

Applications and impact of computer technologies in management of multi-morbidity

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Abstract

Objective: To highlight clinical scenarios and healthcare practitioners' difficulties where computer applications can help in multimorbidity management.

Methods: The cross-sectional study was conducted from December 2017 to January 2019 in the twin cities of Rawalpindi and Islamabad, Pakistan, and comprised local physicians/practitioners. Data was collected using a self-generated questionnaire which was distributed among the subjects. It identified four problems as most commonly faced: treatment/dose management, time management, forgetting to ask necessary questions about disease, and 'others', such as bad handwriting errors and ethical issues. Data was analysed using SPSS 17.

Results: Of the 53 subjects, 33(62%) marked problems related to treatment management, 35(66%) marked problems related to shortage of time, 34(64%) marked those related to difficulty in asking relevant questions about disease, 15(28%) marked the 'other' option.

Conclusion: Computer technologies are significantly helpful in managing the problems of treating multimorbidity by adopting standard database.

Keywords: Multimorbidity, Computer Technologies, Database Integration, SPSS.

(JPMA 70: 1572; 2020) DOI: <https://doi.org/10.5455/JPMA.37601>

Introduction

Multimorbidity is a term applied to patients who suffer from multiple chronic diseases. Management of multimorbidity is a challenging situation which is frequently encountered by health practitioners. While dealing with the number of patients, there are high chances to make mistakes, including forgetting to ask questions about the disease, dosage of treatment and bad handwriting that causes dispensation of wrong medicines. In the early 1990s, a number of research publications particularly from United States, United Kingdom, Australia and Canada identified that medical errors and omissions were significant public health and healthcare issues and thus lead to adverse events.¹ Researchers, policy-makers and administrators from all over the world agreed that these medical errors leading to adverse events needed to be addressed. They identified that traditional approaches used in averting these errors were not very effective and new innovative ways were needed to address these errors.² Digital technology is rapidly growing and significantly found helpful in different domains. In parallel, computer-based systems have also been found to be helpful in healthcare. This has been highlighted that there is a significant need to implement explicit types of health

information technologies, such as decision support system, computerised physician order entry etc. in order to diminish these medical error rates.³ Health Information Technology (HIT) was found to be an innovative intervention that could significantly reduce medical error rates.⁴ HIT has been applied in different areas of healthcare that included clinical decision support systems,⁴ pharmacy information systems or electronic medication administration systems,⁵ and computerised clinical documentation systems to reduce medical error rates such as spelling mistakes of different medicines.⁶

Multimorbid patients suffers from more than one chronic disease and are mostly aged 75 years or above.^{7,8} Due to the need and nature of multimorbidity, there are numerous information technology (IT) applications and tools that have been developed to address this issue. A study⁹ explained that e-Health technology is an application that supports patients regarding their healthcare issues such as electronic health record, web-based disease information and management, tele-health devices and mobile base health applications. A report issued by the United States Department of Health and Human Services¹⁰ recommended advancements in e-Health technology to improve the care of multimorbid patients.

According to a study,¹¹ anamnesis contains some errors. The reasons for these errors are different, including medications errors, diagnostic errors, therapeutic actions, preventive actions and some administrative actions.

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Medical errors represent the major issue in various personnel, including health experts, policy-makers and health providers. Another sensor technology in this domain¹² is called 'remote patient monitoring' that uses different kinds of sensors to monitor patient's vital signs at his/her home. These sensors send information using wireless technology to the local predefined stations which are located near the patient's home, and then these stations work on received information, evaluate information and send alarm to a central monitoring station if the normal limits of received information deviate. In response, healthcare providers take the required steps against the alarm to help the patient.

Today's healthcare is a complex task and thus comprises numerous people. Bowman S.¹³ described that Electronic Health Record (EHR) offered many benefits, including patients' care and decreased cost, but poor architecture and exploitation of EHR can cause serious health problems, leading to poor healthcare quality. It has been made possible to locate the patient record more effectively with the use of digital medical records. A study¹⁴ disclosed that different laboratory results downloaded and stored in a patient's record that are easy to access later and this helps in taking decisions.

