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Restricted use of copy and paste in electronic health records potentially improves healthcare quality

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Abstract

The copy-and-paste feature is commonly used for clinical documentation, and a policy is needed to reduce overdocumentation. We aimed to determine if the restricted use of copy and paste by doctors could improve inpatient healthcare quality.

Clinical documentation in an inpatient dataset compiled from 2016 to 2018 was used. Copied-and-pasted text was detected in word templates using natural language programming with a threshold of 70%. The prevalence of copying and pasting after the policy introduction was accessed by segmented regression for trend analysis. The rate of readmission for the same disease within 14 days was assessed to evaluate inpatient healthcare quality, and the completion of discharge summary notes within 3 days was assessed to determine the timeliness of note completion. The relationships between these factors were used cross-correlation to detect lag effect. Poisson regression was performed to identify the relative effect of the copy and paste restriction policy on the 14-day readmission rate or the discharge note completion rate within 3 days.

The prevalence of copying and pasting initially decreased, then increased, and then flatly decreased. The cross-correlation results showed a significant correlation between the prevalence of copied-and-pasted text and the 14-day readmission rate ($P < .001$) and a relative risk of 1.105 ($P < .005$), with a one-month lag. The discharge note completion rate initially decreased and not affected long term after restriction policy.

Appropriate policies to restrict the use of copying and pasting can lead to improvements in inpatient healthcare quality. Prospective research with cost analysis is needed.

Abbreviations: CI = confidence interval, EHRs = electronic health records, RR = relative risk.

Keywords: copy and paste, electronic health records, healthcare quality

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1. Introduction

Medical records refer to patient records that capture various conditions, examinations, differential diagnoses and treatment plans performed by medical providers engaged in medical services. Electronic health records (EHRs) are stored on a computer, and computer operating systems provide many convenient functions, such as copying and pasting, which can save time. EHRs are different from other electronic files because they record the patient's condition and adjustments to treatment.

The widespread adoption of EHRs has led to significant progress in the modernization of healthcare delivery. According to health provider surveys, EHR adoption can improve healthcare compared with paper-based medical records.[1] Physicians use EHRs to completely, succinctly, accurately and quickly document a patient's condition for their own use and their colleagues' use. The benefits of EHRs include improved access to records, the facilitation of communication, increased quality of patient-centered care through clinical decision support and safety engineering, cost savings, and improved data management for medical research and education.[2,3] In a previous study, we found that the adoption level of EHRs may be related to healthcare quality, with improved quality in the full-EHR stage compared with the no-EHR stage.[4]

Medical documentation has evolved with the rapid growth in the use of EHRs. Physicians spend 26% of their time on clinical documentation and 18% of their time writing on computers.[5] The terms "cut" and "paste" were originally coined in reference to the physical process of cutting and pasting paragraphs between

different locations during the process of manuscript editing. Almost all EHR software allows for information to be moved from almost any part of a patient's record to another section. The results of past study indicate that the majority of physicians work on EHRs, and the review demonstrated that 7.4% of index notes related to diagnostic errors were copied and pasted from prior visit notes. In these cases, the authors concluded that mistakes in copying and pasting contributed to 35.7% of errors.[6] The diagnosis error rate due to the use of the copy-and-paste function is approximately 2.6%,[7] but a significant impact on patient safety issues was not found.[6,8] Using copying and pasting can save time, allowing physicians to focus on addressing the current illness and making adjustments. In the fast-paced medical world, EHRs sanction copying and pasting with word templates and embedded problem lists. The word template of new medical notes was compared with previous notes by the text check method with a threshold of similarity to the restricted use of copying and pasting. However, copying and pasting can cause data integrity issues due to unnecessarily long entries, poor organization, less accurate encounter tracking of medical conditions, inferred communication among users, diagnosis errors induced by false assumptions or attribution of authorship, and regulatory concerns about the accuracy and medical necessity of billed services.[9–14] The negative consequences for physicians are apparent; thus, the effects of technological efficiency must be re-evaluated. This approach risks overlooking new or changing information and allows the perpetuation of prior inaccuracies.[14] Junior physicians in training may not learn how to take an appropriately detailed history, conduct a physical examination, interact with patients and family, or construct a broad differential thought process.[11]

