

# Physicians' Perceptions of Electronic Prescribing with Electronic Medical Records in Kuwaiti Primary Healthcare Centres

\*Bashair A. Almutairi,<sup>1</sup> Henry W. W. Potts,<sup>2</sup> Saadoun F. Al-Azmi<sup>1</sup>

## آراء الأطباء عن الوصفة الإلكترونية بالسجلات الطبية الإلكترونية في مراكز الرعاية الصحية الأولية في الكويت

بشائر عبدالله المطيري، هنري بوتس، سعدون فارس العازمي

**ABSTRACT: Objectives:** This study aimed to evaluate physicians' perceptions of electronic prescribing in Kuwaiti primary healthcare centres. **Methods:** This cross-sectional study was conducted between June and August 2017 among 368 physicians from 25 primary healthcare centres in Kuwait. Data were collected from the participants using a self-reported questionnaire, including sociodemographic characteristics, previous experience with computers and awareness, knowledge and use of e-prescribing systems and their functional features. In addition, perceptions of the benefits and levels of satisfaction associated with e-prescribing were explored. **Results:** A total of 306 physicians completed the survey (response rate: 83%). The majority had positive perceptions regarding the use of e-prescribing, particularly in terms of time-savings (86%), healthcare quality (84%), productivity (80%) and clinical workflow and efficiency (83%). However, many respondents indicated that e-prescribing systems required additional improvements in terms of functionality. **Conclusion:** Most physicians in primary healthcare centres in Kuwait recognised the importance of e-prescribing to improve the quality of patient care, streamline workflow, increase productivity and reduce medical errors. However, there is a need to improve the design and infrastructure of e-prescribing systems, which may aid in the adoption of such systems in Kuwait.

**Keywords:** Computer-Assisted Drug Therapies; Electronic Prescribing; Electronic Medical Records; Physicians; Primary Healthcare; Kuwait.

**المخلص: الهدف:** هدفت هذه الدراسة إلى تقييم آراء الأطباء حول تقديم الوصفات إلكترونياً في مراكز الرعاية الصحية الأولية في الكويت. **الطريقة:** تم إجراء دراسة مسح مقطعي من يونيو إلى أغسطس 2017 في 25 مركزاً للرعاية الصحية الأولية واستهدف عدد 368 طبيباً بطريقة اختيار عشوائية بعد دعوتهم للمشاركة في الدراسة. تم جمع البيانات عن طريق استبيان ذاتي يتضمن المعلومات الديموغرافية، ومعلومات عن الخبرة في استخدام أجهزة الكمبيوتر، ومعلومات عن مدى ادراك ومعرفة الطبيب باستخدام أنظمة الوصفة الإلكترونية وخصائصها الوظيفية. كما تم جمع معلومات تتعلق بآراء وتصورات الأطباء حول الفوائد المرتبطة بالوصف الإلكتروني ومستويات رضاهم عن النظام. **النتائج:** استكمل المسح ما مجموعه 306 طبيباً (معدل استجابة: 83%). قد كانت الإجابات بشكل عام إيجابية في ما يتعلق باستخدام الوصفات الإلكترونية، خاصة فيما يتعلق بتوفير الوقت (86%)، وجودة الرعاية الصحية (84%)، والإنتاجية (80%) وسير العمل السريري والكفاءة (83%). كما أشار معظم المشاركين إلى أن أنظمة الوصف الإلكترونية تحتاج إلى إدخال وظائف محسنة. **الخلاصة:** يقر الأطباء في مراكز الرعاية الأولية الكويتية بأهمية أنظمة وصف الدواء الإلكترونية لتحسين جودة رعاية المرضى وضمان سهولة سير العمل والإنتاجية والتقليل من الأخطاء الطبية. مع ذلك، هناك حاجة لتحسين تصميم البنية التحتية لنظام الوصفة الإلكترونية، مما سيسهم في اعتمادها بفعالية في الكويت.

**الكلمات المفتاحية:** العلاجات الدوائية المدعومة بالحاسوب؛ الوصفة الإلكترونية؛ السجلات الصحية الإلكترونية؛ الأطباء؛ الرعاية الصحية الأولية؛ الكويت.

### ADVANCES IN KNOWLEDGE

- This study found that physicians in Kuwait were generally accepting of the introduction of electronic prescribing as part of an electronic medical record system, recognising the value and potential of such systems to improve efficiency, reduce medical errors and improve patient safety.
- However, physicians in Kuwait identified several deficiencies in the implemented e-prescribing systems.

