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Comparing Patient Satisfaction with Automated Drug Dispensing System and Traditional Drug Dispensing System: A Cross-Sectional Study

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Introduction: The adoption of automated drug dispensing systems (ADDS) in hospital pharmacies is a global trend, driven by its potential to reduce dispensing errors, minimize prescription filling time, and ultimately, improve patient care services. However, a significant research gap exists in the field, as a comprehensive assessment of patient satisfaction with ADDS is currently lacking. This study, with its comprehensive approach, aims to fill this gap by comparing patient satisfaction between hospital pharmacies implementing ADDS and traditional drug dispensing systems (TDDS).

Patients and Methods: The cross-sectional study was conducted in hospitals adopting ADDS and TDDS. All the outpatients aged 18 or above who visited the pharmacy were included, and severely ill patients were excluded from the study. A 17-item, 5-point Likert scale questionnaire assessed the participant's satisfaction. The questionnaire has four domains: pharmacy administration, dispensing practice, patient education, and dispensing system.

Results: The demographics of the study participants were normally distributed between ADDS and TDDS according to chi-square analysis. The mean participant satisfaction was significantly ($P<0.05$) higher in ADDS than in TDDS regarding all the items of dispensing practice and dispensing system domains. Three items related to the pharmacy administration domain showed significant participant satisfaction with ADDS. However, the participants' satisfaction showed no significant difference ($p=0.176$) between ADDS and TDDS in terms of the cleanliness of the pharmacy. Also, the participant's satisfaction between ADDS and TDDS was not statistically significant regarding the pharmacist's explanation of the side effects ($p=0.850$) and provision of all necessary information to the patient ($p=0.061$) in the patient education domain.

Conclusion: Patient satisfaction was higher in the ADDS participants than in TDDS regarding pharmacy administration, patient education, dispensing practice, and systems. However, pharmacists in ADDS need to be motivated to transfer the advantages of ADDS to patient care, including comprehensive patient education, particularly on side effects.

Keywords: automated drug dispensing system, dispensing practice, dispensing system, patient satisfaction, pharmacy administration, traditional drug dispensing system

Introduction

The Pharmacist's role in dispensing medication is crucial and integral to patient care. It involves a complex process that combines technologies and human interaction. Dispensing errors are one component of medication errors that disrupt the achievement of therapeutic outcomes. It is a "discrepancy between a prescription and the medicine that the pharmacy delivers to the patient or distributes to the ward based on this prescription, including dispensing a medicine with inferior pharmaceutical or informational quality."[1,2] The most common dispensing errors reported by the previous studies include wrong medication dispensed, wrong medication strength, and labeling errors.[3] A recent meta-analysis, which includes 62 studies published between 2010 and 2023, reported that the pooled prevalence of dispensing error is 1.6% (95%

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confidence interval 1.2% to 2.1%). They added that the prevalence of dispensing errors ranged from country to country between 0 to 33%.[4] Previous reports stated that 5.8% of medication errors were hazardous, and 0.8% were fatal.[5]

According to a systematic review, the introduction of automated drug dispensing systems (ADDS) globally has shown significant potential in reducing errors and associated risks, thereby enhancing medication safety.[6] Pharmacists and nurses identify 30 to 70% of medication errors in traditional drug dispensing systems (TDDS), which are almost nullified by ADDS and improve patient safety.[7,8]

Pharmacists have expressed a remarkably positive perception of its effectiveness in medication dispensing. They also believe that the time saved through ADDS can be redirected towards patient care, such as patient education and addressing patient queries. This potential to free up more time for direct patient care is a promising aspect of ADDS that can enhance the overall patient experience.[9] In ADDs, the pharmacist had much more time to collaborate with the physician and nurses to check their orders related to patients' drug profiles, medication reconciliation, and ward round participation. Moreover, the ADDS was cost-effective compared to the TDDS.[10] Another advantage of ADDS is that it requires smaller warehouses with improved inventory control and reduced storage errors.[11,12]

Although ADDS was effective in dispensing, it had several barriers and pitfalls before and during implementation.[5] First, as per the recent study reports, 0.018% of dispensing errors, including wrong drugs and quantities, were still detected even after ADDS was implemented.[13,14] Second, it increases the workload for pharmacy technicians in the cart-fill process since collaborating with them was reported as critical.[13,15]

The successful implementation of ADDS is independent of the hospital according to its policies and procedures. Therefore, the outcomes of ADDS implementation vary from one hospital to another.[6–8] Hence, the careful implementation of ADDs will have higher benefits. Obtaining patient satisfaction will play an important role in successfully implementing the drug dispensing system by identifying pitfalls at the hospital level.[16] To our knowledge, patient satisfaction with ADDS is not widely established in this context. Hence, the present study aimed to establish patient satisfaction with ADDS by comparing it with TDDS.

