	1) Workshop 2) Small Group Discussions	Discharge Summary	Discharge Checklist	The quality of hospital discharge summaries improved.	2
6	Davaridolatabadi et al.	Iran	2013	Resident	40	Intervention	Compulsatory	Internal Medicine, Obstetrics and Gynecology, Pediatrics, Anesthesiology, Surgery	To evaluate the effect of an educational intervention on the knowledge and performance of resident medical chart documentation.	Workshop	Chart Documentation	1) Survey 2) Checklist	No significant increase was observed in knowledge and behavior.	2
7	Farzandipour et al	Iran	2013	Resident	19	Intervention	Compulsatory	Internal Medicine, Obstetrics and Gynaecology, Surgery	To examine the effect of an educational intervention on recording medical diagnoses among a sample of medical residents.	Lecture	Unspecified	1) Checlist 2) Written Assessment	The single educational session did not improve the recording of diagnoses.	2

1	Axon et al	USA	2013	Intern and Resident	96	Intervention	Compulsatory	Internal Medicine	To combine team-based feedback on discharge summaries with a discharge summary curriculum and individual feedback to improve discharge summary quality.	1) Lecture 2) Template Card 3) Feedback	Discharge Summary	Discharge Summary Grading Instrument	Discharge summary scores improved, and participants reported increased confidence in producing and critiquing summaries.	2
2	Bischoff et al.	USA	2013	Resident	170	Intervention	Compulsatory	Internal Medicine	To increase the percentage of discharge summaries completed on the day of discharge to at least 75%.	1) Lecture 2) Template-based Discharge Summary 3) Feedback	Discharge Summary	1) Survey 2) Rubric	Significant improvement the timeliness and quality of discharge summaries, providing a valuable model for engaging residents in meaningful quality improvement efforts.	2
3	Kim & Spellberg	USA	2014	Resident	10	Intervention (two group)	Compulsatory	Internal Medicine	To determine if providing real-time feedback to residents or both residents and attending physicians would lead to improved medical documentation.	Feedback	Clinical Note	Chart Audit Tool	Improved diagnostic capture and severity of illness scores were noted, but no significant differences were found in case mix index or billing. No significant differences were observed in any parameter when comparing attending and resident documentation with resident-only documentation.	2
4	Comeau & Craig	Canada	2014	Resident	17	Intervention	Voluntary	Obstetrics and Gynaecology	To determine whether teaching documentation of shoulder dystocia in a simulation environment would translate to improved documentation of the event in an actual clinical situation.	Standardized Patient Encounters	Delivery Note (Shoulder Dystocia)	Documentation Assessment Form	No significant improvement was observed in shoulder dystocia documentation.	2
5	Collard et al.	USA	2014	Resident	153	Intervention	Compulsatory	Radiology	To describe the implementation of a three-stage reporting curriculum with achievement cutoffs and evaluate its effect on residents' core communication and reporting skills.	1) Lecture 2) Feedback	Radiology Report	Radiology Report Score Card	Progressive improvement in major areas of value in radiology communication skills was observed.	2
6	McLean et al.	Australia	2015	Intern	186	Intervention	Compulsatory	Emergency Medicine	To evaluate the impact of a structured education program on clinical documentation.	Workshop	Triage Note, Discharge Summary	Audit Tool	There was a significant improvement in the quality of clinical documentation provided by interns.	2

1	Isoardi et al.	Australia	2015	Intern	24	Control- Intervention	Compulsatory	Emergency Medicine	To determine whether tuition in medical documentation enhances the ability of emergency medicine interns to produce effective medical records.	Lecture	History Note	Score Sheet	There was a significant increase in some components of the intern score sheet related to the quality of clinical notes.	2
2	Carlson et al.	USA	2015	Resident and Attending Physician	74 (total 91)	Intervention	Compulsatory	Pediatrics	To implement an EMR- based intervention that could improve compliance with documentation of well- child checks.	1) Lecture 2) Structured Well Child Checks Forms	Documentation of Well Child Checks	1) Survey 2) Completeness Checklist 3) Completeness Time	Resident perceptions were positive, and there was a significant decrease in self- reported stress. Time to documentation completion improved significantly.	2