There are some controversial views about the use of the copy-and-paste function. This function was not found to be associated with glucose control when information about lifestyle counseling was copied, and its use led to poorer results in evaluations and management.[15,16] Orthopedic trauma was repeated in 85% of inpatient records[17] and in 75% of outpatient ophthalmology records.[18] A previous study has shown that an intervention with note-writing guidelines can improve questions about the quality of EHRs but cannot influence the results of copying and pasting.[13]

Internal institutional policies should be created along with best practices to restrict the use of the copy-and-paste function. The current technology could be harnessed to improve provider productivity and could effectively be integrated into comprehensive patient care. A thoughtful and measured approach is favored, which would need to include staff education and the careful monitoring of notes. Bloated notes containing inaccuracies and oversights are regarded as unsafe, inefficient, and unprofessional. The inappropriate use of copying and pasting should be viewed as a patient safety issue.[9] Longer notes could lead to reader fatigue. One study showed a negative relationship between medical student performance and longer documentation.[19]

We hypothesize that advanced restrictions on the use of the copy-and-paste function have the potential to affect inpatient healthcare quality and influence timely note completion. Physicians may overrely on the copy-and-paste function to meet timeline goals, and they must perform clear history taking and physical examinations with accurate adjustments and optimal treatments.

2. Materials and methods

This retrospective observational study used clinical documentation from an inpatient dataset of EHRs at the Tri-Service General Hospital from 2016 to 2018. The Tri-Service General Hospital is a medical center that provides tertiary service in northern Taiwan. To prevent the overdocumentation of clinical notes, the hospital designed internal policies and identified the percentage of copied-and-pasted text in clinical notes. Electronic tools detected word template similarities between clinical notes to identify those copied and pasted from previous visit notes. To reduce the overuse of copied and pasted text, the institution needed to develop a policy. The threshold for determining whether a progress note was copied and pasted was restricted to 70% similarity to previous documents using natural language programming and text mining[20,21] starting in July 2016 at the Tri-Service General Hospital. If the similarity was more than 70%, the computer would not save the progress note, similar to a plagiarism detection checker. This study explored the correlation between the prevalence of copied-and-pasted text, healthcare quality and timely documentation completion status.

The 14-day readmission rate, length of stay and inpatient mortality rate were evaluated to measure healthcare quality. The 14-day readmission data were obtained from a discharge dataset of patients with the same diagnosis based on comparing the discharge date of the focal admission with the next admission within a 14-day period. The 14-day readmission rate was the number of readmission cases within 14 days divided by the discharge survival cases. The readmission rate was related to inpatient medical care, discharge family care, and inpatient healthcare quality and was surveyed in past studies.[22] The discharge summary note is a summary of the patient's history, examinations, treatments and discharge plan, and its timely completion supports medical provider communication while patients visit the outpatient or unplanned emergency department and are readmitted. The policy-restricted use of copying and pasting reduced the completion rate of medical notes in past studies. The timely completion status of the documentation was assessed by identifying the rate of discharge summary note completion within 3 days. To understand the tendency of the prevalence of copying and pasting after the restricted use of copying and pasting was implemented, scenarios were based on breakpoints using segmented regression 11.96 months and 15 months after policy implementation (Supplementary Digital Content Figure, http://links.lww.com/MD2/A856 Segmented regression of the prevalence of copying and pasting after policy implementation). Four stages were identified according to the time of the implementation of the copy and paste restriction policy and the breakpoints of the prevalence of copying and pasting after the restriction implementation: the premonitoring stage (January 2016–June 2016); scenario 1, descending phase (July 2016–May 2017); scenario 2, ascending phase (June 2017–September 2017); and scenario 3, fluctuation phase (September 2017–December 2018). The flowchart for this study is shown in Figure 1. The study was approved by TSGH IRB 1-108-05-179 (ethical approval date: November 11, 2019).

The inclusion/exclusion criteria were as follows: ten percent of the inpatient notes were checked for the repeat rate every month. The healthcare quality was surveyed every month.