Materials and Methods

Study Design and Site

A cross-sectional study was carried out to compare the patient perceptions regarding outpatient pharmacy services between ADDS and TDDS for six months from February to July 2023. Two Governmental Hospitals belonging to the Ministry of Health in Tabuk city, one that adopted an ADDS and the other that embraced a TDDS, were included. Both hospitals had similarities regarding governance, bed capacity, medical departments, laboratory facilities, number of in-patients, out-patients, and healthcare practitioners.[9]

Participants

This study included all participants aged 18 years or above who visited the outpatient pharmacy during the study period. It excluded the severely ill patients (eg, prolonged cough, severe pain, etc).

Questionnaire

To obtain patient satisfaction with the drug dispensing system, a previously validated 5-point Likert scale questionnaire with 17 items was used.[17] The necessary permission was obtained from the original authors of the questionnaire. The questionnaire has 17 items in four domains: pharmacy administration (4 items), dispensing practice (3 items), patient education (5 items), and dispensing system (5 items). The response was recorded as strongly agree, agree, neutral, disagree, and strongly disagree, with scores of 5,4,3,2 and 1, respectively. The questionnaire also has demographic details of the participants, including gender, age, nationality, education, residence, marital status, employment, type of care, and number of visits to the pharmacy per year.

Sampling and Data Collection Method

Following the inclusion and exclusion criteria in the participant section mentioned above, a convenient sampling method was used to recruit the study participants. After obtaining their medications, patients who visited the outpatient pharmacy

were requested to participate in the study. The reasons for refusals were also documented. The participants were thoroughly explained about the study objectives and expected outcomes. The consented participants were included in the study.

Statistics

Chi-square statistics were used to analyze the distribution demographics of the study population. The Mean (± Standard Deviation) value of the participant's perception was compared between the ADDS and TDDS using the Mann–Whitney *U*-test. A confidence interval of 95% was used, and $p < 0.05$ was considered statistically significant. A statistical package of social sciences (SPSS Version 25.0) was used for the statistical analysis.

Results

Recruitment Process of the Study Population

Figure 1 shows the details of the recruitment process for the study participants. A total of 503 and 496 participants visited the pharmacies of ADDs and TDDs, respectively. According to the inclusion and exclusion criteria, 79 patients in ADDS and 75 patients in TDDS were deemed not eligible for the study. Predominantly aged < 18 years, participants were excluded from both ADDS (n=79) and TDDS (n=75). Eighty-seven participants in ADDS and 78 participants in TDDS

