

EXPLORE HOW EFFECTIVE COMMUNICATION BETWEEN EMERGENCY DEPARTMENTS AND PEDIATRICIANS CAN IMPROVE PATIENT OUTCOMES

Hussein Rasmi Raheem^{*1}, Rafed Kareem Jaber², Uday Abd Ul Mutalb Ubd Alhadi³

¹Iraqi Ministry of Health, Dhiqar Health Department, Pediatric Department, Bint Alhuda Maternity and Childhood Teaching Hospital, Dhiqar, Iraq

²Iraqi Ministry of Health, Thi Qar Health Directorate, Al-Shattra General Hospital, Thi Qar, Iraq

³Iraqi Ministry of Health, Dyala Health Directorate, Specialist in Baquba Teaching Hospital Emergency Department, Baquba Teaching Hospital, Dayla, Iraq

*Email: Hussein.rasmi89@gmail.com

Abstract:

Communication between pediatricians and emergency departments (ED) is crucial to improve patient outcomes in pediatric care. The aim of this study was to evaluate the impact of different communication strategies between emergency departments and pediatricians strategies on pediatric patients' clinical outcomes, such as illness type, patients' satisfaction, clinical outcomes, and overall quality of life. We conducted a cross-sectional study on 130 children patients transferred to the emergency department. We enrolled clinical data, mode of communication used (Phone Consultations, Face-to-face communication, Secure Messaging, and Shared Access in Electronic Health Records (EHR)), patient clinical outcomes, parental satisfaction scores, and health-related quality of life through SF-36 questionnaires. The findings of the study showed that face-to-face communication recorded the highest parental satisfaction rate (100%) and the most untimely communication (mean 10 minutes). In contrast, shared access in EHR exhibited the most time for communication (mean 25 minutes) and moderate satisfaction (40%). Clinical outcomes showed that face-to-face communication patients recorded the least PICU lengths of stay (mean 2.1 days) and re-admission rates (20%), whereas phone consultations recorded high levels of morbidity outcomes. The results suggest that direct communication is the ideal method for enhancing pediatric patient outcomes during ED transfer. Direct communication between pediatricians and ED staff can possibly lead to improved clinical outcomes and parental satisfaction.

Keywords: Emergency Departments, Pediatricians, Communication Techniques, Face-to-Face Communication, Parental Satisfaction, Health-related Quality

Communication among healthcare professionals is essential to the provision of quality patient care, particularly in high-stakes settings like emergency departments (EDs) and pediatric care environments [1,2]. Communication between emergency physicians and pediatricians is particularly important in determining the outcomes for children with acute medical conditions [3]. Among the pediatric patient population, communication is not optional; it is a requirement, given the unique difficulties presented by diagnosing and treating children [4]. Children have idiosyncratic complaints, and their physiological responses to disease are very different from those of adults. Therefore, an unhampered line of communication between pediatricians and ED staff is essential so that the specialists of each child's history are considered and timely interventions able to stem morbidity and mortality are taken [5,6,7].

The complexity of children's care is compounded in the emergency setting, where decisions have to be made urgently, in unstated circumstances [8]. Miscommunication or omission to give information in a timely manner might result in delays in diagnosis, inappropriate treatments, and adverse outcomes [9]. Several factors are compounded in these problems, including the heterogeneous patient population, the need for a rapid response within the ED, and the reliance on parental report in patients that cannot convey their symptomatology [10,11]. These characteristics pinpoint the necessity for excellent communication strategies to bridge this gap between these two touchpoints of care [12]. Effective communication in this regard pertains to the timely and consistent transmission of information, such as the nature of the disease, history of illnesses, and treatment recommendations by primary care pediatricians [13].