One study¹⁵ addressed different applications that deal with patient's electronic record facing ethical issues EHR is an application to manage the patient record (medical histories, treatment, investigations, physical examinations) in digital format. Different physicians and hospitals use the EHR because it reduces the cost of paper, patient management is saved electronically and records can be easily accessible when required. However, ethical issue arises when data is shared with others without consent from the patients. According to Afaq et al.,¹⁶ the successful implementation of EHR depends on medical professionals. They determine the end-user's willingness to adopt EHR in hospitals or clinics, with the willingness framework including technological criteria, basic needs criteria, societal criteria and engagement criteria. According to a study,¹⁷ physicians should be trained on the use of EHR and benefits of EHR systems must be explained to all. The maintenance of EHR for getting accurate results is a necessary part. However, coordination between government and private-sector organisations for advancement in EHR systems may play an important role in successful deployment and use of EHR in hospitals.

The current study was planned to highlight clinical scenarios and healthcare practitioners' difficulties where computer applications can help in multimorbidity management.

Subjects and Methods

The cross-sectional study was conducted December 2017 to January 2019 in the twin cities of Pakistan named as Rawalpindi, Islamabad and comprised local physicians/practitioners working at different Government, Semi-Government and private hospitals/clinics. We particularly focused on the clinics that are located in commercial areas of above mentioned cities such as clinics/hospitals located in Saidpur road, 6th road, commercial market, Saddar, F-10 Markaz, Karachi company etc. The reason to choose these areas was high patients' outcome. Among subjects such as health professionals, 39 (74%) were general practitioners while rest of the 14 (26%) were physicians. The average experience of included subjects at working in clinics or hospitals was 4-5 years at the time of study period; however, few subjects were more experienced such as 10-15 years' service as health professionals. After approval from the ethics review board of Khan Research Laboratories (KRL), the sample size was calculated using World Health Organization (WHO) calculator with 80% power and 95% confidence interval (CI). Purposive sampling, a type of non-probability sampling technique, was used to raise the sample. Those practitioners included who's dealing with multimorbid patients in their routine and had no computer-based electronic data entry system. All other practitioners were excluded.

Data was collected using a pre designed questionnaire generated after consultation with a number of doctors who identified four problems as the most commonly-faced issues which could not be addressed because of lack of evidence-based approach. The questionnaire had four questions regarding treatment management or dose

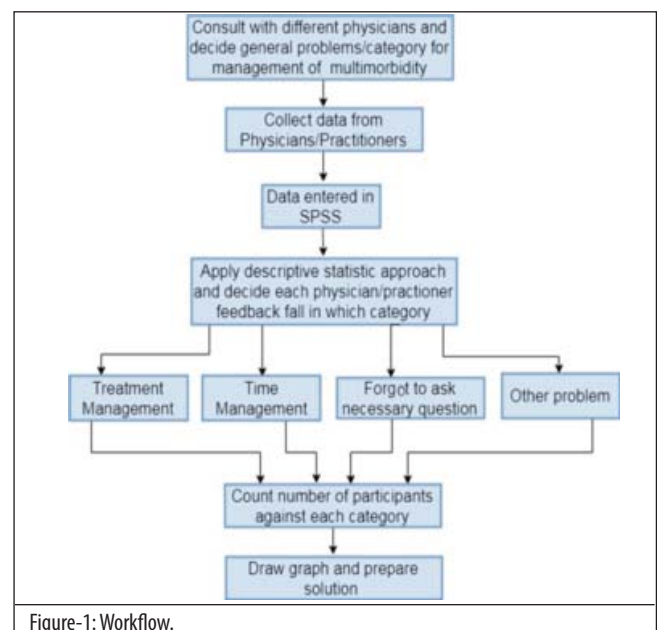


Figure-1: Workflow.

management, shortage of time, difficulty in asking or forgetting to ask necessary questions about the disease, and 'other' traits such as bad handwriting, ethical problem in usage of patients' data for further studies etc. All the practitioners/physicians were encouraged to complete the questionnaire to highlight their problems regarding multimorbidity. Participants had the option to mark more than one problem in the questionnaire (Figure 1). Data was analysed using SPSS17.

