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Review Article

SMS Medicine: Revolutionizing Healthcare Delivery through Mobile Technology

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Abstract: In the contemporary era, digital technologies have significantly transformed the medical sector, enhancing accessibility and efficiency through advanced connectivity. Telemedicine, a pivotal advancement in medical science, facilitates remote diagnosis and treatment via telephones and other digital devices. Among various telemedicine modalities, Short Message Service (SMS) medicine emerges as a particularly effective method for delivering healthcare services over long distances using mobile technologies. This paper explores the transformative potential of SMS medicine in healthcare delivery, particularly in low-resource settings and during emergencies such as the COVID-19 pandemic, where it served as a critical tool in maintaining patient care while minimizing physical contact. Through a comprehensive literature review and analysis of case studies, the study highlights the benefits of SMS medicine, including cost-effectiveness, scalability, improved medication adherence, chronic disease management, and enhanced patient-provider communication. Additionally, the integration of SMS with web and mobile applications, such as MDLIVE and Updox, demonstrates increased flexibility and accessibility for patients, especially in rural areas. However, the implementation of SMS medicine is not without challenges, including data privacy concerns, technological limitations, disparities in mobile phone access, and the need for effective integration with existing healthcare systems. The paper also discusses future directions, emphasizing the potential integration of artificial intelligence (AI) and the Internet of Things (IoT) to further enhance personalized medicine and real-time health monitoring. By addressing these challenges and leveraging SMS's strengths, SMS medicine can bridge critical gaps in healthcare access and delivery, offering sustainable and inclusive solutions for diverse populations. This research underscores the significance of SMS medicine in revolutionizing healthcare systems, particularly in resource-limited environments.

Keywords: SMS Medicine, Telemedicine, Digital Health, Healthcare Accessibility, Mobile Health, Chronic Disease Management, Data Privacy, AI in Healthcare, IoT, Rural Healthcare

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1. Introduction

In the present era, digital technologies have made everything easily graspable within a very short period, especially in the medical sector. The virtue of advanced medical connectivity is one of the most approvable if it helps the user with their demands. Telemedicine is one of the medical science advancements that refers to a medical treatment or diagnosis system that can be done over telephones or using other devices from distant places. Short Message System(SMS) medicine is one effective way of delivering telemedicine services since providing medical services involves delivering care from a long distance using various mobile technologies. Regarding rapid advancement in a lifetime, interactions, audio-visual, and huge internet capacity, telemedicine has made our medical services faster in many areas of health care, whereas the annual global growth rate is 13% to 27% (6). Considering the outbreak of the COVID-19 pandemic, telemedicine was the only savior for many patients since it helped prevent physical contact. In the process of telemedicine, many web applications and mobile

applications are utilized. Web applications such as Updox, Mend, Klara, and On-call Health are more usable, whereas there are also some mobile applications such as MDLIVE, Lemonaid, Live Health, Doctor on Demand, Talk space, PlushCare, etc, which are more flexible. All these apps or other formats are used to connect directly to desired health care, and some even get visual directions or prescriptions from doctors. Traditionally, any moment corresponding with consulting doctors over the phone is telemedicine, but the technology does much more than typical doctor consultations. Telemedicine allows users to exchange real-time text messages with healthcare professionals about symptoms or treatments. Moreover, users can even enjoy the privilege of video chats if needs be. Rural people with emergency medication needs can easily meet their desired doctors or healthcare professionals quickly through telemedicine applications. Patients can enjoy all these services when there is no specific time or place to bother them. Thus, telemedicine helps every miserable forbearing with a sustainable process and useful process.