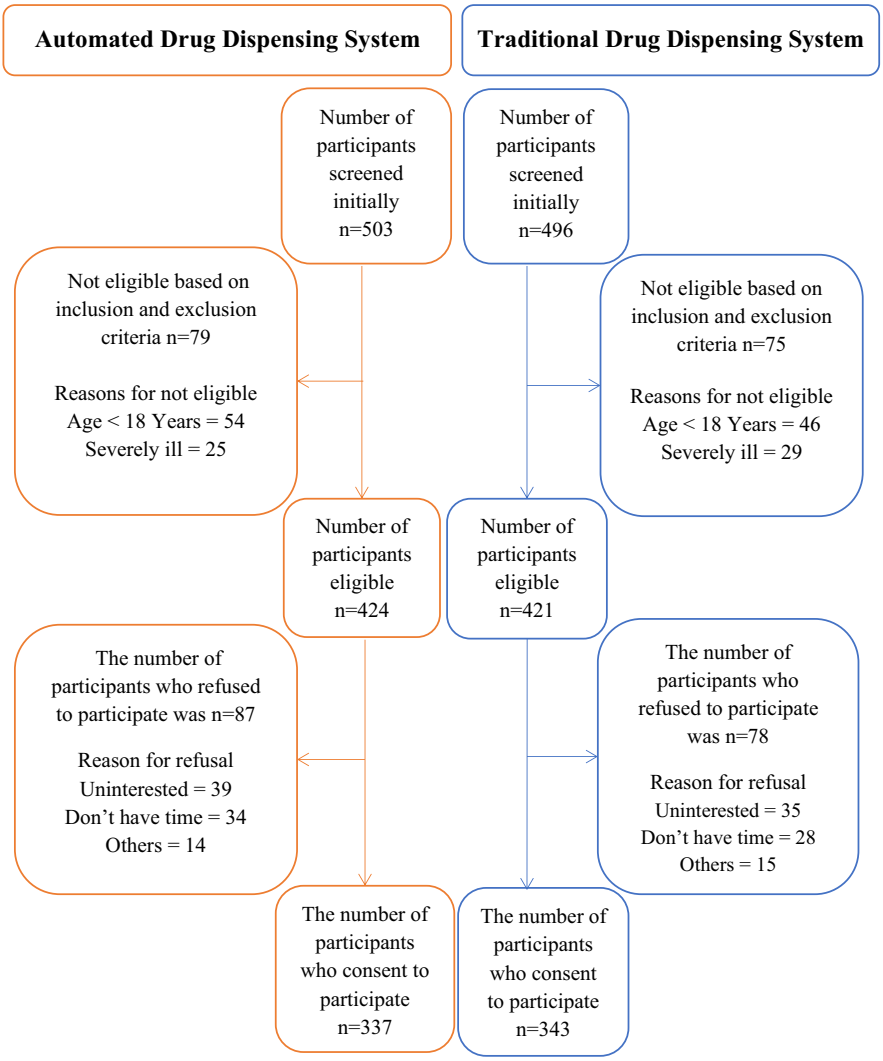

Figure 1 Details of inclusion of participants for a survey.

refused to participate in the study. Uninterested was the main reason for the refusal in both ADDS (n=39) and TDDS (n=35). Finally, 337 participants in the ADDS and 343 in the TDDS consented to participate in the study.

Demographics of the Study Population

Table 1 shows the demographics of the study population. According to chi-square statistics, there is no significant statistical difference in the distribution of the participants' demographics between ADDS and TDDS. ADDS and TDDS had a predominant distribution of males over 65, Saudi nationals who had school education, were married, had private employment, were in acute care, and visited the pharmacy twice a year. The predominant population in ADDS (53.41%) resides in the city, and TDDS (53.93%) resides outside the city. However, this result has no significant statistical difference (χ^2=3.672; df=1; p=0.055).

Level of Participant's Satisfaction Between ADDS and TDDS

The mean (standard deviation) comparison of participant's satisfaction levels between ADDS and TDDS was analyzed using the Mann-Whitney *U*-test, represented in Table 2. The ADDS participants were significantly more satisfied

Table 1 Demographics of the Study Population

Demographics	Total (680) n (%)	ADDS (337) n (%)	TDDS (343) n (%)	χ^2	df	p
Gender						
Male	376 (55.29)	184 (54.60)	192 (55.98)	0.130	1	0.718
Female	304 (44.70)	153 (45.40)	151 (44.02)			
Age (in years)						
Less than 30	85 (12.5)	36 (10.68)	49 (14.28)	2.019	2	0.364
31–65	225 (33.08)	114 (33.82)	111 (32.36)			
More than 65	370 (54.41)	187 (55.48)	183 (53.35)			
Nationality						
Saudi	648 (95.29)	318 (94.36)	330 (96.21)	1.294	1	0.255
Non-Saudi	32 (4.70)	19 (5.64)	13 (3.79)			
Education						
Illiterate	6 (0.88)	2 (0.59)	4 (1.16)	3.922	2	0.141
School	385 (56.61)	203 (60.23)	182 (53.06)			
Graduates/Diploma	289 (42.5)	132 (39.16)	157 (45.77)			
Residence						
City	338 (49.70)	180 (53.41)	158 (46.06)	3.672	1	0.055
Outside City	342 (50.29)	157 (46.59)	185 (53.93)			
Marital Status						
Single	204 (30)	114 (33.82)	90 (26.23)	7.255	3	0.064
Married	459 (67.5)	213 (63.20)	246 (71.72)			
Divorcee	9 (1.32)	4 (1.19)	5 (1.46)			
Widow/Widower	8 (1.17)	6 (1.78)	2 (0.58)			
Employment						
Government	114 (16.76)	54 (16.02)	60 (17.49)	6.416	5	0.268
Military	42 (6.17)	21 (6.23)	21 (6.12)			
Private	369 (54.26)	182 (54)	187 (54.51)			
Business	45 (6.61)	29 (8.60)	16 (4.66)			
Student	84 (12.35)	36 (10.68)	48 (13.99)			
Retired	26 (3.82)	15 (4.45)	11 (3.20)			

(*Continued*)

Table 1 (Continued).