Results

Of the 53 subjects, 33(62%) marked problems related to treatment management, 35(66%) marked problems related to shortage of time, 34(64%) marked those related to difficulty in asking relevant questions about disease, 15(28%) marked the 'other' option (Table).

Table: Survey Results.

Questions asked to participants	Participants response with percentage	
	YES	NO
Are you facing problems regarding treatment/dose management of multimorbid patients?	33 (62%)	20 (38%)
Are you facing problems regarding time management while dealing multimorbid patients?	35 (66%)	18 (34%)
Are you facing problems regarding forget to ask necessary questions of suspected disease?	34 (64%)	19 (36%)
Do you have other problems regarding multimorbidity management?	15 (28%)	38 (72%)

Discussion

The current study identified four key areas in the management of multimorbidity.

The first area was treatment management. Practitioners experienced that the treatment and administration of multimorbid patients was challenging as humans had a limit to the number of medicines they can remember. Thus it is difficult to think about various medicines to prescribe to the patients. A study by Desai et al.¹⁸ supports a system which includes standard database for various registered medicines because the brand names of different medicines vary from area to area, and different medicines are available with different brand names in markets.

The second area related to time issue which occurs when the practitioner needs to discuss with patient his problems and inquire all the questions about the disease and then formulate the prescription within a short period of time. A panic process leads to poor handwriting and spelling mistakes. Another study by Trevor et al.¹⁹ recommends a computerised clinical documentation system which may help in follow-up of multimorbidity cases and it will also prevent handwriting / spelling mistakes.

The third question was about the tendency to forget necessary questions about the suspected disease. It is strenuous effort to remember all the relevant questions and queries about diseases which are suspected in a

patient because in the daily life we forget or cannot recall many things at a specific time. Practitioners are no different and that may cause mismanagement. A study by Damiani G et al.²⁰ recommends a computerised clinical system having standard guidelines about various diseases.

The final question related to 'other' that the practitioners wanted to identify. These included ethical issues in terms of sharing patient data for further studies without their consent and exploiting their privacy. A research study by Kim J et al.²¹ supports a computerised consent by patients in the clinical system that allows hospital/clinic administrations to use patient data.

Individuals use different resources, such as internet, blogs etc., to check guidelines about different diseases as well as medical treatment. Unfortunately, over the internet there are wide variations in the quality of content related to guidelines and treatment.²²

The problems identified by the current study can best be solved by the creation and deployment of a standard database having standard guidelines about medical treatment and dosage management issued by the national health ministry/department which may be provided to the software engineers at the time of developing the medical systems. Subsequently, practitioners may check these standard guidelines rather than searching from different websites/sources. Offline accesses to these guidelines will increase ease/reliability for the end-users. In the same context, the problem of asking disease-related questions can also be solved by storing standard knowledge in the database that can easily be accessible by the end-user through applications or medical software.

In addition, the problematic factor of time consumption in preparing prescription and handwriting errors can also be solved by medical software, such as medicines and investigations may get auto-suggested by the computer software against the selected disease from the database that will contain medicines/investigations information. Practitioners will have access to modify these medicines and investigations according to their requirements. In this way, the practitioners will be able to reduce data entry process. Furthermore, treatment for follow-up patients, can be regenerated/loaded by the software from the database against patient's medical identity (ID) because, as discussed earlier, multimorbid patients frequently visit hospitals for medicine dose adjustment. By adopting this approach, we will able to reduce the time, handwriting mistakes and save