3	Thompson et al.	USA	2015	Resident	88	Intervention	Compulsatory	Surgery, Orthopedy, Otorhinolaryngology , Neurosurgery, Urology	To highlight critical aspects of informed consent to improve resident performance in documentation skills.	1) Lecture 2) Standardized Patient Encounters	Informed Consent	Standardized Patient Encounter Assesment	Informed consent training using standardized patients and a structured approach led to improved resident ability to discuss and document the informed consent process.	2
4	Owen et al.	Ireland	2015	Intern	Unspecified	Intervention	Compulsatory	Emergency Medicine	To determine to what degree interns adhere to documentation recommendations while on call and how this adherence would be affected by an educational session focusing on the recommendations and their importance to clinical care.	Discussion	Unspecified	Compliance National Standards (The National Hospitals Office)	Significant improvements following the intervention were found; however, significant deficits remained in noting an impression of the case and providing information to patients.	2
5	Momin et al.	USA	2016	Resident and Attending Physician	12 (total 29)	Intervention	Compulsatory	Otolaryngology	To instruct healthcare professionals on how to improve the quality and accuracy of clinical records.	1) Lecture 2) Flash cards	Inpatient Documentation	Capture Rates of (Complications, Major Comorbid Diagnoses, Complications, Severity of Illness , Risk of Mortality)	There was a significant increase in the capture rates of variables.	3
6	Sayyah- Melli et al.	Iran	2017	Resident	32	Intervention	Voluntary	Obstetrics and Gynaecology	To evaluate the effect of medical recording education on the quantity and quality of recording in gynecology residents.	Workshop	All Documentation	Checklist	No significant increase in the quantitative or qualitative recording of medical files was noted.	2

Nadeem et al.	Pakistan	2017	Resident	25	Control-Intervention	Compulsatory	Radiology	To explore whether chart-stimulated recall can be used to improve the reporting skills of radiology residents.	Interview	Radiography Report	Bristol Radiology Report Assessment Tool	A significant increase in radiology report assessment scores was observed.	2
Varacolla et al	USA	2017	Resident	32	Intervention	Voluntary	Orthopedy	To analyze the effect of a single educational session on resident knowledge acquisition and awareness of basic clinical documentation guidelines and coding principles.	Lecture	Documentation Knowledge	1) Survey 2) Written Assessment (Multiple Choice Questions)	There was a significant increase in self-rated confidence levels and knowledge scores of the residents.	2
Meidani et al.	Iran	2017	Resident	35	Intervention	Compulsatory	Surgery	To investigate the effects of education, audit, feedback, and incentive mechanisms on the improvement of medical records documentation.	1) Lecture 2) Feedback	History Note, Progress Note, Discharge Summary, Operation Note	Medical Record Review Checklist	There was a significant improvement in the quality of notes at post-intervention phases. However, no sustained improvement in document quality was observed nine months after the cessation of the intervention.	3
Guerges et al.	USA	2017	Resident and Attending Physician	(total 62)	Intervention	Compulsatory	Internal Medicine, Surgery, Obstetrics and Gynaecology	To increase awareness of the importance of documentation and potentially reduce the incidence of malpractice claims with a mock deposition exercise.	1) Mock Exercise 2) Lecture	Unspecified	Survey	The mock deposition exercise provided a means for educating residents regarding the importance of medical documentation.	2
Lee et al.	USA	2017	Resident	66	Intervention	Compulsatory	Internal Medicine	To introduce the purpose and value of ICD-10-CM to residents through a simulated EHR experience.	1) Lecture 2) Small Group Discussions 3) Clinical Vignettes Simulated Patient	Documentation Knowledge	1) Survey 2) Written Assessment (Multiple Choice Questions)	A timely and relevant active-learning module, supplemented with a simulated electronic medical record exercise, was created to introduce residents to the use of ICD-10-CM in outpatient practice.	2