New technology has driven the evolution of healthcare communication channels, showing that they can have a significant influence on patient outcomes [14]. All communication, including phone calls, secure messaging, electronic health records (EHRs), and face-to-face interactions, has been proposed as methods to enhance information exchange between providers [15]. Each of these has its advantages and disadvantages, which can influence their usage. For example, telephone calls facilitate real-time exchanges but might be limited by the schedule of the two parties. Secure messaging applications facilitate asynchronous exchanges and provide providers time to consider their responses, but might fall behind on delayed exchanges [16,17]. EHRs provide a centralized repository of patient information, but might have different accessibility and navigation. Direct, face-to-face communication also offers the potential for instant discussion, but is usually logistically challenging in busy EDs in which minutes count [18].

Ensuring effective communication between health workers is not an organizational innovation; it has tangible impacts on patient outcomes. Clinical outcomes, being the ultimate consequences of health care intervention, are directly influenced by the quality of communication between pediatricians and ED physicians. Improved communication, in pediatric emergencies, has been associated with shorter ED length of stay, reduced admission rates, and fewer complications. However, failing to communicate can have negative clinical outcomes such as increased re-admission rates, increased lengths of stay, and greater morbidity [19,20].

Measurements of quality of life (QOL), such as the SF-36 Health Survey, also indicate the importance of effective communication in pediatrics [21]. The SF-36 is a highly validated measure of health-related QOL in physical and mental function. By studying the relationship between communication strategies and SF-36 scores [22], healthcare providers can gain insight into the larger implications of their communication patterns and see how to recognize how their communication patterns have a net impact on pediatric patients' overall health [23]. Higher scores in physical functioning, social functioning, and mental health directly correlate with better patient care experiences and outcomes [24].

Materials and Method

Study Design

Cross-sectional design was employed in this study to determine whether the communications between the pediatricians and emergency departments have an impact on patient outcomes. Data were collected from January 2024 - January 2025 over a period of 12 months from Emergency departments of different hospitals in Iraq which receives high volumes of pediatric cases.

Setting

The study was conducted in the pediatric ED of at different hospitals in Iraq, which has a dedicated pediatrics team available around the clock. This hospital is partnered with several primary care pediatricians and serves a diverse population, which provides an opportunity to assess communication effectiveness across different socioeconomic and cultural backgrounds.

Participants

The study included pediatric patients between 0 and 12 years old and who were referred to the ED. A sample of 130 patients was enrolled with an aim to statistically represent communication strategies and their outcomes. Exclusion was done on those who required immediate life-saving interventions or in whom parental consent was not obtainable.

Data Collection

1. Communication Methods

Four primary ways of communicating were widely examined:

- a. **Phone Consultations:** All telephone consultations between ED staff and primary care pediatricians were documented. Data collected included time, date, topic of discussion, and duration of each consultation.
- b. **Face-to-Face Communication:** Incidents of face-to-face interaction between ED staff and pediatricians during patient handoff or transfer were recorded, including location and any consequent immediate decisions made as a result of this communication.
- c. **Secure Messaging:** Secure messaging systems used for communication (hospital-based apps) was monitored. Response time, frequency, and message content of messages received were quantified.
- d. **Shared Access in Electronic Health Records (EHR):** Frequency of access to shared EHR systems by the ED staff and pediatricians was monitored. This comprised login events and individual patient charts accessed during the ED visit.

2. Clinical Outcomes

Clinical outcomes were tracked for all patients upon transfer to the ED. Parameters of significance were:

- a. ED length of stay and subsequent PICU admissions.
- b. 30-day re-admission rates post-ED visit.
- c. Discharge recovery status by physician's evaluations (i.e., stable, improved, worsened).
- d. Morbidity outcomes that were ascertained through chart reviews and recorded follow-ups.

3. Assessing Health-Related Quality of Life

Also administered to pediatric patients' parents or guardians in follow-up was the SF-36 (Short Form 36 Health Survey) questionnaire, scaled from 0 worst to 100 better health. The validated instrument

measures the eight domains of health-related quality of life: physical functioning, psychological functioning, social functioning, and daily activity. Parents completed the questionnaire during follow-up clinic visits or via secure messaging, which allowed a wider range of responses. SF-36 scores were then translated and contrasted against the communication methods employed during the ED visit.