The prevalence of copied-and-pasted text, the rate of discharge summary note completion within 3 days, and inpatient mortality (Shapiro–Wilk test: 0.403, 0.678, 0.083, 0.344) were fitted as
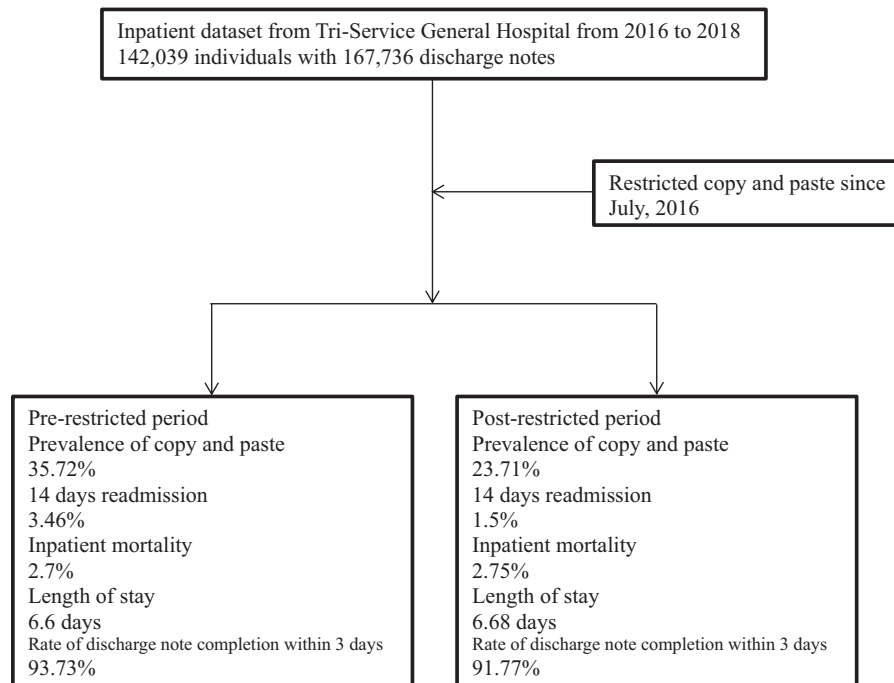
Figure 1. The flowchart of the protocol of this study.

normally distributed. The rate of readmission within 14 days (Shapiro–Wilk < 0.001) was not fitted as normally distributed.

Continuous variables were assessed with Student t test with a significance threshold of $P < .05$. For the segmented analysis of the prevalence of copying and pasting after implementation of the restriction policy, the segmented package in R was used.[23] The rates of the discharge summary note being completed within 3 days in the different post-restriction scenarios were compared with those in the pre-restriction period. We performed a multifractal cross-correlation analysis of the rate of readmission for the same disease within 14 days compared with the prevalence of copied-and-pasted text to calculate the lag time between the time series, and the highest correlation coefficient was selected. Poisson regression was performed to assess the relative effect of the copy-and-paste restriction policy on the 14-day readmission rate with a 1-month lag or discharge note completion rate within

3 days. The analysis was performed with IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY).

3. Results

There were a total of 142,039 patients with 167,736 medical records in this study. The average numbers of annual discharges were approximately 25,561 and 14,967 for internal medicine and surgery, respectively, from 2016 to 2018. The annual average discharge number was approximately 2168 in gynecology and obstetrics, approximately 1697 in pediatrics, approximately 1727 in otorhinolaryngology and approximately 1188 in ophthalmology. We compared the variables between the premonitoring and postmonitoring stages. The prevalence of copying and pasting was significantly reduced, from $35.72 \pm 5.53\%$ to $23.71 \pm 6.9\%$ ($P = .001$), after monitoring. The overall

Table 1

The characteristics of the pre-monitoring and post-monitoring periods for copying and pasting.

	Prerestriction (SD) 26326	Postrestriction (SD) 141410	P
Prevalence of copy and paste (%)	35.72 (5.53)	23.71 (6.9)	.001[*]
14-day readmission rate (%)	3.46 (0.43)	1.5 (1.03)	<.001[*]
Internal medicine (%)	4.57 (0.48)	2.01 (1.15)	<.001[*]
Surgery (%)	2.39 (0.5)	1.01 (0.88)	<.001[*]
GYN and OBS (%)	3.94 (1.85)	1.09 (1.07)	.011[*]
Pediatric (%)	0.53 (0.45)	0.24 (0.32)	.191
Otolaryngology (%)	1.68 (1.07)	0.43 (0.72)	.033[*]
Inpatient mortality (%)	2.70 (0.43)	2.75 (0.31)	.764
Length of stay (days)	6.6 (7.88)	6.68 (7.89)	.983
The rate of discharge summary note completion within 3 d (%)	93.73 (1.39)	91.77 (1.67)	.011[*]
Case mix index	1.2 (0.02)	1.2 (0.03)	.833