According to a World Health Organization (WHO) report, mobile technologies, including SMS, have become indispensable in improving healthcare access and outcomes, particularly in low-resource settings where traditional healthcare infrastructure may be lacking (1). With its ability to deliver timely information and reminders directly to patients' mobile phones, SMS has emerged as a cost-effective and scalable solution for enhancing medication adherence, chronic disease management, and preventive care initiatives (2). The concept of SMS Medicine encapsulates a diverse array of applications, ranging from health education campaigns and remote patient monitoring to emergency response systems. By leveraging SMS, healthcare providers can effectively bridge communication gaps, empower patients with essential health information, and streamline healthcare delivery processes (3). Despite its simplicity, SMS Medicine presents unique challenges, including ensuring data privacy, overcoming technological barriers, and addressing disparities in mobile phone access and literacy levels among diverse populations (4). These considerations underscore the importance of developing contextually appropriate strategies that leverage SMS's strengths while mitigating its limitations. Looking ahead, the future of SMS Medicine holds promise for further innovation and integration with advanced technologies such as artificial intelligence (AI) and the Internet of Things (IoT). These advancements are poised to enhance the capabilities of SMS in personalized medicine, real-time health monitoring, and population-level health interventions (5).

The purpose of this research is to explore the transformative potential of SMS medicine in healthcare delivery. By examining existing literature, case studies, and current practices, this paper aims to provide a comprehensive overview of how SMS technology is revolutionizing healthcare. It seeks to identify the benefits and challenges associated with its use and offer recommendations for future advancements. This investigation is crucial for understanding the broader implications of integrating SMS medicine into healthcare systems, particularly in resource-limited settings where traditional healthcare infrastructure may be lacking.

The significance of SMS medicine lies in its ability to bridge gaps in healthcare access and delivery. In many low- and middle-income countries (LMICs), where healthcare resources are scarce and geographical barriers hinder access to care, SMS medicine presents a viable solution to extend healthcare services to underserved populations. The ubiquitous nature of mobile phones, even in remote areas, makes SMS an accessible and practical tool for delivering healthcare information and services.

2. Literature Review

Mobile technology has revolutionized healthcare delivery through the advent of apps-based or other format SMS (Short Message Service) medicine, offering innovative solutions to improve patient care, enhance disease management, and facilitate communication between healthcare providers and patients. Mobile health (mHealth) applications, including SMS interventions, leverage the ubiquity of mobile phones to deliver timely health information and support across diverse healthcare domains (15). SMS-based medical applications have demonstrated efficacy in addressing medication adherence challenges prevalent in chronic diseases like HIV/AIDS, tuberculosis, diabetes, and hypertension, thereby improving treatment outcomes (12). Beyond medication reminders, SMS plays a crucial role in maternal and child health by providing antenatal care reminders and vaccination alerts, ensuring timely healthcare

interventions (14). Behavioral health interventions utilize SMS to deliver motivational messages, behavioral prompts, and support for conditions such as depression and smoking cessation, contributing to improved mental health outcomes (12).

The technological infrastructure supporting SMS-based medicine includes mobile network operators, short message service centers (SMSCs), and backend systems that enable reliable message delivery and data management (16). However, implementing SMS-based medical applications faces challenges such as scalability, data security, and maintaining user engagement. Scalability requires robust infrastructure and partnerships across multiple sectors to reach diverse populations effectively (13). Data security concerns necessitate compliance with healthcare regulations and the implementation of encryption methods to protect patient information. Furthermore, sustaining user engagement involves personalized messaging and feedback mechanisms to ensure continued patient adherence and participation (13).

Looking forward, the future of apps-based other formats of SMS medicine holds promise, with advancements in artificial intelligence (AI) and the Internet of Things (IoT) expected to enhance personalized healthcare delivery. AI can analyze patient data to tailor SMS messages, predict patient behavior, and optimize healthcare interventions (12). Integration with IoT devices offers real-time health monitoring and feedback, further enhancing the precision and effectiveness of SMS-based medicine applications (12). In conclusion, SMS-based medical applications represent a transformative approach to healthcare communication, leveraging mobile technology to overcome traditional barriers and improve patient outcomes globally.