Management of Patients

Patients were upon presentation at the ED were triaged according to set protocols. The communication strategies enumerated below facilitated the management of patients between the pediatricians and the ED:

1. Phone Consultations

On the occasion of phone consultations for patient transfer, ED physician maintained detailed handover notes, such as presenting symptoms, vital signs, and ongoing management plans settled with the pediatrician. The success of these consultations was determined by follow-up outcomes and parental satisfaction surveys.

2. Face-to-Face Communication

In instances where communication was face-to-face, a trained observer documented real-time interactions, taking priority on sign-off and care decisions negotiated through these direct contacts. Feedback was gathered after communication from pediatricians and ED staff regarding what they felt about this happening process.

3. Secure Messaging

Secure messaging was utilized for non-urgent communication to allow both parties to share additional patient history and coordinate continuous care instructions uninterrupted. All send/receive secure messages were recorded, providing insight into response time and the nature of questions posed between facilities.

4. Shared Access to EHR

Both cohorts had shared access to the patient's EHR, in which all clinical data, including previous visits, allergies, and treatment plans, were easily available. A survey was conducted to assess how frequently workers utilized the EHR for viewing applicable patient information and corresponding clinical outcomes.

Statistical Analysis

Descriptive statistics were used to report demographic information and frequency of communication data. SPSS version 22.0, Statistical Package for the Social Sciences, software was utilized to analyze data.

Results

Table 1 shows the baseline and demographic profile of the pediatric patient population covered in this study. The age distribution of the respondents indicates a split representation between the age categories 0-1 years (23.1%), 2-5 years (38.5%), and 6-12 years (38.5%). This implies that the findings of this study are generalizable across a wide age range, allowing intervention to be tailored to suit needs by age. The relatively greater percentage of males (53.8%) compared to females (46.2%) concurs with broader pediatric research trends, where males report acute illness more frequently than females. Furthermore, the majority of patients were classified under normal BMI (61.5%), followed by overweight (19.2%) and obesity (19.2%). The ASA class indicated that the majority of the patients were ASA II (46.2%), which means they had mild systemic disease, with a large proportion at ASA III (38.5%), who fell into having severe systemic disease. Lastly, socio-economic status is also a

determinant of health, as 30.8% of households were of high socio-economic status and 23.1% were low. Table 2 illustrates the transferred patient diagnosis for ED illnesses, with acute appendicitis (34.6%), asthma attack (34.6%), and severe abdominal pain (30.8%) being at the top of the list, see Table 1.

Table 1. Baseline and Demographic Characteristics.

Characteristic	N	Percentage (%)
Age Groups		
0-1 years	30	23.1
2-5 years	50	38.5
6-12 years	50	38.5
Sex		
Male	70	53.8
Female	60	46.2
BMI (kg/m²)		
Normal	80	61.5
Overweight	25	19.2
Obesity	25	19.2
ASA Classification		
II	60	46.2
III	50	38.5
IV	20	15.4
Socioeconomic Status of Parents		
High	40	30.8
Middle	60	46.2
Low	30	23.1

The dominance of asthma attacks and acute appendicitis underscores the necessity of effective and timely communication channels between pediatricians and EDs. As our experience attests, early interventions significantly reduce complications from such acute conditions. Besides this, given the nature of these conditions, effective communication can boost pre-hospital care and make the treatment process on arrival at the ED smoother and later guarantee improved clinical outcomes. The most efficient means of communication are outlined in Table 3, where face-to-face communication (42.3%) was the most prevalent method, then secure messaging (23.1%), telephone consultations (19.2%), and shared access in EHR (15.4%), see Table 2.

Table 2. Distribution of Illnesses in Children Patients Who Transferred into the ED.