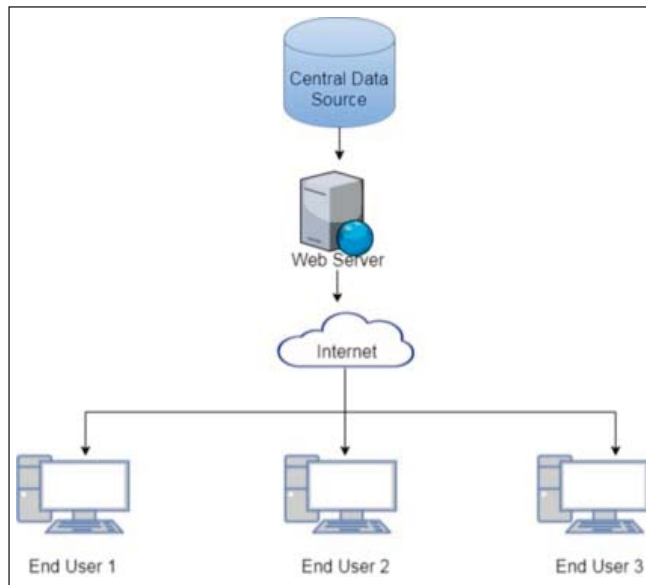


Figure-2: Access of central data to end-user applications.

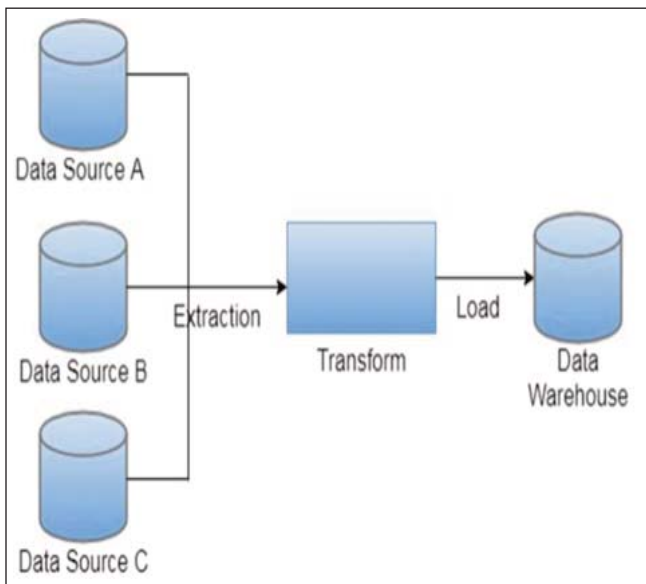


Figure-3: Different sub sections of Extraction, Transform, Load (ETL) process .

data that will also help in future studies.

Networking is an important part of Information Technology that provides secure solutions for sending/receiving data from the data centre to the end-user applications. By adopting the secure network technologies, the end-user software establishes a secure connection with data centre source via internet. Software engineers are required to integrate medical applications with database that contains standard guidelines about diseases and medicines management (Figure 2).

Information Technology also provides a secure way to

integrated data from different hospitals/clinics in one location that may use for further studies. Extraction, Transform and Loading (ETL) is one of the ways that can be used for this purpose.²³

Additionally, clinics/hospitals can share patient data for further research studies that may be available/accessible over the internet (Figure 3). In the first step of extraction, data is collected /extracted from different data sources, like clinics or hospitals. The data at this stage is heterogeneous or unstructured so at the next step of 'transform', the extracted data is checked/transformed to uniform scheme which is acceptable by data warehouse. In the final step of 'loading', data is loaded to a target data warehouse.

The current study has its own limitations. Sample size was too small and all the subjects belonged to Islamabad and Rawalpindi alone. As such, findings cannot be generalised.

We recommend the use of medical computer software in hospitals and clinics by integrating the software to a standard database.

Conclusion

Computer technologies are significantly helpful in managing the problems of treating multimorbidity by adopting standard database.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

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