3. Needs for SMS Medicine

SMS medicine is a potential tool to reduce patients' transport and time expenditure and enables efficient medical services. Traditionally, medical care has been shown to be effective, particularly in the management system, while it also adapts or utilizes hospital settings. For primary treatment, there are many obstacles to deal with in case of emergency, such as traveling to the hospital, getting an appointment, talking to a specialist according to patients' needs, etc. These all create a barrier to medical services. SMS medicine systems can play a vital role in initial treatment. Moreover, it is possible to speak directly to the specialists, and the patient can visually and lively communicate with the doctors if the patient insists. There is no need to go to a hospital, make an appointment, and face all these obstacles. So, in the case of primary treatment, SMS telemedicine will provide a potential and effective solution to primary treatments. In the emergency department, many digitized medical technologies have been implanted in many rural hospitals to provide specific SMS health care and specialists to patients in critical, time-sensitive situations. In an emergency, the patient will study a large number of medicare centers around him and study the specialist he needs. Afterward, the SMS medicine will match the hospitals' needs. After that, the primary door-to-door service is provided, and if needed, the transfer or other hospital instruments will be done (4).

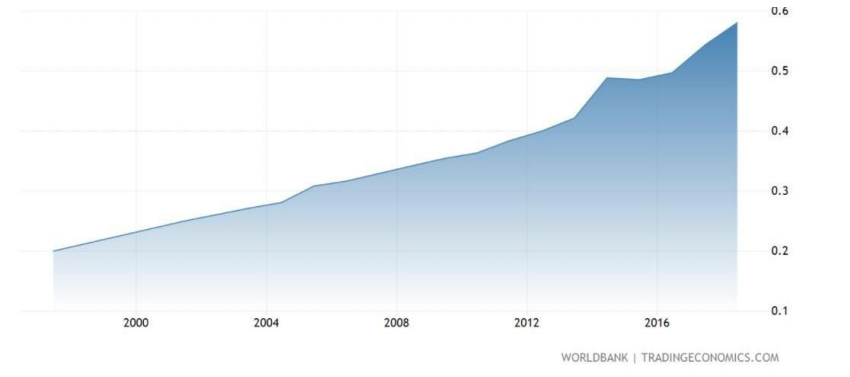

Figure 1. Number of patients compared to a doctor in Bangladesh

In the present time, every doctor or specialist has to deal with 6 patients, which came out of the recent analysis done in 2018 in BANGLADESH. It is very difficult to handle 6 patients for a single doctor, and these numbers are increasing. Thus, to reduce the pressure, SMS medicine would surely play a vital role since the process is quite compatible with both

doctors and users. The initial treatment can be helped through the SMS. So, all-encompassing SMS-based medicine will be helpful in an emergency case to deal with numerous patients in finding immediate Medicare and other services since doctors are comparatively 16% of the patients. On the contrary, the traditional method is banal and less helpful than SMS-based medicine.