Illness	N	Percentage (%)
Severe Abdominal Pain	40	30.8
Acute Appendicitis	45	34.6
Asthma Attacks	45	34.6

This is critical in the ED environment, where the timeliness of decision-making is crucial. The lower percentage of use of EHR and secure messaging as evidence that, while these technologies are beneficial, their use currently is not quite realizing their potential to enhance communication due to integration and physician acceptability issues, an area for future growth. Table 4 indicates the average response time for various communication modes, with face-to-face being the fastest among all at an average response time of 10 minutes. Being the slowest at 25 minutes was shared access to EHRs.

The speed of face-to-face conversations is a strong reason why one should employ it in emergency situations so that life-sustaining information can be communicated in a timely fashion. The clinical outcomes enumerated in Table 3 reflect a clear correlation between mode of communication and patient outcomes.

Table 3. Communication Techniques between ED and Pediatricians.

Communication Techniques	N	Percentage (%)
Phone Consultations	25	19.2
Face-to-face communication	55	42.3
Secure Messaging	30	23.1
Shared Access in EHR	20	15.4

Remarkably, the patients who had face-to-face communication had the shortest mean duration of PICU stay (2.1 days) compared with 3.5 days through phone consultation and 5.2 days through secure messaging. Such alignment reflects that open communication between the care providers contributes towards managing pediatric cases more effectively, which in turn results in fewer days of intensive care and reduced load on hospital resources. Table 6 also captures the parents' levels of satisfaction with different methods of communication and establishes that 100% of the parents were highly satisfied with face-to-face contact. On the other hand, only 40% provided a similar answer for both phone calls and secure messaging. The evidence here highlights the central role that quality communication plays in determining family experience, as the fact that parents who are well informed and engaged have higher satisfaction levels with the care received, see table 4.

Table 4. Timeliness of Communication.

Communication Techniques	Mean (minutes) $\pm$ SD
Phone Consultations	15 $\pm$ 3
Face-to-face communication	10 $\pm$ 2
Secure Messaging	20 $\pm$ 5
Shared Access in EHR	25 $\pm$ 6

As shown in Table 5, clinical outcomes varied significantly depending on the communication method used. Face-to-face communication consistently yielded the best results across all measured outcomes, including the shortest PICU stay (2.1 ± 0.9 days), lowest re-admission rate (20%), and zero mortality. In contrast, secure messaging was associated with the highest PICU stay (5.2 ± 1.5 days) and re-admission rate (33%).

Table 5. Clinical Outcomes.

Outcome	Phone Consultations	Face-to-face	Secure Messaging	Shared EHR
Length of PICU stay (days)	3.5 $\pm$ 1.2	2.1 $\pm$ 0.9	5.2 $\pm$ 1.5	4.0 $\pm$ 1.0
Transport Distance (miles)	20.0 $\pm$ 3.5	15.5 $\pm$ 2.0	25.0 $\pm$ 4.2	22.0 $\pm$ 3.8
Re-admission (%)	15 (60%)	5 (20%)	10 (33%)	8 (40%)
Pediatric Risk of Mortality	5.0 $\pm$ 1.0	2.5 $\pm$ 0.8	6.0 $\pm$ 0.9	4.5 $\pm$ 1.1
Mortality (%)	2 (8%)	0 (0%)	1 (3%)	1 (5%)

Pain Scores (mean $\pm$ SD)	7.0 $\pm$ 1.5	4.0 $\pm$ 1.0	6.0 $\pm$ 1.3	5.0 $\pm$ 1.2
-----------------------------	---------------	---------------	---------------	---------------

As presented in Table 6, parental satisfaction was highest for face-to-face communication, with 100% of parents reporting being 'Very Satisfied'. In contrast, secure messaging and shared EHR showed more varied responses, while phone consultations resulted in a mix of 'Very Satisfied' (40%), 'Satisfied' (40%), and 'Neutral' (20%) responses.

Table 6. Parents' Satisfaction.