Demographics	Total (680) n (%)	ADDS (337) n (%)	TDDS (343) n (%)	χ^2	df	p
Patient care						
Acute	501 (73.67)	238 (70.62)	263 (76.68)	3.212	1	0.073
Chronic	179 (26.32)	99 (29.37)	80 (23.32)			
Number of visits/years						
1	111 (16.32)	59 (17.50)	52 (15.16)	3.251	4	0.517
2	296 (43.52)	151 (44.80)	145 (42.27)			
3	132 (19.41)	60 (17.80)	72 (20.99)			
4	91 (13.38)	40 (11.87)	51 (14.86)			
Five or more than 5	50 (7.35)	27 (8.01)	23 (6.71)			

Note: p<0.05 considered as statistically significant (mentioned in bold letters).
Abbreviations: ADDS, Automated Drug Dispensing System; TDDS, Traditional Drug Dispensing System; df, Degrees of freedom.

Table 2 Level of Participant's Satisfaction Between ADDs and TDDs

Domain	Item	ADDS Mean (SD)	TDDS Mean (SD)	Z	p
Pharmacy Administration	Maintenance of the pharmacy is good	4.04 (0.68)	3.91 (0.71)	−2.318	**0.020**
	The pharmacy area is neat and hygienic	3.59 (0.96)	3.50 (0.80)	−1.353	0.176
	The Pharmacy has sufficient space for the drug dispensing process	3.41 (1.51)	3.01 (0.98)	−4.901	**0.000**
	A sufficient number of pharmacists working in the pharmacy	4.00 (0.87)	3.26 (0.98)	−9.963	**0.000**
Dispensing Practice	The medication label is clear and understandable	4.07 (0.67)	3.84 (0.71)	−4.298	**0.000**
	The Pharmacist dispensed all the medications in the correct quantity	4.09 (0.71)	3.88 (0.66)	−4.283	**0.000**
	The Pharmacist verifies all the medications before dispensing	3.59 (1.01)	3.35 (0.39)	−3.227	**0.001**
Patient Education	The Pharmacist explains how to take medications	4.07 (0.65)	3.87 (0.67)	−4.011	**0.000**
	The Pharmacist explains the side effects of medications	3.40 (1.15)	3.41 (1.04)	−0.189	0.850
	The Pharmacist provides all the necessary information for the patient	3.85 (0.82)	3.74 (0.72)	−1.876	0.061
	The Pharmacist always listened to the patients and cleared doubts	3.78 (0.81)	3.63 (0.70)	−2.494	**0.013**
	The Pharmacist ensures that the patient fully understands the explanation given	3.67 (0.94)	3.42 (0.86)	−3.693	**0.000**
Dispensing System	This drug dispensing system is efficient	3.83 (0.80)	3.59 (0.73)	−4.289	**0.000**
	The drug dispensing system is safe for the patient	3.82 (0.79)	3.60 (0.69)	−3.574	**0.000**
	This dispensing system reduces patient time	3.64 (0.96)	3.41 (0.87)	−3.326	**0.001**
	This dispensing system reduces pharmacists' time	3.74 (0.79)	3.46 (0.74)	−4.150	**0.000**
	This dispensing system is helpful to the hospital	3.91 (0.82)	3.67 (0.70)	−4.678	**0.000**

Note: p<0.05 considered as statistically significant (mentioned in bold letters).
Abbreviations: ADDS, Automated drug dispensing system; TDDS, Traditional Drug Dispensing System.

($p<0.05$) than the participants in TDDS with all the items regarding the dispensing practice and dispensing system domains. The participants in ADDS believed that their dispensing systems were efficient, safe for the patient, helpful to the hospital, and reduced patient and pharmacist time. Also, they added that regarding the dispensing practice domain, the medication label was clear and understandable, the pharmacist dispensed all the medications in the correct quantity, and the drugs were readily available.

In the pharmacy administration domain, the participants in ADDS were significantly more satisfied with three out of four items than those in TDDS. They felt the pharmacy's maintenance was good; sufficient seating was available in the waiting area near the pharmacy, and a sufficient number of pharmacists were working there. Meanwhile, the satisfaction level regarding the neatness and hygiene of the pharmacy was higher in ADDS participants than in TDDS participants; it did not reach a statistically significant difference ($p=0.176$).

Meanwhile, two items in the patient education domain also have participant satisfaction levels between ADDS and TDDS, which have no statistical significance. Those were where the pharmacists explained the side effects of the medications ($p=0.850$), and the pharmacist provided all the necessary information for the patient ($p=0.061$). On the other hand, the participants in ADDS had statistically more satisfaction than TDDS in the items, including the pharmacist explaining how to take the medication, the pharmacists always listening to the patients and clearing doubts, and the pharmacist ensuring that the patient fully understood the explanation.