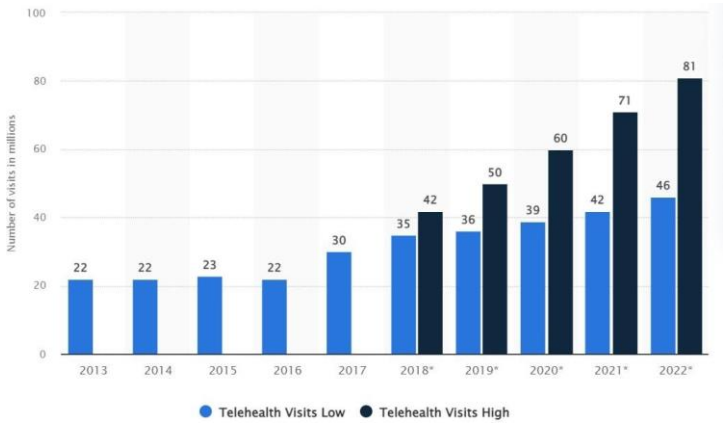

Figure 2. Number of Users of SMS Medicine in the US

The graph depicts the number of people using SMS medicine in the US from 2013 to 2021 and also the estimates for 2022. Just a little over a decade ago, people did not use SMS medicine extensively because they did not know its simplicity or efficiency. However, after realizing its benefits, patients started using SMS medicine, taking advantage of time, cost, etc. At present, people consult with staying home with the specialist they want. Since all the numbers are increasing rapidly, the need for SMS medical will also increase. One of the quickest and simplest ways of communicating is through SMS-based medicine. Everyone can access or contact the required specialist within a very short period and does not even need to go to their centers. So, these apps or websites have made everything within the boundaries of the patients. All these are just because of patients' needs and to reduce time consumption. Urgent care is now made in SMS medicine with better options, which makes it possible to offer patients easy access to their comfort zone. Moreover, it also enables everyone to connect with their desired doctors easily and with very short formalities, making the process easier. Around the world, telecommunication has made everything easier in the medical department, enabling every needy person to enjoy their desired services. Since SMS medicine is easy to use, the service is mostly hassle-free. The patients do not need to go through long critical processes and complex procedures. So it is easy to use. On the other hand, patients do not need to go to hospitals and other Medicare centers and do the usual trite systems; they are quite free from this suffering.

4. How SMS Medicine Works

The SMS medicine process consists of the steps that are needed to receive the service from any web or mobile application. In most applications, the two most used methods are direct prescriptions by doctors in the chamber or control room by direct SMS and automatic prescriptions generated by an AI-based central system derived from the symptoms-based message.

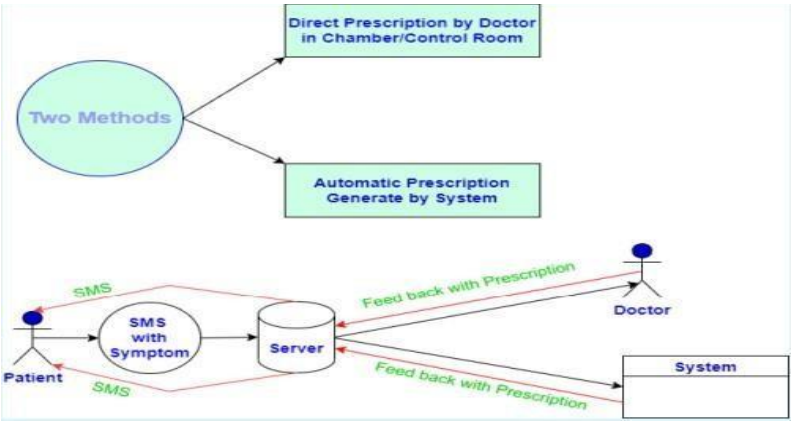

Figure 3. Process of SMS Medicine

In the first method, the patients must provide SMS with all the symptoms; the central server receives the SMS. Then, the server provides appropriate prescriptions from the specialist. Nevertheless, if required, the doctor can connect with the patient via audio or video, discuss the patient's issues, and prescribe medicines accordingly. So, in this one, the patient connects with the specialists directly. Using the other method, the patients have to provide an SMS with the symptoms. That message is received by a server that connects to the system which is developed to provide prescriptions according to the symptoms. Thus, the system applies the symptoms to analyze the designed medications and finally provides some medication that patients receive. Hence, in this second process, the patient gets prescriptions from the central system, not from the doctors.

5. The power of SMS in Healthcare

SMS (Short Message Service) has revolutionized how healthcare providers communicate with patients, leading to improved patient engagement, better health outcomes, and streamlined care delivery.

5.1 Enhancing Patient-Provider Communication

SMS enables healthcare providers to stay connected with patients directly through text messaging. This enhanced communication facilitates:

- Timely appointment reminders and medication adherence prompts
- Improved patient education and health literacy
- Shared decision-making and informed patients

5.2 Improving Patient Outcomes

By leveraging SMS, healthcare providers can:

- Increase patient engagement and satisfaction
- Optimize time management and efficiency
- Reduce costs for healthcare organizations

5.3 Boosting Appointment Attendance

SMS reminders have been shown to increase scheduled appointment attendance significantly. This highlights the effectiveness of SMS in reducing no-shows and improving patient access to care.

5.4 Enabling Targeted Messaging

SMS allows for personalized and segmented messaging to various patient populations based on their specific healthcare needs. This targeted approach enhances the relevance and effectiveness of patient communication.

5.5 Integrating with Existing Systems

SMS can be seamlessly integrated with existing healthcare systems, such as electronic health records (EHRs) and telehealth platforms. This integration streamlines communication workflows and ensures consistent patient data across multiple touchpoints.