GYN and OBS = gynecology and obstetrics, SD = standard deviation.
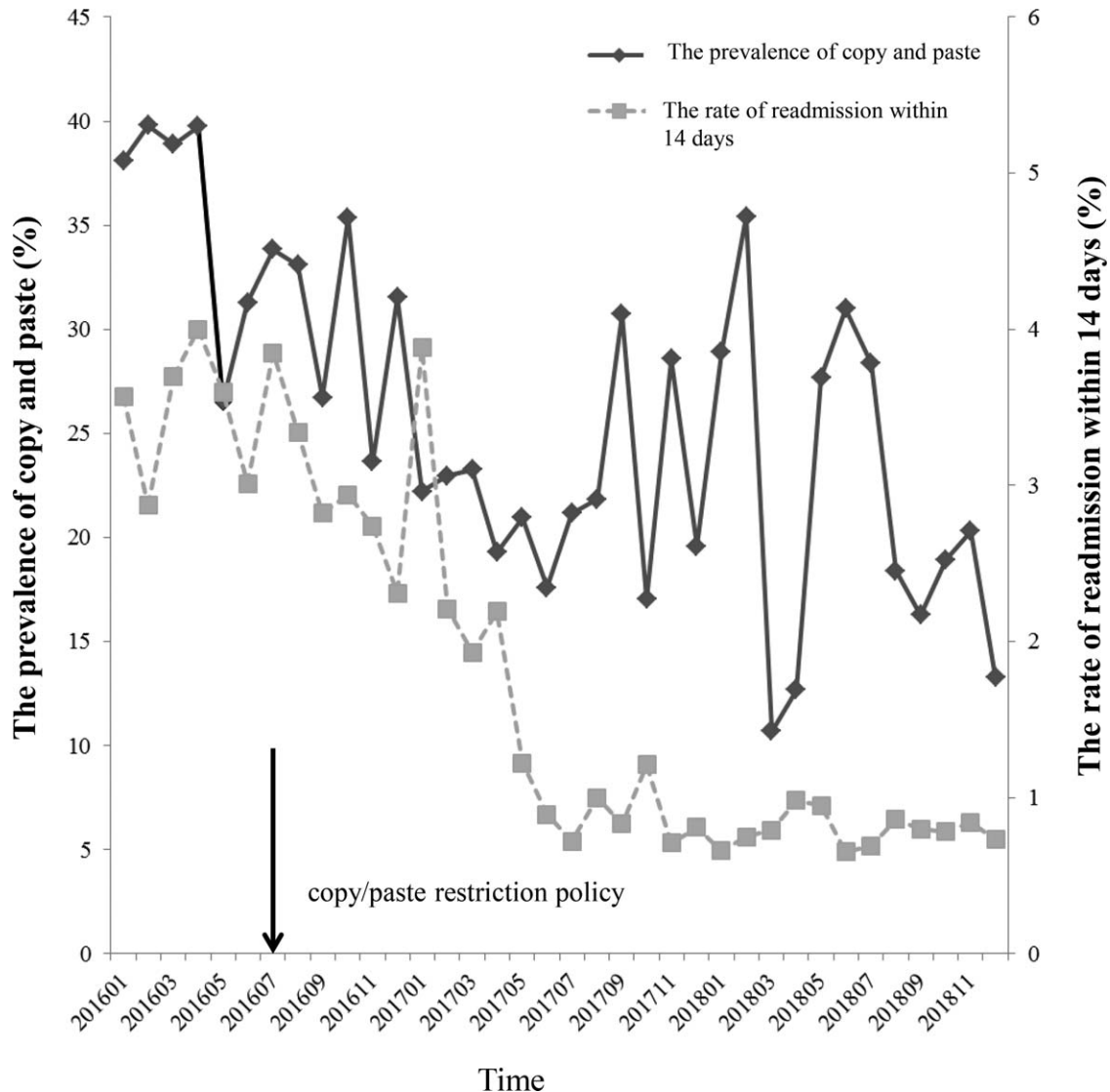
[*] $P < .05$.

