



## Diversity of Physicians' Handwriting and Name Stamp in Chemotherapy Prescriptions: Potential Target for Fraud

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### ABSTRACT

**Backgrounds:** Verification and authentication of the paper-based handwritten prescriptions is of great importance for antineoplastic medications that are good targets for forgery and fraud. Pharmacists usually investigate handwriting, signature and name stamp of prescribers to verify prescriptions in Iran. Anecdotal reports of variations in handwriting and name stamp of physicians who wrote antineoplastic prescriptions raised concerns in this regard. The aim of the study was to investigate the reported diversity and evaluate the quality of writing physician identity and required items in antineoplastic prescriptions.

**Methods:** All insured hand-written prescriptions contained at least one antineoplastic medication and were dispensed by four main authorized community pharmacies dispensing antineoplastic medications in Tehran during one month were included. Prescriptions that were written by specialties other than oncology-related fields were excluded. Prescriptions of each physician were evaluated considering handwriting and name stamp by experienced pharmacy staff and the frequency of detected handwriting and name stamp types was recorded.

**Results:** Of the 11022 included prescriptions, 10944 were eligible and written by 241 physicians. Median (third quartile) number of physicians' prescriptions was 17 (51). Maximum number of observed handwriting and name stamp types were eight and six respectively. High prescribers tended to have several handwriting and name stamp types.

**Conclusion:** The observed diversity and variation in handwriting and name stamp of the physicians in antineoplastic prescriptions may facilitate the entrance of forged prescription and makes fraud detection difficult. Administrative and regulatory interventions in addition to notification of health care professionals about the observed potential might be necessary.

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**Table 1.** Physicians' demographics.

<b>Sex, N (%)</b>	Male	176 (73)
	Female	65 (27)
<b>Graduation status, N (%)</b>	Postgraduate students	37 (15.4)
	Graduated physicians	204 (84.6)
<b>Specialty, N (%)</b>	Adult hematologist-oncologist	135 (56)
	Pediatric hematologist-oncologist	27 (11.2)
	Radiotherapist	75 (31.2)
	Others	4 (1.6)

## Introduction

Prescription is the most essential tool for physicians that enables them to communicate with the dispenser and transmit orders (1). The first step in the procedure of dispensing in community pharmacies is authentication of the prescriber (2). Prescriber's name, address, telephone number, and initials or signature are among items that a prescription should contain in according to World Health Organization (WHO) good prescribing guideline (3). According to Iran medical council law, prescriptions without prescriber's name stamp are invalid. The physician name stamp should include prescriber's first and last name accompanying prefix "doctor", Iran medical council registration number and last academic degree and specialty. Academic rank and institution name are optional items in the stamp.

Verification and authentication of the paper-based handwritten prescriptions is challenging (4). Considering lack of national health information network in Iran, pharmacists usually investigate handwriting, signature and name stamp of prescribers to verify a hand-written prescription.

In the case of antineoplastic medications that are mainly dispensed by authorized community pharmacies in our country, verification of the prescription is of great importance. Authentication of the paper-based handwritten prescriptions is especially important for medications with high potential for being used and sold in illegal ways (5). Antineoplastic prescriptions could be good targets considering the expense and shortage of medications.

To the extent of our knowledge, no study described the situation of prescription writing quality in terms of physician identity and legitimacy elements in our country. Considering the importance of the issue for antineoplastic medications, we aimed to evaluate the quality of writing physician identity and required items in antineoplastic prescriptions.

## Methods

This observational study was conducted in four main authorized community pharmacies dispensing

antineoplastic medications in Tehran from 22 August to 22 September 2014. All insured hand-written prescriptions contained at least one antineoplastic medication, based on AHFS drug information, were included. We took photo from all included prescriptions and categorized the photo files based on physicians' name. Then, we excluded all prescriptions that were written by physicians with specialties/subspecialties other than oncology, hematology-oncology, radiotherapy, gynecology-oncology and urology-oncology.

Prescriptions of each physician were evaluated considering handwriting and imprinted name stamp by experienced pharmacy staff. Prescriptions with different handwriting and name stamp were copied to subfolders for each physician. Differences in name font or size and stating academic degree, specialty title, academic rank and institution name were considered in determining name stamp types. Finally, frequency of detected handwriting and name stamp types was recorded for each physician. A second researcher was involved in the assessment if there was a hesitation in detection the type of the items. Moreover, demographic characteristics of physicians and stated information in the name stamps were also recorded.