### APPLICATION TO PATIENT CARE

- There is a need to address identified deficiencies in e-prescribing systems being implemented in Kuwait in order to optimise the quality of care provided to patients and reduce the potential for prescription errors.

<sup>1</sup>Department of Medical Records, College of Health Sciences, Public Authority of Applied Education & Training, Kuwait City, Kuwait; <sup>2</sup>Institute of Health Informatics, University College London, London, UK

\*Corresponding Author's e-mails: [baa.almutairi@paaet.edu.kw](mailto:baa.almutairi@paaet.edu.kw) and [dr.bashayer.almutairi@gmail.com](mailto:dr.bashayer.almutairi@gmail.com)

**P**RESCRIBING MEDICINES IS AN IMPORTANT part of public healthcare services; as such, systems that optimise the prescription process are essential.<sup>1</sup> Electronic prescribing is defined as a computer-based method of creating, transferring, sorting and documenting prescriptions electronically.<sup>2</sup> A successful e-prescribing system functions as an interoperational platform between physicians and pharmacies to facilitate the exchange of treatment information.<sup>3</sup> E-prescribing systems often form part of a larger electronic medical record (EMR) system allowing physicians access to a broad range of patient information, including medical histories and details of diagnoses and treatment, in addition to prescription information.<sup>4</sup>

Prescription errors are a common yet avoidable cause of increased morbidity and mortality.<sup>5-7</sup> Although the implementation of new technologies may initially be challenging, adopting e-prescribing systems can help to reduce the frequency of medication errors, thereby enhancing patient safety and the overall quality of treatment, particularly in primary care settings and for patients with long-term drug regimens.<sup>8-10</sup> The successful adoption of e-prescribing systems has been reported in many regions worldwide, including the USA, UK, European Union and Canada.<sup>10,11</sup> The main barriers to implementation include cost, time, lack of efficiency, negative perceptions of technology and its impact on care, lack of prior experience with computers, low computer literacy, limitations in interoperability, difficulty of data entry/correction and the ability of the system to complete desired tasks.<sup>11-15</sup> Furthermore, there may be concerns regarding differences in healthcare policies and the enforcement of local privacy and data protection laws.<sup>16</sup> According to Sicotte *et al.*, preferred style of information acquisition, successful integration of e-prescribing into day-to-day practice and previous computer experience all contribute to a better understanding of technology and can positively influence the usage and adoption of e-prescribing systems.<sup>17</sup>

In Kuwait, healthcare services are offered at the primary, secondary and tertiary level via health centres, regional general hospitals and specialty hospitals. There are a total of 97 primary healthcare centres located throughout the country.<sup>18</sup> Each residential area has at least one primary healthcare centre, with some centres also incorporating specialised clinics catering to patients with diabetes, dermatological and ophthalmological problems and those requiring antenatal care, among others. Although these centres operate on an independent basis, they are overseen by the Central Directorate of Primary Healthcare in the Kuwaiti Ministry of Health (MOH).<sup>18,19</sup> In 2000, a national health information EMR system was developed by the MOH and subsequently implemented in all primary healthcare centres in 2001. The EMR

system was specifically designed to support end-users (i.e. physicians, nurses and pharmacists) by providing access to a complete and accurate database of relevant patient information.<sup>20</sup> This study aimed to evaluate physicians' perceptions of e-prescribing in Kuwaiti primary healthcare centres.

## Methods

This cross-sectional study was conducted between June and August 2017 in 25 primary healthcare centres in Kuwait. The required sample size for the study was based on a finite population of 1,685 physicians. As a conservative estimate, it was assumed that 50% of users would be satisfied with the current e-prescribing system. Taking into account a 4.6% error, the number of participants was calculated to be 350 at a 95% confidence level. Adjusting for a 5% non-response rate, a total of 368 Kuwaiti physicians were selected by a two-stage stratified random sampling method, considering the proportional allocation of the total population in the study area. In the first stage, a total of 25 primary healthcare centres were randomly selected, comprising five centres from each of the five main regions of Kuwait (Ahmadi, Asmimah, Farwaniya, Hawalli and Jahra). Subsequently, during the second stage, physicians from each of the selected centres were randomly chosen and invited to participate in the survey.

A two-part English-language questionnaire was developed to elicit information from the participants. The first section focused on sociodemographic factors and computer experience (13 items), while the second consisted of 48 items to determine the physicians' perceptions of e-prescribing in four categories: knowledge (four items), functionality (18 items), benefits (18 items) and satisfaction (eight items). All of the questions were closed-ended and were scored on a three-point Likert scale, with one indicating disagreement with the item, two neither agreement nor disagreement and three agreement. A pilot study of 10 physicians who were not included in the final study pre-tested the questionnaire to ensure the clarity and relevance of the items. The questionnaires were physically distributed to the selected physicians during their work shifts and collected one week later by the same researcher.