Figure 2. The correlation between the prevalence of copying and pasting and the rate of readmission for the same disease within 14 days.

rate of readmission for the same disease within 14 days was reduced from $3.46 \pm 0.43\%$ to $1.5 \pm 1.03\%$ ($P < .001$), reflecting reductions in internal medicine, surgery, gynecology and obstetrics, and otolaryngology. The rate of discharge summary note completion within 3 days decreased from $93.73 \pm 1.39\%$ to $91.77 \pm 1.67\%$ ($P = .011$) after monitoring. However, the length of stay and inpatient mortality were not significantly different (Table 1).

The scenarios were based on the breakpoints at 11.96 months and 15 months after policy implementation. Postrestriction scenario 1 showed that the prevalence of copying and pasting decreased (slope: -1.459%/month). Then, the prevalence of copying and pasting increased (slope: 2.807%/month) in postrestriction scenario 2, followed by fluctuations (slope: -0.546%/month) in postrestriction scenario 3. The decreasing trend with a relative risk (RR) every month was 0.979 (95% confidence interval [CI]: 0.963–0.996, $P = .015$) during the premonitoring stage with prepolicy education. The decreasing trend with RR was 0.977 (95% CI: 0.966–0.989, $P = .002$) during scenario 1 after restriction. The increasing trend with RR

was 1.077 (95% CI: 0.997–1.163, $P = .054$) during scenario 2 after restriction. The decreasing trend with RR was 0.992 (95% CI: 0.972–1.012, $P = .396$) during scenario 3 after restriction.

The prevalence of copied-and-pasted text decreased compared with that in the prerestriction stage: 35.72 ± 5.53 vs 26.62 ± 5.78 ($P = .009$) during scenario 1 after restriction; 35.72 ± 5.53 vs 22.83 ± 5.57 ($P = .01$) during scenario 2 after restriction; and 35.72 ± 5.53 vs 21.8 ± 7.57 ($P < .001$) during scenario 3 after restriction. The readmission rate for the same disease within 14 days decreased from 3.46 ± 0.43 to 2.68 ± 0.81 ($P = .02$) until 11 months of restriction (Fig. 2). The highest 3-day note completion rate was 95.8% in April 2016, and the lowest was 87.6% in May 2017 (Fig. 3). The decrease in the rate of 3-day discharge summary note completion after monitoring continued until May 2017 ($93.73 \pm 1.39\%$ vs $90.59 \pm 1.62\%$, $P = .001$) (Table 2).

The prevalence of copied-and-pasted text was related to the rate of readmission for the same disease within 14 days, with a 1-month lag (cross-correlation coefficient = 0.616). The RR of 1.105 (95% CI: 1.064–1.147, $P < .001$) of the 14-day readmission rate was affected by the prevalence of copying and pasting,
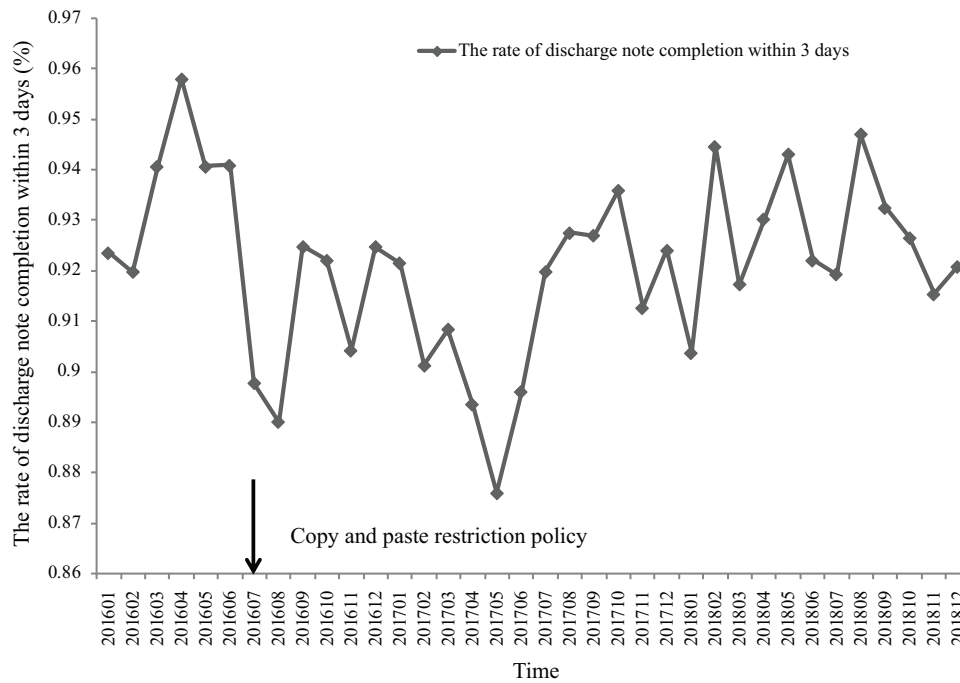
Figure 3. The rate of discharge summary note completion within 3 days.