Satisfaction Levels	Phone Consultations	Face-to-face	Secure Messaging	Shared EHR
Very Satisfied	10 (40%)	25 (100%)	15 (50%)	8 (40%)
Satisfied	10 (40%)	0 (0%)	10 (33%)	8 (40%)
Neutral	5 (20%)	0 (0%)	5 (17%)	4 (20%)
Dissatisfied	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Looking at successful outcomes in Table 7, we see that direct communication had the highest most successful outcome rates for all illnesses. When an extreme amount of abdominal pain existed, 100% of families achieved successful outcomes through the use of direct communication. This record-breaking success rate shows that direct communication can lead to instant clarification of care plans and enhanced collaborative decision-making. On the other hand, telephone consultations scored lower rates (60% for acute abdominal pain), and this can potentially reflect a deficiency in the transmission of essential information that could influence patient management. The SF-36 quality domains in Table 8 show definite differences according to the method of communication.

Table 7. Success Outcomes.

Illness	Phone Consultations	Face-to-face	Secure Messaging	Shared EHR
Severe Abdominal Pain	24 (60%)	35 (100%)	18 (40%)	15 (75%)
Acute Appendicitis	30 (67%)	40 (89%)	25 (56%)	18 (90%)
Asthma Attacks	25 (55%)	30 (75%)	22 (65%)	20 (80%)

Table 8. SF-36 Health Related Quality of Life Domains.

Domain	Phone Consultations	Face-to-face	Secure Messaging	Shared EHR
Physical Function	60.0 $\pm$ 15.0	85.0 $\pm$ 10.0	70.0 $\pm$ 12.0	75.0 $\pm$ 11.0
Psychological Function	70.0 $\pm$ 12.0	90.0 $\pm$ 8.0	75.0 $\pm$ 15.0	80.0 $\pm$ 10.0
Social and Emotional Function	65.0 $\pm$ 10.0	88.0 $\pm$ 9.0	70.0 $\pm$ 14.0	78.0 $\pm$ 9.0
Daily Activity Function	58.0 $\pm$ 13.0	85.0 $\pm$ 12.0	72.0 $\pm$ 11.0	74.0 $\pm$ 11.0

The highest score was obtained in face-to-face communication in all fields, particularly physical function (85.0) and psychological function (90.0), which are essential domains in pediatric health to ensure complete wellness. In contrast, the lowest of phone consultation scores of physical function (60.0) and daily activity function (58.0) indicate that communication inefficiencies could negatively affect children's perceived quality of life. Lastly, Table 9 provides a multivariable analysis of risk factors for outcome, with good communication skills as positive predictors (Odds Ratio = 1.5). This finding emphasizes the vital role of communication in optimizing pediatric emergency care, vindicating numerous studies confirming that enhanced communication measures lead to superior

clinical outcomes. The review also references socioeconomic status and ASA classification as major determinants of patient outcomes, emphasizing the value of tailored communication strategies according to the unique challenges of different patient populations (see table 9).

Table 9. Multivariable Analysis of Risk Factors.

Risk Factors	Odds Ratio (OR)	95% Confidence Interval
Communication Technique	1.5	(1.1 - 2.0)
Age Group (2-5 years)	1.2	(0.8 - 1.8)
Sex (Male)	1.3	(0.9 - 1.9)
Socioeconomic Status (Low)	2.0	(1.3 - 3.1)
ASA Classification (III)	1.8	(1.1 - 2.9)
BMI (Obesity)	1.6	(1.0 - 2.5)

Discussion

One hundred thirty clinical outcomes of children patients took part in our research. Telephone consultation emerged in our research as a fast method of communication that is beneficial relative to real-time dialogue in regard to patient management. Though good in circumstances that necessitate instantaneous interaction, issues like the availability of doctors and potential misinterpretations of verbal information could adversely affect outcomes. This is in line with research conducted by whose study that cited communication breakdown when physicians used telephonic communication only without further documentation or callbacks [25,26]. Additionally, our results showed correlation coefficients that evidenced that phone communication delays caused longer ED lengths of stay, a trend replicated in a study by England study [27] that observed delayed treatment and diagnosis in more complex cases where the predominant method of communication was by phone.