Discussion

This survey addresses patient satisfaction using a validated 17-item questionnaire for the first time. The survey was implemented simultaneously in pharmacies that adopted ADDs and TDDs, and the level of patient satisfaction was compared between them. According to the demographics, the study participants were normally distributed between ADDS and TDDS. The participants were significantly more satisfied with ADDs than TDDs in all items related to dispensing practice and system domain. The participants in ADDS had significantly higher satisfaction than those in TDDS regarding the dispensing system's efficiency, safety, and helpfulness to the hospital. These results authenticate the previous findings regarding the efficiency of automated drug dispensing system.[7,8,11,15,18–21]

The participants in ADDS believed that automation could reduce the patient and pharmacist time since it minimizes the workload of pharmacists by reducing the prescription filling time, and this finding substantiates the previous reports.[7,8,13,20,22–24] This saved time could be translated into patient care by providing appropriate patient education to improve the therapeutic outcomes, as already emphasized by the previous researchers.[9,13] This study authenticates those findings since participants in ADDS showed higher satisfaction regarding the pharmacist's involvement in educating the patients on taking medications, listening to them, clearing their doubts, and ensuring their understanding of their medications. However, the participants in ADDS had no significantly higher satisfaction than TDDS participants regarding the pharmacist's involvement in explaining side effects and providing all necessary information for the patient. Hence, pharmacists in ADDS need more motivation to translate their freed-up time, as has already been addressed by previous research.[9] Only a very low proportion of pharmacists (30.4%) explain possible side effects[25] that can be improved by effectively implementing ADDS. Provision of all necessary information to the patient regarding the drug inarguably improves medication safety and patient compliance.[26] In this regard, the institutions adopting ADDS should ensure improved patient care by providing good quality patient education from the pharmacists.

The participants perceived the dispensing practice in ADDS more than in the TDDS regarding pharmacist verification of medications before dispensing, clear medication labeling, and dispensing of medications in the correct quantity. These results are consistent with the previous reports, which addressed the efficient dispensing process with reduced errors.[10,20,21,27,28]

In this study, both hospitals belong to the Ministry of Health, and healthcare facilities are almost identical. However, one hospital adopted ADDS, and another one used TDDS. According to participants' satisfaction levels, the hospital adopting ADDS had better pharmacy administration regarding maintenance, sufficient space for dispensing, and a sufficient number of pharmacists. Adopting ADDS helps improve pharmacy administration by minimizing the shortage of pharmacists' workload, and prescription filling time.[22–24,29–31]

Patient satisfaction with pharmacy services is multifactorial and varies from hospital to hospital. It includes pharmacy administration, patient education services, dispensing practice, and systems.[32–35] Therefore, the institutions adopting ADDS should assess the level of patient satisfaction for effective implementation.

Strength and Limitations

The following are considered strengths of this study: 1. The study adopted a validated questionnaire for the first time to assess patient satisfaction between ADDS and TDDS. 2. Both hospitals that adopted ADDS and TDDS belong to similar governance and are almost equal in facilities. 3. The demographic findings revealed that the study participants were normally distributed between ADDS and TDDS.

The study also has some limitations, such as it does not include ethnicity, details of comorbidities, and the number of drugs in a prescription, which could be potential factors in patient satisfaction with pharmacy services. The efficiency of the dispensing process can be influenced directly by the number of drugs in a prescription and indirectly by individuals' comorbidities (which determine the number of drugs in each prescription). Future researchers in ADDS can address these characteristics.

Conclusion

Patient satisfaction was higher in the ADDS participants than in TDDS regarding pharmacy administration, patient education, dispensing practice, and systems. However, pharmacists in ADDS need to be motivated to transfer the advantages of ADDS to patient care, including comprehensive patient education, particularly on side effects. The hospital adopting ADDS can periodically assess the acquired benefits of ADDS with patient satisfaction.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval and Patient Consent

The Institutional Review Board, Ministry of Health, approved the study (TU-077/023/182). This study complies with the Declaration of Helsinki. Before enrolment, written consent was obtained from all participants. The study was conducted in two Government hospitals (study sites) belonging to the Ministry of Health (MOH); hence, obtaining IRB approval from the MOH is mandatory in Saudi Arabia. Meanwhile, healthcare professionals at the study sites did not contribute to or co-author the paper. However, we acknowledged the hospital administrators for permitting us to conduct the study. I assure you there is no conflict of interest regarding authorship and affiliation.

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Disclosure

The authors declare no conflict of interest.

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