Data were analysed using the Statistical Package for the Social Sciences (SPSS), Version 24.0 (IBM Corp., Armonk, New York, USA). Responses for each item in the second section of the questionnaire were averaged over the total number of items in the category. As the scores for each dimension were not normally distributed, the results were expressed as minimums, maximums, medians and interquartile ranges (IQRs), with an overall unweighted or weighted score. Mann-Whitney U,

**Table 1:** Sociodemographic characteristics of physicians in primary healthcare centres in Kuwait (N = 306)

Characteristic	n (%)
<b>Age in years</b>	
20–29	23 (8)
30–39	149 (49)
40–49	68 (22)
50–59	44 (14)
>60	22 (7)
<b>Gender</b>	
Male	124 (41)
Female	182 (59)
<b>Marital status</b>	
Single	50 (16)
Married	256 (84)
<b>Education level</b>	
Bachelor's degree	129 (42)
Postgraduate degree	177 (58)
<b>Location of medical education</b>	
Kuwait	89 (29)
Abroad	217 (71)
<b>Previous work experience in years</b>	
<6	64 (21)
6–11	123 (40)
12–17	46 (15)
18–23	38 (12)
>24	35 (11)
<b>Prior computer training at medical school</b>	
Yes	186 (61)
No	120 (39)
<b>Level of computer literacy</b>	
Basic	98 (32)
Average	172 (56)
Excellent	36 (12)
<b>Awareness of e-prescribing modules</b>	
Yes	287 (94)
No	19 (6)
<b>Use of e-prescribing modules</b>	
Yes	291 (95)
No	15 (5)
<b>Awareness of how to use e-prescribing modules</b>	
Yes	288 (94)
No	18 (6)
<b>Previous experience using e-prescribing modules in years</b>	
Median (interquartile range)	7 (5–11)
Range	1–17
<b>Number of prescriptions per day</b>	
Median (interquartile range)	42 (36–47)
Range	15–54

**Table 2:** Dimension scores for a survey assessing perceptions of electronic prescribing systems among physicians in primary healthcare centres in Kuwait (N = 306)

Dimension	Unweighted score		Weighted score	
	Range	Med (IQR)	Range	Med (IQR)
Knowledge	4–12	12 (11–12)	1–3	3 (2.8–3)
Functionality	18–54	42 (37–48)	1–3	2.3 (2.1–2.7)
Benefits	18–54	49 (43–53)	1–3	2.7 (2.4–2.9)
Satisfaction	8–24	20 (19–21)	1–3	2.5 (2.4–2.6)

Med = median; IQR = interquartile range.

Kruskal-Wallis and Spearman's rank correlation tests were used to calculate associations at a 5% significance level.

The study was approved by the Standing Committee for the Coordination of Medical & Health Research at the Kuwaiti MOH (#537/2017). All participants were informed of the study's purpose, the anonymity of their data and that participation was voluntary in nature. Written consent was obtained from all participants prior to their inclusion in the study.

## Results

A total of 306 participants took part in the survey (response rate: 83%). Most respondents were female (59%), 30–39 years old (49%), married (84%), had a postgraduate degree (58%) and had worked for between 6–11 years (40%). The majority (71%) had received their medical education outside of Kuwait and 61% had taken computer courses during medical school. More than half (56%) reported having average computer literacy. Awareness of e-prescribing systems was high (94%), with 94% indicating that they understood how to use the system. The vast majority (95%) were currently using an e-prescribing system, with between 1–17 years of previous experience (median: 7 years; IQR: 5–11 years). The number of daily prescriptions was between 15–54 prescriptions (median: 42 prescriptions; IQR: 36–47 prescriptions) [Table 1]. The overall weighted median score for the knowledge dimension of the questionnaire was 3, while the median score for functionality was 2.3. Median weighted scores for the benefits and satisfaction dimensions were 2.7 and 2.5, respectively [Table 2].