To report continuous variables, we used mean  $\pm$  SD. The categorical variables were reported as percentage. Chi-square test was also applied for frequency analysis. In order to compare the average of written prescriptions, in the different handwriting types or different name stamps ANOVA was used. This statistical analysis was performed using SPSS version 21. We used the correspondence analysis to summarize the data of handwriting and name stamps in two dimensions. For this purpose, the "FactoMineR" and "factoextra" packages and "CA" function of R software version 3.3.2 were used.

## Results

Of the 11022 included prescriptions, 10944 were eligible and mainly dispensed by one of the four included pharmacies (47%). Considering specialty of prescribers, 241 physicians met the criteria and were recruited for prescription evaluation. Median (third quartile) number of physicians' prescriptions were 17 (51) with

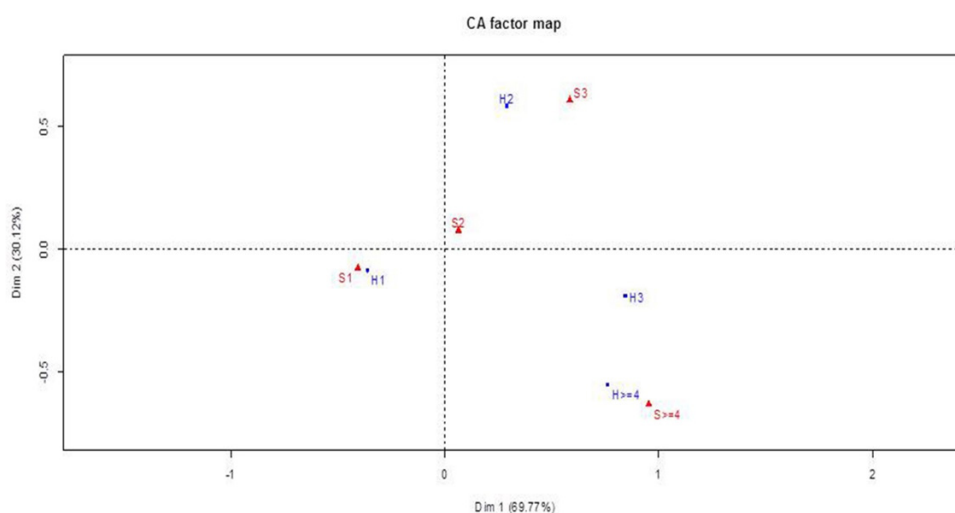


Figure 1. Correspondence analysis biplot of the handwriting and name stamp types.

minimum and maximum of 1 and 341 prescriptions. Eight physicians wrote more than 200 prescriptions during study period. Demographic characteristics of physicians are summarized in Table 1.

Diversity of detected handwriting and name stamp types are described in Table 2. Maximum number of observed handwriting types was eight that were detected in 47 and 25 prescriptions of two physicians. Both of these physicians had four types of name stamp. Six types of name stamps were observed in 56 and 53 prescriptions of two physicians who wrote their prescription with one type of handwriting.

Correspondence analysis biplot (Figure 1) showed that one type of handwriting existed in prescriptions of most of the physicians who had one type of name stamp. Whereas, more than 4 types of handwriting was detected in prescriptions of most of the physicians who had over 4 types of name stamp.

To further explore diversities of handwriting and name stamp types in prescriptions of the physicians, we divided the studied physicians into two categories; high prescribers and low prescribers. Low prescribers were physicians, who had equal to or less than 50 prescriptions (Third quartile  $\approx$  50) and high prescribers were the physicians, who had more than 50 prescriptions. Of the 63 high prescribers, 27% were radiotherapist and 73% were hematologist-oncologist.

The results showed that among low prescribers, 74.2% and 62.9% had one handwriting and stamp type respectively, while high prescribers tended to have several handwriting and name stamp types (Table 3). The observed frequency of handwriting and name stamp types in the two mentioned categories was significantly different (Table 3).

The relationships between prescriber's sex and the handwriting and name stamp types were also statistically significant (Table 3).

Name stamps assessment revealed that the academic rank, degree and specialty /subspecialty titles were stated using various wordings. Radiotherapy specialty and Hematology-oncology subspecialty were mentioned in five and 27 different wordings respectively. We observed one unique academic rank, degree and specialty /subspecialty title for 69.2% of the physicians. Four different title statements were observed for four of the studied physicians.