with a 1-month lag. The RR of 1.043 (95% CI: 0.971–1.119, $P = .248$) of the discharge note completion rate was affected by the prevalence of copying and pasting.

4. Discussion

According to this time-series study, the rate of readmission for the same disease within 14 days is potentially moderately associated with the prevalence of copied-and-pasted text. The effects of the copying-and-pasting intervention on physicians' habits appeared to persist for approximately 1 year, with fluctuations. Adequate training and education are needed to reduce the increasing prevalence of copying and pasting. The rate of discharge summary note completion within 3 days was higher before the copy-and-paste intervention. After restriction of the copy-and-paste process, the timely completion rate decreased for several months. This study can contribute to the understanding of changes in the prevalence of text copying and pasting in medical records, enhance patient care and reduce the learning period for timely note completion.

Compared with traditional paper-based medical records, EHRs improve legibility and accessibility while decreasing costs because paper-based methods are cumbersome and time consuming for physicians.

EHRs in image reports have been utilized at our hospital since 2009; discharge summary notes were implemented in 2011; and inpatient nurse notes and outpatient medical records were implemented in 2013. Inpatient progress notes and notes from the emergency department were implemented in 2015, and inpatient medication notes have been utilized since 2017. Our previous study found that healthcare quality, including inpatient mortality and the length of stay showed no significant changes between partial (2015–2016) and full EHR (2017–2018) stages,[4] but healthcare quality must be further improved with EHR adoption after 2015. Importing technology such as copying and pasting is common, useful and convenient for documentation and clinical notes, but its use in clinical documentation is controversial. The advantages of using the copy-and-paste function include the efficiency in data capture, improved

The difference in the post-restricted scenario compared with the prerestricted stage using bonferroni correction for multiple comparisons.

Stage	Prevalence of copy and paste		14-day readmission rate		3-day completion rate	
	Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Prerestricted	35.72 ± 5.53		3.46 ± 0.43		93.73 ± 1.39	
Postrestricted scenario 1	26.62 ± 5.78	.009[*]	2.68 ± 0.81	.02[*]	90.59 ± 1.62	.001[*]
Postrestricted scenario 2	22.83 ± 5.57	.01[*]	0.86 ± 0.12	<.001[*]	91.76 ± 1.48	.078
Postrestricted scenario 3	21.8 ± 7.57	<.001[*]	0.81 ± 0.15	<.001[*]	92.64 ± 1.25	.13

SD = standard deviation.
[*] $P < .05$.

timeliness, legibility, consistency, completeness, communication, and positive payment and outcome measures. However, excessive use can lead to the recording of inaccurate or outdated information about patients. This is an important issue that requires improvement. Excessive use of copied and pasted text in EHRs can increase the efficiency of patient care but can also impact patient safety and present legal and ethical issues. It may also lead to the introduction of inaccurate information and oversights in the patient records, poor communication of the patient's current status, and subsequent diagnostic inaccuracies and a reduction in patient safety.[9]

Physicians may overrely on the copy-and-paste function to meet timeline goals. Physicians spend 26% of their time on clinical documentation and 18% of their time writing on computers. Copying and pasting can save time, allowing physicians to focus on addressing the current illness and making adjustments.[24] The prevalence of copied-and-pasted text was 25% in the documentation on discharge plans, goals of hospitalization and the estimated length of stay.[25] A practical solution needs to be developed, and identifying the percentage of copied-and-pasted text in clinical notes may be a helpful adjunct in reviewing the documentation of care. It was worth surveying the influence of the policy of copying-and-pasting restriction on healthcare quality. We retrospectively analyzed the prevalence of copied-and-pasted text since 2016 and found that the beginning of the third quarter of 2016 after the intervention had a particularly noticeable change: the prevalence persistently decreased to the lowest annual average of 21.82% in 2018. The trends showed a 2.1% decrease per month in the premonitoring stage, a 1.459% decrease per month in scenario 1 after restriction, and a 0.546% decrease per month in scenario 3 after restriction. In a previous study that analyzed assessment and treatment plans in the intensive care unit during 2009, 20% of the text in 82% of notes from residents and 74% of notes from attending physicians was found to include copied information.[26] We found that the prevalence of copied-and-pasted text was 40% before the restriction and decreased to less than 20% each year after the restriction policy was implemented. A good text mining tool for identifying duplications and acceptable policies could reduce the prevalence of duplications. There were 2 peaks: in 2018, during the Chinese New Year, when fewer medical providers were present during the holiday in February, and at the time when new interns and residents arrived to the hospital being not familiar with the process easy to duplication the notes in May.