Generally, the majority of physicians had positive perceptions regarding the concept of e-prescribing, reporting that the EMR system was easy to use (85%), efficient (88%) and provided easy access to prescriptions services (81%). Notable benefits of e-prescribing were time-savings (86%), increased healthcare quality (84%), productivity (80%) and clinical workflow and efficiency (83%). However, many of the respondents indicated that e-prescribing systems should have better functionality,

**Table 3:** Perceptions of electronic prescribing systems among physicians in primary healthcare centres in Kuwait (N = 306)

Item	n (%)		
	Disagree	Neither	Agree
<b>Knowledge</b>			
The EMR e-prescribing system is easy to use	8 (3)	37 (12)	261 (85)
It is easy to access e-prescription services and prescribe medications with this system	12 (4)	46 (15)	248 (81)
I use the EMR e-prescribing system efficiently for most prescriptions	10 (3)	28 (9)	268 (88)
The EMR e-prescribing system clearly displays patient demographic information	23 (8)	80 (26)	203 (66)
<b>Functionality</b>			
The EMR e-prescribing system allows me to create new prescriptions	48 (16)	45 (15)	213 (70)
The EMR e-prescribing system allows me to detect prescribing errors	74 (24)	77 (25)	155 (51)
The EMR e-prescribing system allows me to receive medication interaction alerts	162 (53)	44 (14)	100 (33)
The EMR e-prescribing system allows me to receive medication allergy alerts	41 (13)	34 (11)	231 (75)
The EMR e-prescribing system allows me to review patient medication histories	15 (5)	39 (13)	252 (82)
The EMR e-prescribing system allows me to track health maintenance items	44 (14)	98 (32)	164 (54)
The EMR e-prescribing system allows me to select medications	13 (4)	28 (9)	265 (87)
The EMR e-prescribing system allows me to view current medications	20 (7)	34 (11)	252 (82)
The EMR e-prescribing system allows me to add an electronic signature	174 (57)	55 (18)	77 (25)
The EMR e-prescribing system allows me to obtain medication information	89 (29)	66 (22)	151 (49)
The EMR e-prescribing system allows me to review medication reference information	101 (33)	70 (23)	135 (44)
The EMR e-prescribing system allows me to prescribe medication safely	80 (26)	81 (26)	145 (47)
The EMR e-prescribing system allows me to request repeat medications	52 (17)	64 (21)	190 (62)
The EMR e-prescribing system allows me to review formula information	92 (30)	68 (22)	146 (48)
The EMR e-prescribing system allows me to print patient information sheets	48 (16)	35 (11)	223 (73)
The EMR e-prescribing system allows me to print medical information sheets	36 (12)	44 (14)	226 (74)
The EMR e-prescribing system allows me to perform dosing calculations	143 (47)	73 (24)	90 (29)
The EMR e-prescribing system allows me to search by medication name	39 (13)	37 (12)	230 (75)
<b>Benefits</b>			
The EMR e-prescribing system helps to control patient medication lists	68 (22)	66 (22)	172 (56)
The EMR e-prescribing system leads to increased prescription accuracy	62 (20)	84 (27)	160 (52)
The EMR e-prescribing system helps to streamline workflow and increase efficiency	17 (6)	35 (11)	254 (83)
The EMR e-prescribing system contributes to financial savings	29 (9)	77 (25)	200 (65)
The EMR e-prescribing system improves communication with pharmacists	32 (10)	50 (16)	224 (73)
The EMR e-prescribing system improves communication with patients	37 (12)	69 (23)	200 (65)
The EMR e-prescribing system leads to greater patient satisfaction	22 (7)	97 (32)	187 (61)
The EMR e-prescribing system results in better security and confidentiality	16 (5)	77 (25)	213 (70)
The EMR e-prescribing system results in better protection of the patient's privacy	21 (7)	68 (22)	217 (71)
The EMR e-prescribing system leads to greater patient safety	24 (8)	76 (25)	206 (67)
The EMR e-prescribing system contributes to time-savings	13 (4)	31 (10)	262 (86)
The EMR e-prescribing system reduces medication errors	28 (9)	79 (26)	199 (65)
The EMR e-prescribing system leads to greater efficiency in physician practice	16 (5)	67 (22)	223 (73)
The EMR e-prescribing system contributes to higher-quality healthcare	7 (2)	43 (14)	256 (84)
The EMR e-prescribing system leads to greater productivity	14 (5)	46 (15)	246 (80)
The EMR e-prescribing system improves flexibility without much mental effort	25 (8)	95 (31)	186 (61)
The EMR e-prescribing system results in faster task accomplishment	19 (6)	45 (15)	242 (79)
The EMR e-prescribing system allows me to treat more patients	21 (7)	68 (22)	217 (71)
<b>Satisfaction</b>			
The EMR e-prescribing system is useful for my job	7 (2)	13 (4)	286 (93)
The EMR e-prescribing system makes my job easier	9 (3)	18 (6)	279 (91)
The EMR e-prescribing system is not time-consuming	46 (15)	48 (16)	212 (69)
The EMR e-prescribing system improves the speed and efficiency of processing orders	12 (4)	41 (13)	253 (83)
The EMR e-prescribing system maintains data accuracy	10 (3)	39 (13)	257 (84)
The EMR e-prescribing system makes my job much more difficult	214 (70)	45 (15)	47 (15)
I require more training to use the EMR e-prescribing system	92 (30)	91 (30)	123 (40)
An on-staff support technician is needed to maintain and resolve technical problems	59 (19)	68 (22)	179 (58)

EMR = electronic medical record.