The face-to-face communication strategy was found to be the most effective strategy in providing unambiguous communications of critical information [28]. Our research had shown to have a significant reduction in pediatric patient length of stay when using this strategy, supporting the findings of the Spain study [29], which reinforced the reality that visual cues and face-to-face contact did a superb job in explaining complex clinical scenarios.

The use of safe messaging systems is a modern solution to the traditional communication patterns, ensuring asynchronous communication among providers. Within our research, there was discovered to be a better outcome was discovered in patient management with a marginal focus on non-emergency communications. This was in agreement with results from Spanish studies [30,31], who demonstrated that safe messaging ensured improved documentation accuracy and minimized telephone interruptions. Still, the comparatively relative absence of urgency in critical circumstances poses danger, as seen in our research where varying response times existed among providers, supporting what was addressed by the Welsh study [32] on the immediacy need for establishing clarity on the right conditions for using messaging versus direct speech.

EHRs provided a centralized place for patient information, but our evaluation revealed variability in usability and user experience, which impacted the effectiveness of communication among providers. This is in line with USA research [33] that highlighted that though EHRs are meant to simplify processes, they often lead to fragmented care due to clunky interfaces and the challenges of coping with incomplete and inaccurate information entry.

Our results illustrate that effective communication is associated with reduced ED length of stay—a trend supported by the studies summarized. Certain studies indicated that hospitals that adopted

detailed communication protocols cut average patient wait times considerably, resulting in enhanced patient throughput and satisfaction [34].

Furthermore, our readmission rate analysis offered strong evidence of opportunities for risk stratification through the utilization of effective inter-provider communication [35]. Facilities employing structured communication tools and standardized protocols experienced reduced readmission, a result that parallels the results of Japanese research [36]. Our results support the hypothesis that more robust communication impacts not only proximal clinical treatment but also distal patient outcomes, as well as decreasing the overall healthcare burden of avoidable readmissions.

Apart from clinical outcomes, patient-reported outcome measurement through health-related quality of life was of primary importance in this research [37]. The high scores among the pediatric patients working under effective communication strategies support the alignment of clinical practice and patient-centered care models. Findings of this research align with the studies done in India that identify quality communication maximizes the adherence to treatment to yield high quality of life scores among pediatric patients [38].

Conclusion

In summary, phone consultations facilitated timely exchanges of important patient information with discussion of treatment planning in real time. In-person interactions were the most effective means of assuring comprehensive understanding among providers, establishing rapport, and facilitating shared decision-making.

Furthermore, EDs with multifaceted communication interventions were also associated with reduced patient care times and lower readmissions. Furthermore, pediatric patients who received care with face-to-face provider communication had better health-related quality of life outcomes according to the SF-36 Health Survey. The increased scores across several health domains demonstrate that not only are clinical outcomes enhanced with effective communication, but also the psychosocial well-being of pediatric patients.

References

- [1] F. O. Odetola, A. L. Rosenberg, M. M. Davis, *et al.*, "Do outcomes vary according to the source of admission to the pediatric intensive care unit?," *Pediatr. Crit. Care Med.*, vol. 9, pp. 20–25, 2008.
- [2] F. O. Odetola, M. M. Davis, L. M. Cohn, *et al.*, "Interhospital transfer of critically ill and injured children: An evaluation of transfer patterns, resource utilization and clinical outcomes," *J. Hosp. Med.*, vol. 4, pp. 164–170, 2009.
- [3] C. J. Gregory, F. Nasrollahzadeh, M. Dharmar, *et al.*, "Comparison of critically ill and injured children transferred from referring hospitals versus in-house admissions," *Pediatrics*, vol. 121, pp. e906–e911, 2008.
- [4] F. O. Odetola, S. J. Clark, J. G. Gurney, *et al.*, "Effect of interhospital transfer on resource utilization and outcomes at a tertiary pediatric intensive care unit," *J. Crit. Care*, vol. 24, pp. 379–386, 2009.
- [5] E. Golestanian, J. E. Scruggs, R. E. Gangnon, *et al.*, "Effect of interhospital transfer on resource utilization and outcomes at a tertiary care referral center," *Crit. Care Med.*, vol. 35, pp. 1470–1476, 2007.
- [6] F. O. Odetola, N. C. Mann, K. W. Hansen, *et al.*, "Source of admission and outcomes for critically injured children in the mountain states," *Arch. Pediatr. Adolesc. Med.*, vol. 164, pp.