The rate of readmission for the same disease within 14 days showed a decreasing trend year by year. In this case, the RR, which is affected by copied-and-pasted text, was reduced to a level similar to that in past studies, showing its effectiveness for improving patient safety. Patient encounters deserve focus to establish good patient–physician relationships and in-depth knowledge of EHRs. The rates in pediatrics did not change after the intervention, potentially due to greater complexities in pediatric patient care and pediatricians investing more time in caring for patients. A previous study showed that EHRs are not related to quality in the pediatric department.[27]

Because the policy induced reduced copying and pasting at first, doctors adapted to the policy. The hospital monitored the similarity rate and implemented promotional education to let the similarity rate stabilize. With the establishment of the mechanism of prevention of copying and pasting in the third quarter of 2016, the institute controlled the prevalence of copied-and-pasted text using natural language programming and text mining. Because of the need to adapt at the initial stage of implementation, there was initially a reduction in the prevalence of copied-and-pasted text and a decline in the timely completion rate of medical records. The adaptation period after 11 months showed a brief ascending trend, followed by stability. The timely note completion rate showed a decline following the restriction and then recovered in the middle of 2017, with a gap for physicians to adapt to the new policy. Every new policy needs better training and persistent education to reduce fluctuations in the rate of copying and pasting and the initial delay of timely note completion.

In general, copy-and-paste features reduce the time spent by physicians and allow them to focus more on the patient's condition and on making judgments. Our study showed that restricting the use of copied-and-pasted text could reduce the rate of readmission for the same disease within 14 days, with a 1-month lag, and reduce the 3-day note completion rate for months, without a long-term trend effect. Our research suggests that combined with an educational intervention, progress notes could be more accurate, succinct, and efficient. This change could be harnessed to improve quality.

There are some limitations to our study. First, our retrospective data from 1 medical center in Taiwan require prospective research at multiple-level hospitals to expand its generalizability. Second, training programs persisted after the restriction, and good training and education will be needed after future interventions in the use of copying and pasting. However, evaluation data after training and education were not available. Third, we did not evaluate physicians' attitudes toward the new behavior and whether it allowed them to spend more time taking histories, performing physical examinations, checking reports and adjusting treatment, nor did we find a direct association with these behaviors. Restricting the use of the copy and paste function reduces the risk of errors, but there is the potential for personal key-in mistakes; we did not assess the accuracy of notes that were not copied and pasted. Fourth, discharge evaluation and medication administration may affect readmission. Our hospital is a territory teaching hospital in Taiwan, and physicians follow the principal rules of evidence-based medicine. Additional research needs to be performed with a survey. Fifth, previous studies have found that excessive copying and pasting prolonged the length of stay and increased mortality.[7,28] In addition, the increase in the length of stay is among the factors that can increase costs.[29] However, our study did not show a significant effect of copying-and-pasting restrictions.

5. Conclusions

This is the first study to discuss restrictions of the copy-and-paste function in a Chinese hospital, thus broadening the focus of this issue beyond Western countries. The rate of readmission for the same disease within 14 days was found to be related to the prevalence of copying and pasting in our study, with a 1-month lag. The prevalence of copying and pasting initially showed a decreasing trend for 11 months, followed by a short period of a significantly increasing trend and then stability after the restriction of copying and pasting. The rate of discharge summary note completion within 3 days declined for months after the restriction of copying and pasting. The cost analysis of restricted copying and pasting needs to be conducted in the future. More aggressive policies with good education are needed to improve healthcare quality and timeliness of notes for future policy implementation in other countries.

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