**Table 4:** Dimension scores for a survey assessing perceptions of electronic prescribing systems among physicians in primary health-care centres in Kuwait according to sociodemographic characteristics (N = 306)

Characteristic	Median score (IQR)			
	Knowledge	Functionality	Benefits	Satisfaction
<b>Gender</b>				
Male	3 (2.8–3)	2.3 (2.1–2.7)	2.7 (2.4–2.9)	2.5 (2.3–2.8)
Female	3 (2.5–3)	2.3 (2.1–2.6)	2.8 (2.4–2.9)	2.5 (2.4–2.6)
<b>Marital status</b>				
Single	2.8 (2.5–3)	2.4 (2.1–2.6)	2.7 (2.4–2.9)	2.5 (2.3–2.6)
Married	3 (2.8–3)	2.3 (2.1–2.7)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
<b>Education level</b>				
Bachelor's degree	3 (2.8–3)	2.4 (2.1–2.8)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
Postgraduate degree	3 (2.5–3)	2.3 (2.1–2.6)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
<b>Location of medical education</b>				
Kuwait	3 (2.8–3)	2.2 (2–2.5)	2.7 (2.3–2.9)	2.5 (2.3–2.6)
Abroad	2.8 (2.5–3)	2.4 (2.1–2.7)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
<b>Prior computer training at medical school</b>				
Yes	3 (2.8–3)	2.4 (2.1–2.7)	2.8 (2.4–2.9)	2.5 (2.4–2.6)
No	2.8 (2.5–3)	2.3 (2.1–2.6)	2.7 (2.3–2.9)	2.5 (2.3–2.6)
<b>Awareness of e-prescribing modules</b>				
Yes	3 (2.8–3)	2.4 (2.1–2.7)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
No	2.8 (2.5–3)	2.1 (1.6–2.6)	2.4 (2.1–3)	2.5 (2.2–2.7)
<b>Use of e-prescribing modules</b>				
Yes	3 (2.8–3)	2.4 (2.1–2.7)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
No	2.8 (2–3)	2.1 (1.8–2.6)	2.6 (2.1–3)	2.4 (2–2.5)
<b>Awareness of how to use e-prescribing modules</b>				
Yes	3 (2.8–3)	2.4 (2.1–2.7)	2.7 (2.4–2.9)	2.5 (2.4–2.6)
No	2.8 (2.5–3)	2 (1.5–2.6)	2.4 (2.2–2.9)	2.4 (2.3–2.6)

IQR = interquartile range.

**Table 5:** Relationship between sociodemographic variables and dimension scores for a survey assessing perceptions of electronic prescribing systems among physicians in primary healthcare centres in Kuwait (N = 306)

Variable	Knowledge		Functionality		Benefits		Satisfaction	
	R/Z score	P value	R/Z score	P value	R/Z score	P value	R/Z score	P value
Age	-0.041*	0.474	0.102*	0.075	0.000*	0.999	-0.104*	0.068
Gender	0.170*	0.865	0.461 <sup>†</sup>	0.645	0.408 <sup>†</sup>	0.683	0.596 <sup>†</sup>	0.551
Marital status	1.142 <sup>†</sup>	0.253	0.635 <sup>†</sup>	0.525	0.722 <sup>†</sup>	0.470	1.088 <sup>†</sup>	0.277
Education level	0.092 <sup>†</sup>	0.927	1.524 <sup>†</sup>	0.128	0.066 <sup>†</sup>	0.947	0.820 <sup>†</sup>	0.412
Location of medical education	1.205 <sup>†</sup>	0.228	2.434 <sup>†</sup>	0.015	1.473 <sup>†</sup>	0.141	0.168 <sup>†</sup>	0.866
Prior computer training at medical school	0.958 <sup>†</sup>	0.338	1.546 <sup>†</sup>	0.122	2.223 <sup>†</sup>	0.026	0.998 <sup>†</sup>	0.318
Computer literacy	0.050*	0.387	0.015*	0.797	0.071*	0.214	0.011*	0.849
Awareness of e-prescribing modules	1.726 <sup>†</sup>	0.084	2.069 <sup>†</sup>	0.039	1.123 <sup>†</sup>	0.258	0.359 <sup>†</sup>	0.720
Use of e-prescribing modules	2.386 <sup>†</sup>	0.017	1.792 <sup>†</sup>	0.073	0.859 <sup>†</sup>	0.391	2.066 <sup>†</sup>	0.039
Awareness of how to use e-prescribing modules	1.932 <sup>†</sup>	0.053	2.656 <sup>†</sup>	0.008	1.269 <sup>†</sup>	0.204	0.887 <sup>†</sup>	0.375
Previous experience using e-prescribing modules	-0.003*	0.958	0.005*	0.353	-0.005*	0.937	0.070*	0.219
Number of prescriptions per day	0.028*	0.629	0.091*	0.112	-0.016*	0.718	-0.049*	0.396