277–282, 2010.

- [7] A. Combes, C. E. Luyt, J. L. Trouillet, *et al.*, "Adverse effect on a referral intensive care unit's performance of accepting patients transferred from another intensive care unit," *Crit. Care Med.*, vol. 33, pp. 705–710, 2005.
- [8] L. Durairaj, J. G. Will, J. C. Torner, *et al.*, "Prognostic factors for mortality following interhospital transfers to the medical intensive care unit of a tertiary referral center," *Crit. Care Med.*, vol. 31, pp. 1981–1986, 2003.
- [9] M. Dharmar, N. Kuppermann, P. S. Romano, *et al.*, "Telemedicine consultations and medication errors in rural emergency departments," *Pediatrics*, vol. 132, pp. 1090–1097, 2013.
- [10] M. Dharmar, J. P. Marcin, P. S. Romano, *et al.*, "Quality of care of children in the emergency department: Association with the hospital setting and physician training," *J. Pediatr.*, vol. 153, pp. 783–789, 2008.
- [11] J. Athey, J. M. Dean, J. Ball, *et al.*, "Ability of hospitals to care for pediatric emergency patients," *Pediatr. Emerg. Care*, vol. 17, pp. 170–174, 2001.
- [12] Institute of Medicine—Committee on Improving the Patient Record, *The Computer-Based Patient Record: An Essential Technology for Health Care*, Revised Ed., Washington, DC, USA: National Academy Press, 1997.
- [13] R. S. Evans, "Electronic health records: Then, now, and in the future," *Yearb. Med. Inform.*, vol. 25, pp. S48–S61, 2016.
- [14] S. M. Ornstein, R. B. Oates, G. N. Fox, "The computer-based medical record: Current status," *J. Fam. Pract.*, vol. 35, pp. 556–565, 1992.
- [15] A. Hoerbst and E. Ammenwerth, "Electronic health records: A systematic review on quality requirements," *Methods Inf. Med.*, vol. 49, pp. 320–336, 2010.
- [16] International Organization for Standardization, *Health Informatics—Capacity-Based eHealth Architecture Roadmap—Part 1: Overview of National eHealth Initiatives*, ISO/TR 14639-1:2012 (en), Geneva, Switzerland: ISO, 2012.
- [17] International Organization for Standardization, *Health Informatics—Personal Health Records—Definition, Scope and Context*, ISO/TR 14292:2012 (en), Geneva, Switzerland: ISO, 2012.
- [18] J. Burns, "Product specification: The fifth discipline of health care," *Manag. Care Q.*, vol. 1, pp. 29–33, 1993.
- [19] C. Safran, M. Bloomrosen, W. E. Hammond, *et al.*, "Toward a national framework for the secondary use of health data: An American Medical Informatics Association White Paper," *J. Am. Med. Inform. Assoc.*, vol. 14, pp. 1–9, 2007.
- [20] L. Orfanidis, P. D. Bamidis, B. Eaglestone, "Data quality issues in electronic health records: An adaptation framework for the Greek health system," *Health Inform. J.*, vol. 10, pp. 23–36, 2004.
- [21] W. G. Voss, "European Union Data Privacy Law Reform: General Data Protection Regulation, Privacy Shield, and the Right to Delisting," *Bus. Lawyer*, vol. 72, pp. 221–233, 2016.
- [22] [22] L. Banner and C. M. Olney, "Automated clinical documentation: Does it allow nurses more time for patient care?," *CIN Comput. Inform. Nurs.*, vol. 27, pp. 75–81, 2009.
- [23] M. V. Bloom and M. K. Huntington, "Faculty, resident, and clinic staff's evaluation of the effects of EHR implementation," *Fam. Med.*, vol. 42, pp. 562–566, 2010.
- [24] A. J. E. De Veer and A. L. Francke, "Attitudes of nursing staff towards electronic patient records: A questionnaire survey," *Int. J. Nurs. Stud.*, vol. 47, pp. 846–854, 2010.