### Discussion

Antineoplastic medications are mainly dispensed by authorized community and hospital pharmacies in Iran. Anecdotal reports from main pharmacies in Tehran indicated variations in handwriting, signature and name stamp of physicians who wrote the antineoplastic prescriptions. Our study results revealed similar variations and diversities.

In this study, more than half of the physicians had two or more different name stamps. Observed diversity in each physician's name stamp could have been expected considering that most of the physicians worked concurrently at different institutions (private office, academic centers and hospitals, etc.) and used a specific stamp in each of them. In some of the institutions, especially academic centers, the name stamp of the attending physician is available for use by the post-graduate medical students (residents and flows) and nursing staff. Subsequently this might have led to the observed variations of the physician's handwriting.

Study results revealed that physicians with higher number of prescriptions tend to have handwriting and

**Table 2.** Number of physicians considering detected types of handwriting and name stamp.

Number of physicians with each detected type(s)		Name stamp type(s)						Total
		1	2	3	4	5	6	
Handwriting type(s)	1	95	36	8	4	1	2	146
	2	14	15	16	2	-	-	47
	3	5	8	7	7	3	-	30
	4	2	5	2	1	1	-	11
	5	1	-	-	2	-	-	3
	6	1	-	-	-	1	-	2
	8	-	-	-	2	-	-	2
<b>Total</b>		118	64	33	18	6	2	241

name stamp that is more diverse. In other words, mean number of prescriptions from physicians with three or more handwriting and name stamp types was higher. This observation could be explained as busy physicians usually work at two or more centers and considering time limitations, probably get help from colleagues in writing

prescription.

Reports from mentioned pharmacies revealed that the handwriting and/or name stamp of a physician in the prescription was not the same as what usually was observed, which make pharmacist suspicious about prescription authenticity. Following further exploration

**Table 3.** Frequency of handwriting and name stamp type(s) based on prescriber's categories

			Prescribing frequency		Prescriber sex	
			Low prescriber (N=178)	High prescriber (N=63)	Male (N=176)	Female (N=65)
Handwriting (N%)	Type (s)	1	132 74.2%	14 22.2%	98 55.7%	48 73.8%
		2	24 13.5%	23 36.5%	35 19.9%	12 18.5%
		3	11 6.2%	19 30.2%	26 14.8%	4 6.2%
		≤4	11 6.2%	7 11.1%	17 9.7%	1 1.5%
		Pearson Chi-Square=56.4, p-value<0.001			Pearson Chi-Square=9.65, p-value=0.022	
Name Stamp (N%)	Type (s)	1	112 62.9%	6 9.5%	77 43.8%	41 63.1%
		2	43 24.2%	21 33.3%	52 29.5%	12 18.5%
		3	14 7.9%	19 30.2%	24 13.6%	9 13.8%
		≤4	9 5.1%	17 27.0%	23 13.1%	3 4.6%
		Pearson Chi-Square=66.2, p-value<0.001			Pearson Chi-Square=8.96, p-value=0.03	

by the pharmacists in some suspicious cases, they found that the physician did not write the prescription and it was a forged one. Altering a legitimate prescription and abusing legitimate physician's signature and name stamp are fraudulent behaviors that lead to prescription forgery and uttering (4, 6).

These observations raised concern about a notable health care fraud in this regard. In other words, antineoplastic medications could be received by patients and/or fraudster using insurance coverage and paying for only 30 to 0 percent of the total price and entered the gray market by dealers. Health-care and prescription fraud detection have been studied previously (7-9). However, the fraudulent behaviors concerning antineoplastic medications and corresponding prescriptions need to be investigated in future studies.

### Conclusion

The diversity and variation in handwriting and/or name stamp of the physicians in our study, shapes the bells about the potential of forged prescription entrance in this vulnerable process. Previous studies have highlighted the role of electronic prescription service (EPS) on decreasing medication errors and enhancing patient safety (10, 11). Reducing the risk of medical records fabrication, which is possible in paper-based systems, is another advantage of EPS (12). Major obstacles such as infrastructure barriers should be overcome to substitute paper-based and handwritten prescribing with electronic system in Iran(10). Until implementation of this system, regulatory and administrative interventions might be necessary to manage the current situation of antineoplastic prescribing and prevent subsequent fraudulent behaviors. Additionally, awareness of health care professionals concerning the potential of forgery using antineoplastic

prescriptions in the current practice would be effective in the prevention of related fraud.

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