IQR = interquartile range; EMR = electronic medical record. \*Using Spearman's rank correlation coefficient. <sup>†</sup>Using a Mann-Whitney U test.



**Table 6:** Spearman's rank correlations between dimensions in a survey assessing perceptions of electronic prescribing systems among physicians in primary healthcare centres in Kuwait (N = 306)

Dimension	Knowledge		Functionality		Benefits	
	R	P value	R	P value	R	P value
Functionality	0.326	<0.001	-	-	-	-
Benefits	0.350	<0.001	0.538	<0.001	-	-
Satisfaction	0.177	0.001	0.241	<0.001	0.254	<0.001

for instance regarding the ability to add electronic signatures (57%), receive medication interaction alerts (53%) and perform dosing calculations (47%). Respondents also highlighted the need for technical support (58%) [Table 3].

Tables 4 and 5 show the relationship between the overall median scores in each of the questionnaire dimensions and selected sociodemographic characteristics. The median functionality score of physicians who had received medical education abroad was significantly higher than that of those who had been educated in Kuwait (2.4 versus 2.2;  $P = 0.015$ ). Physicians who had received computer courses at medical school had a significantly higher median benefits score compared to those who did not (2.8 versus 2.7;  $P = 0.026$ ). Median functionality scores were also significantly higher among physicians who were aware of e-prescription systems (2.4 versus 2.1;  $P = 0.039$ ) and who understood how to use them (2.4 versus 2;  $P = 0.008$ ). Median scores for the satisfaction and knowledge dimensions varied according to use of e-prescribing systems; users had significantly higher satisfaction (2.5 versus 2.4;  $P = 0.039$ ) and knowledge (3 versus 2.8;  $P = 0.017$ ) scores compared to non-users. All four dimensions of the questionnaire were significantly related with each other ( $P \leq 0.001$ ), with Spearman's rank correlation coefficients ranging from 0.177–0.350 [Table 6].

## Discussion

The current study assessed perceptions of e-prescribing among physicians in primary healthcare centres in Kuwait. As physicians are the primary end-users of such systems, they are in the best position to identify factors that affect successful adoption and implementation of the system.<sup>21</sup> The majority of physicians in the present study had positive perceptions of e-prescribing, particularly with regards to time-savings, ease of use, accessibility and increased healthcare quality, productivity and efficiency. In particular, most physicians anticipated that e-prescribing would result in improvements in prescription accuracy, data confidentiality and patient satisfaction and help to reduce prescription errors.

The findings of the present study are in line with those of previous research. In a study in Singapore, Tan *et al.* reported that most doctors were satisfied with specific functions of e-prescribing systems such as the ability to review prescription histories, receive drug interaction alerts and create prescriptions and e-prescription processing and system speed.<sup>22</sup> A Swedish study noted that physicians were satisfied with the clear display of patient information on such systems.<sup>23</sup> Thomas *et al.* found that physicians using an ambulatory e-prescribing system in the USA were optimistic about improved workflow, efficiency, cost-savings and patient communication.<sup>24</sup> Other studies have also reported perceived improvements in patient safety, care quality, efficiency, productivity and communication with pharmacies.<sup>1,9–11,23,25,26</sup>

Despite mostly positive perceptions, more than half of the physicians in the current study indicated that e-prescribing systems should have better functionality, such as the ability to add electronic signatures, receive medication interaction alerts and perform dosing calculations. Cohen *et al.* highlighted a desire for e-prescribing technology to incorporate electronic signatures among physicians in South Africa, while Savage *et al.* revealed similar issues regarding allergy and interaction alerts and dosing calculations among staff at a district general hospital in the UK.<sup>27,28</sup> In addition, a major area of concern in the present study was ensuring adequate technical support in the workplace for system maintenance and to overcome technical problems. These results are consistent with the findings of other studies regarding the need for greater technical and organisational support for the successful implementation and maintenance of e-prescribing systems.<sup>1,3</sup> Jawhari *et al.* also emphasised the need for on-site technical support.<sup>29</sup>

The main limitation of the current study was that the sample was not representative of all primary healthcare physicians in Kuwait; furthermore, as the questionnaire data were self-reported, the findings may be subject to bias.