Ming et al.	USA	2019	Student (Fourth grade)	78	Intervention	Voluntary	Transition to Residency Course	To train fourth-year medical students in writing high-quality discharge summaries.	Feedback	Discharge Summary	1) Survey 2) Discharge Summary Evaluation Tool	Participants' attitudes were positively influenced.	2
Ryan et al.	Ireland	2020	Intern	27	Intervention	Voluntary	Surgery	To assess the standard of notation for surgical inpatients and create/pilot an educational tool to improve the quality of documentation.	1) Lecture 2) DATA educational tool (poster)	Clinical Note	Health Service Executive Guidelines Criteria Tool	There was a significant increase in the quality of notes written for surgical inpatients.	2
Olvet et al.	USA	2020	Student (Second-third grade)	222	Control-Intervention	Compulsatory	Unspecified	To implement a near-peer teaching program to teach students how to write a patient note, overcoming time burden and variability in faculty feedback and filling this curricular gap.	1) Lecture 2) Near-peer Teaching	History notes	Objective Structured Clinical Examination (OSCE)	Near-peer teaching improves student documentation of the history and physical exam, though only the effects on the physical exam portion persist into the clinical years of training.	3
Weber et al.	USA	2021	Intern	60	Control-Intervention	Compulsatory	Internal Medicine	To determine if the implementation of a documentation curriculum led to improvement in admission note quality.	1) Small Group 2) Workshop	Admission Note	1) Checklist 2) Admission Note Assessment Tool	Several aspects of clinical documentation can improve with a formal documentation curriculum, routine assessment, and direct feedback; improvement was also observed due to the passage of time.	2
Masoooleh et al.	Iran	2021	Interns	150	Intervention	Compulsatory	Internal Medicine	To assess the effectiveness of a training intervention on daily progress note writing.	Lecture	Progress Note	Written Assessment	There was improvement in daily progress note writing and adherence to its standard principles based on the SOAP note format.	2
Lai and Tillman	USA	2021	Student (Third-fourth grade)	105	Intervention	Compulsatory	Emergency Medicine	To build proficiency specifically in emergency medicine documentation while also introducing documentation principles broadly applicable.	1) Lecture 2) Standardized Patient Encounters 3) Feedback	Patient Note	Survey	This curriculum was effective at training medical students on proficient patient care documentation in emergency medicine.	1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Wagoner et al.	USA	2022	Student (Third grade)	255	Intervention (two group)	Compulsatory	Obstetrics and Gynaecology	To examine the effectiveness of two specific forms to improve the quantity and quality of feedback to students about their medical documentation.	Feedback	Unspecified	Survey	The formative feedback card substantially increased the proportion of students who received feedback on written documentation. The simplified feedback card achieved comparable outcomes with the detailed feedback card.	1																																
Kusnoor et al.	USA	2022	Student (Second grade)	365	Intervention (two group)	Compulsatory	Unspecified	To compare near-peer and faculty teaching outcomes in history of present illness documentation skills.	1) Workshop 2) Near-peer Teaching	History Note	1) Survey 2) History Note Grading 3) Objective Structured Clinical Examination (OSCE)	Near-peer facilitators were as effective as faculty facilitators for the history of present illness workshop.	2																																
Richardson et al.	USA	2022	Resident	32	Intervention	Compulsatory	Internal Medicine	To improve clinical reasoning by focusing on the value of clinical documentation and encouraging peer feedback.	1) Discussion Session 2) Small Group Discussions 3) Feedback	Progress Note	Survey	Improved perceptions of the clinical and educational value of clinical documentation were noted.	1																																