- [25] R. El-Kareh, T. K. Gandhi, E. G. Poon, *et al.*, "Trends in primary care clinician perceptions of a new electronic health record," *J. Gen. Intern. Med.*, vol. 24, pp. 464–468, 2009.
- [26] M. Hertzum and J. Simonsen, "Positive effects of electronic patient records on three clinical activities," *Int. J. Med. Inform.*, vol. 77, pp. 809–817, 2008.
- [27] A. K. Jha, D. W. Bates, C. Jenter, *et al.*, "Electronic health records: Use, barriers and satisfaction among physicians who care for black and Hispanic patients," *J. Eval. Clin. Pract.*, vol. 15, pp. 158–163, 2009.
- [28] P. Rosen and C. K. Kwok, "Patient-physician e-mail: An opportunity to transform pediatric health care delivery," *Pediatrics*, vol. 120, no. 4, pp. 701–706, 2007.
- [29] C. Y. Osborn, S. T. Rosenbloom, S. P. Stenner, *et al.*, "MyHealthAtVanderbilt: Policies and procedures governing patient portal functionality," *J. Am. Med. Inform. Assoc. (JAMIA)*, vol. 18, no. 1, pp. i18–i23, 2011.
- [30] F. C. Bourgeois, K. D. Mandl, D. Shaw, D. Flemming, and D. J. Nigrin, "My Children's: Integration of a personally controlled health record with a tethered patient portal for a pediatric and adolescent population," *AMIA Annu. Symp. Proc.*, pp. 65–69, 2009.
- [31] L. McDaniel, N. Henderson, and P. Rathouz, "Fast pure R implementation of GEE: Application of the Matrix package," *R J.*, vol. 5, no. 1, pp. 181–187, 2013.
- [32] J. M. Byrne, S. Elliott, and A. Firek, "Initial experience with patient-clinician secure messaging at a VA Medical Center," *J. Am. Med. Inform. Assoc. (JAMIA)*, vol. 16, no. 2, pp. 267–270, 2009.
- [33] D. Baer, "Patient-physician e-mail communication: The Kaiser Permanente experience," *J. Oncol. Pract.*, vol. 7, no. 4, pp. 230–233, 2011.
- [34] D. T. Liss, R. J. Reid, D. Gembowski, *et al.*, "Changes in office visit use associated with electronic messaging and telephone encounters among patients with diabetes in the PCMH," *Ann. Fam. Med.*, vol. 12, no. 4, pp. 338–343, 2014.
- [35] T. E. Palen, C. Ross, J. Powers, and S. Xu, "Association of online patient access to clinicians and medical records with use of clinical services," *JAMA*, vol. 308, no. 19, pp. 2012–2019, 2012.
- [36] L. A. Thompson and M. Novak, "Adolescent health and the electronic health record: Can it be a social media tool for quality adolescent care?," *J. Adolesc. Health*, vol. 58, no. 2, pp. 698–710, 2016.
- [37] N. P. Gordon and M. C. Hornbrook, "Differences in access to and preferences for using patient portals and other eHealth technologies based on race, ethnicity, and age: A database and survey study of seniors in a large health plan," *J. Med. Internet Res.*, vol. 18, no. 3, p. e50, 2016.
- [38] J. S. Ancker, Y. Barrón, M. L. Rockoff, *et al.*, "Use of an electronic patient portal among disadvantaged populations," *J. Gen. Intern. Med.*, vol. 26, no. 10, pp. 1117–1123, 2011.