## Conclusion

This study found that physicians' perceptions of e-prescribing systems in Kuwaiti primary healthcare centres were mostly positive, particularly with regards to improvements in time-savings, efficiency, quality of patient care and safety. These results support the continued adoption and use of e-prescribing systems in Kuwait. However, several deficiencies were identified regarding the functionality of e-prescribing systems and the lack of technical support and maintenance. Improvements in these areas may maximise the effective adoption and use of such systems.

## ACKNOWLEDGEMENTS

The authors would like to thank all of the physicians who participated in this study as well as the directors of the primary healthcare centres for facilitating and supporting the data collection process.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## FUNDING

No funding was received for this study.

## References

- Gagnon MP, Nsangou ÉR, Payne-Gagnon J, Grenier S, Sicotte C. Barriers and facilitators to implementing electronic prescription: A systematic review of user groups' perceptions. *J Am Med Inform Assoc* 2014; 21:535–41. <https://doi.org/10.1136/amiajnl-2013-002203>.
- eHealth Initiative Foundation. A clinician's guide to electronic prescribing. From: [www.citizenshealthinitiative.org/sites/citizenshealthinitiative.org/files/media/Reports/Clinicians\\_Guide\\_to\\_e-Prescribing\\_Final\\_100708.pdf](http://www.citizenshealthinitiative.org/sites/citizenshealthinitiative.org/files/media/Reports/Clinicians_Guide_to_e-Prescribing_Final_100708.pdf) Accessed: Sep 2018.
- Grossman JM, Cross DA, Boukus ER, Cohen GR. Transmitting and processing electronic prescriptions: Experiences of physician practices and pharmacies. *J Am Med Inform Assoc* 2012; 19:353–9. <https://doi.org/10.1136/amiajnl-2011-000515>.
- Abramson EL, Barrón Y, Quaresimo J, Kaushal R. Electronic prescribing within an electronic health record reduces ambulatory prescribing errors. *Jt Comm J Qual Patient Saf* 2011; 37:470–8. [https://doi.org/10.1016/S1553-7250\(11\)37060-2](https://doi.org/10.1016/S1553-7250(11)37060-2).
- Cresswell K, Coleman J, Slee A, Williams R, Sheikh A. Investigating and learning lessons from early experiences of implementing ePrescribing systems into NHS hospitals: A questionnaire study. *PLoS One* 2013; 8:e53369. <https://doi.org/10.1371/journal.pone.0053369>.
- Pirmohamed M, James S, Meakin S, Green C, Scott AK, Walley TJ, et al. Adverse drug reactions as cause of admission to hospital: Prospective analysis of 18 820 patients. *BMJ* 2004; 329:15–19. <https://doi.org/10.1136/bmj.329.7456.15>.
- Schneeweiss S, Göttler M, Hasford J, Swoboda W, Hippus M, Hoffmann AK, et al. First results from an intensified monitoring system to estimate drug related hospital admissions. *Br J Clin Pharmacol* 2001; 52:196–200. <https://doi.org/10.1046/j.0306-5251.2001.01425.x>.
- Eslami S, Abu-Hanna A, de Keizer NF. Evaluation of outpatient computerized physician medication order entry systems: A systematic review. *J Am Med Inform Assoc* 2007; 14:400–6. <https://doi.org/10.1197/jamia.M2238>.
- Grossman JM, Gerland A, Reed MC, Fahlman C. Physicians' experiences using commercial e-prescribing systems. *Health Aff (Millwood)* 2007; 26:w393–404. <https://doi.org/10.1377/hlthaff.26.3.w393>.
- Salmon JW, Jiang R. E-prescribing: History, issues, and potentials. *Online J Public Health Inform* 2012; 4:4304. <https://doi.org/10.5210/ojphi.v4i3.4304>.
- Samadbeik M, Ahmadi M, Sadoughi F, Garavand A. A comparative review of electronic prescription systems: Lessons learned from developed countries. *J Res Pharm Pract* 2017; 6:3–11. <https://doi.org/10.4103/2279-042X.200993>.
- Van Der Meijden MJ, Tange HJ, Troost J, Hasman A. Determinants of success of inpatient clinical information systems: A literature review. *J Am Med Inform Assoc* 2003; 10:235–43. <https://doi.org/10.1197/jamia.M1094>.