5.6 Overcoming Barriers

SMS has the potential to overcome language and literacy barriers by providing accessible and easy-to-understand health information. This is particularly beneficial for diverse patient populations. In conclusion, SMS has emerged as a powerful tool in healthcare, revolutionizing patient engagement and communication. By leveraging SMS, healthcare providers can enhance patient outcomes, optimize operational efficiency, and deliver high-quality care that meets the evolving needs of patients.

6. Advantages of SMS Telemedicine

SMS medicine is one of the best tools for receiving medical services in case of emergency because, traditionally, patients have to go to the hospital first if they need any medications or consultations. However, in SMS-based systems of medication, the patient does not even need to go anywhere. The person can get connected with any specialist he wants to meet and consult with while sitting in his room. Further, he can visually contact the therapist and talk about symptoms. Thus, SMS medicine is far better than any traditional way to consult with others, where the patient can get instant primary treatment without any delay. Telemedicine does not consider the time and space barrier since everything is done by web or mobile applications over the phone and other devices. Hence, instant primary medical provisions are easily reachable through just a message. App-based SMS medicine has another great advantage: it is a less costly treatment. SMS medicine is far less costly than any other way. Considering the usual treatments we take, one has to go to the hospital to meet with any specialist or doctors to consult. One has to bear various expenses, the most dominant one being the consulting cost that is to pay to meet with any consultant. There are also other expenses, such as applicant expenses, hospital visits, and traveling costs. Thus, usual treatment becomes costlier, whereas, in SMS medicine, one has to pay the charge of being online and getting the basic app and the cost of sending messages, which is not even a cost if judged. So, the medical app is far more cost-effective than any other treatment process. One of the most significant benefits of SMS medicine is that it can be used by anyone from anywhere without any barricade of time, place, or money. Anyone from far from the city area can also access this tell medication service through a message only. He just needs to possess the device and the internet connection, and he can easily get services from the server. Considering the usual process of taking medical healthcare or prescriptions, one has to go to the hospital and talk to the doctors, specialists, or other therapists. However, in the SMS medicine system, one can easily access the doctors or therapists through a message and get what he needs. In that way, people from rural areas can also easily access SMS Medical care services. SMS system telecare is a treatment for all people without any class or status. Anyone who needs basic treatment or any consultation can possess the privilege of the application. In a basic way, not all people could obtain medical consultations for various ways, such as some could not afford the medical expenses, so they did not take the service. Some could not go outside the area, so they were unable to pursue medical care. There are also other reasons why they could not make it to the hospital and take the needed service. However, in SMS medical care, anyone can take advantage of medical health care. Thus, it is for most of the people of our country since the majority of the people can access this service, and anyone can utilize the advantage of application-based medication. The important pros of SMS medicine are that it is a time-saving tool that saves time for patients and doctors. The SMS medication is used over telephones or other devices, so one does not need to go to the hospital or any other center, which saves travel for both patient and doctor. Hence, it saves both of them time. But traditionally, people have to go to the hospital and wait for their turn and other procedures, which eventually wastes time. Furthermore, they often could not get the desired specialist. So, it is not worth it compared to SMS-based medicine. Because the app-based Medicare helps save time for both patients and doctors. Most significantly, SMS-based medication will eventually change the face of our traditional primary health system with a new face.

7. Challenges and Considerations

While SMS medicine offers numerous advantages in enhancing healthcare delivery, it also presents several challenges and considerations that must be addressed to ensure its effectiveness and sustainability. These challenges span technical, socio-economic, privacy, and regulatory domains.

7.1 Privacy and Security Concerns:

SMS messages often contain sensitive health information, necessitating stringent measures to ensure privacy and security. To safeguard patient data, healthcare providers must comply with regulations such as GDPR (General Data Protection Regulation) in Europe or HIPAA (Health Insurance Portability and Accountability Act) in the United States. Encryption of SMS transmissions and secure storage of information on servers is essential to prevent unauthorized access and breaches (4). Implementing policies for data minimization, retention periods, and secure deletion of messages after they are no longer needed helps mitigate risks associated with data privacy.