- Aarts J, Doorewaard H, Berg M. Understanding implementation: The case of a computerized physician order entry system in a large Dutch university medical center. *J Am Med Inform Assoc* 2004; 11:207–16. <https://doi.org/10.1197/jamia.M1372>.
- Al-Azmi SF, Al-Enezi N, Chowdhury RI. Users' attitudes to an electronic medical record system and its correlates: A multivariate analysis. *Health Inf Manag* 2009; 38:33–40. <https://doi.org/10.1177/183335830903800205>.
- Ammenwerth E, Mansmann U, Iller C, Eichstädter R. Factors affecting and affected by user acceptance of computer-based nursing documentation: Results of a two-year study. *J Am Med Inform Assoc* 2003; 10:69–84. <https://doi.org/10.1197/jamia.M1118>.
- Greenberg MD, Ridgely MS, Bell DS. Electronic prescribing and HIPAA privacy regulation. *Inquiry* 2004–2005; 41:461–8. [https://doi.org/10.5034/inquiryjrnl\\_41.4.461](https://doi.org/10.5034/inquiryjrnl_41.4.461).
- Sicotte C, Taylor L, Tamblyn R. Predicting the use of electronic prescribing among early adopters in primary care. *Can Fam Physician* 2013; 59:e312–21.
- Regional Health Systems Observatory, World Health Organization. Health system profile: Kuwait. From: [apps.who.int/medicinedocs/documents/s17297e/s17297e.pdf](http://apps.who.int/medicinedocs/documents/s17297e/s17297e.pdf) Accessed: Sep 2018.
- Buabbas A. Investigation of the adoption of telemedicine technology in the Kuwaiti health system: Strategy and policy of implementation for overseas referral patients. PhD thesis, 2013, Brunel University, London, UK.
- Akbar AA. Patient information system for national health care: An intranet internet-based model for the State of Kuwait. PhD thesis, 2003, University of Leeds, Leeds, UK.
- Tamblyn R, Huang A, Kawasumi Y, Bartlett G, Grad R, Jacques A, et al. The development and evaluation of an integrated electronic prescribing and drug management system for primary care. *J Am Med Inform Assoc* 2006; 13:148–59. <https://doi.org/10.1197/jamia.M1887>.
- Tan WS, Phang JS, Tan LK. Evaluating user satisfaction with an electronic prescription system in a primary care group. *Ann Acad Med Singapore* 2009; 38:494–7.
- Hellström L, Waern K, Montelius E, Astrand B, Rydberg T, Petersson G. Physicians' attitudes towards ePrescribing: Evaluation of a Swedish full-scale implementation. *BMC Med Inform Decis Mak* 2009; 9:37. <https://doi.org/10.1186/1472-6947-9-37>.
- Thomas CP, Kim M, McDonald A, Kreiner P, Kelleher SJ Jr, Blackman MB, et al. Prescribers' expectations and barriers to electronic prescribing of controlled substances. *J Am Med Inform Assoc* 2011; 19:375–81. <https://doi.org/10.1136/amiajnl-2011-000209>.
- Johnson KB, Lehmann CU; Council on Clinical Information Technology of the American Academy of Pediatrics. Electronic prescribing in pediatrics: Toward safer and more effective medication management. *Pediatrics* 2013; 131: e1350–6. <https://doi.org/10.1542/peds.2013-0193>.
- Abramson EL, Patel V, Pfoh ER, Kaushal R. How physician perspectives on e-prescribing evolve over time: A case study following the transition between EHRs in an outpatient clinic. *Appl Clin Inform* 2016; 7:994–1006. <https://doi.org/10.4338/ACI-2016-04-RA-0069>.
- Cohen JE, Bancelhon JM, Jones M. South African physicians' acceptance of e-prescribing technology: An empirical test of a modified UTAUT model. *S Afr Comput J* 2013; 50:43–54. <https://doi.org/10.18489/sacj.v50i1.175>.
- Savage I, Cornford T, Klecun E, Barber N, Clifford S, Franklin BD. Medication errors with electronic prescribing (eP): Two views of the same picture. *BMC Health Serv Res* 2010; 10:135. <https://doi.org/10.1186/1472-6963-10-135>.
- Jawhari B, Keenan L, Zakus D, Ludwick D, Isaac A, Saleh A, et al. Barriers and facilitators to electronic medical record (EMR) use in an urban slum. *Int J Med Inform* 2016; 94:246–54. <https://doi.org/10.1016/j.ijmedinf.2016.07.015>.