7.2 Technological Limitations:

Access to reliable mobile network coverage and smartphone penetration varies globally, posing challenges for the widespread adoption of SMS-based interventions. In regions with poor connectivity or limited access to smartphones, the effectiveness of SMS in delivering timely health information or supporting remote monitoring may be compromised (3). This limitation underscores the need for alternative communication strategies or hybrid approaches that combine SMS with other technologies to ensure continuity of care.

7.3 Health Literacy and Language Diversity:

Effective communication through SMS requires messages to be comprehensible to diverse populations, including those with varying health literacy and linguistic proficiency levels. Tailoring messages to be culturally sensitive and using simple language improves understanding and adherence to healthcare instructions (5). Healthcare providers should consider employing multilingual SMS platforms and providing educational resources to support patient comprehension and engagement.

7.4 Integration with Healthcare Systems:

Integrating SMS into existing healthcare systems presents logistical challenges, including interoperability with electronic health records (EHRs), clinical workflows, and administrative processes. Ensuring seamless integration requires collaboration between IT departments, healthcare providers, and SMS service providers to streamline communication channels and data exchange (2). Overcoming resistance to technological change and aligning SMS interventions with organizational goals is critical for achieving sustained adoption and effectiveness.

7.5 User Engagement and Behavior Change:

Effective engagement and behavior change through SMS depend on messages' relevance, timing, and interactivity. Personalizing SMS content to individual patient preferences and health goals enhances motivation and adherence to treatment regimens (3). Implementing feedback mechanisms, interactive features, and behavioral nudges within SMS platforms can promote active participation and long-term behavior modification among patients.

7.6 Regulatory and Ethical Considerations:

Compliance with regulatory guidelines and ethical standards is paramount in SMS Medicine. Healthcare providers must obtain informed consent from patients for SMS communications, ensuring transparency about the purpose, frequency, and potential risks associated with messaging (4). Respecting patient confidentiality, maintaining data security, and adhering to legal frameworks governing telemedicine practices are essential for building trust and upholding ethical principles in healthcare delivery.

7.7 Evaluation of Effectiveness and Impact:

Assessing the effectiveness and impact of SMS interventions requires robust evaluation methodologies and metrics. Healthcare organizations should conduct rigorous studies to measure outcomes such as patient adherence, health outcomes, and healthcare utilization rates (2). Quantitative analysis of SMS delivery metrics, patient surveys, and qualitative insights from healthcare providers and patients contribute to understanding the impact of SMS Medicine on healthcare delivery and patient outcomes.

8. Future Directions

Future directions for SMS Medicine encompass several exciting possibilities that could further enhance its impact on healthcare delivery. Firstly, artificial intelligence (AI) advancements could revolutionize SMS interactions by enabling more sophisticated chatbots capable of providing personalized medical advice and interventions based on patient data and trends. Integrating blockchain technology could address security concerns by ensuring robust encryption and data integrity in SMS healthcare communications. Additionally, deeper integration with telemedicine platforms could extend SMS Medicine's capabilities, allowing seamless transitions from text-based consultations to more comprehensive virtual healthcare services. Behavioral insights derived from SMS data analytics could enable tailored interventions that address patient needs and preferences better. Lastly, expanding SMS Medicine globally requires addressing regional disparities in mobile phone access and healthcare infrastructure while considering cultural sensitivities to ensure effective implementation across diverse populations. These advancements promise to make SMS Medicine an indispensable tool for improving healthcare access, efficiency, and patient outcomes worldwide.

9. Conclusion

Telemedicine is a broad field where patients use various techniques to communicate with doctors, such as video calling, audio calling, etc. SMS medicine is one of the most used healthcare in recent days since everyone around is available with mobile phones. Through SMS medicine, anyone can enjoy the privilege of healthcare from anywhere by just sending a message only and can be connected with a specialist. SMS medicine helps any patient to take initial treatment with less time consuming and without any place barrier. Moreover, it is convenient to use and a very simple process. People far from medical centers can use SMS medicine to prevent any serious situation by taking primary health care from any specialist they need. Hence, SMS medicine is easy to use, less costly, and less time-consuming. However, all-encompassing SMS medicine is really helpful and convenient for everyone, even those far from any medical center.

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