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Short Communication

Experience of delivering laboratory reports as short message service to patients: A one-year experience

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ARTICLE INFO

Article history:

Received 4 November 2015

Accepted 22 February 2016

Available online 16 April 2016

Keywords:

Short message service

Laboratory reports

Clientele satisfaction

Actionable report

ABSTRACT

Background: One of the common problems faced by patients in any government hospital is the fact that they do not get the results of the laboratory investigation ordered on them at the proper time. While the issues of quality control in laboratory have been adequately addressed by most of the hospital laboratories, the practice of issuing results to the patient in most hospitals is manual and this adds the element of human errors involved in retrieval and issue of the results to them. Hence an attempt was made to send the laboratory results as short message service (SMS) to the patients.

Methods: The project was started for haematology and biochemistry reports as they comprised most of the bulk of investigation ordered on patients. In-house modules were developed using MS Access for the data-entry of the haematology and biochemistry results. The results were then mapped to the patients' name and telephone. Services of an SMS gateway firm were used to then send the results to the patient in the form of SMS.

Results: On an average 150 haematology and 250 biochemistry results are being sent daily to different patients. The cost of sending one SMS is approximately Rs. 0.10. This has resulted in a significant improvement of clientele satisfaction.

Conclusion: Sending laboratory reports as SMS to patients is an easy, efficient and economical way to reach out to the clientele and improve their satisfaction. The method can easily be duplicated in other hospitals also.

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Introduction

Laboratory reports form a very important backbone on which the management of most of the patients is based.

With improved diagnostic facilities, it is possible to tailor-make individual specific treatment. There has been a progressive increase in reliance on laboratory diagnostic services as reflected by the steady increase in the number of tests being done in all laboratories. Automation in the field

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<http://dx.doi.org/10.1016/j.mjafi.2016.02.009>

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of laboratories has made it possible to cope up with the ever increasing demand of laboratory tests. However, even today the most common problem that all hospitals are facing is the delivery of the reports. While the turn-around time of performing the tests is very less, it is a big challenge to deliver the report to the patient as soon as the result gets validated. As a common measure, OPD patients are advised to report to the hospital the next day/during the next visit to the clinician to collect their report. Reports of hospitalised patients are delivered to the ward the same evening. This process is usually manual in nature. At times, due to lack of manpower to transport reports to the ward, many of the reports remain uncollected for long period of times. A report not available to the clinician at the time he wants it, is a wasted report. It is a waste of money, energy and effort on all the echelons involved from the ordering of the test to the delivery of result to the concerned specialist.

Electronic laboratory reporting (ELR), a system where laboratory reports were being sent on digital format to health authorities, has been in vogue for over a decade.^{1,2} In its initial form, the ELR was used predominantly as a tool for surveillance of notifiable diseases. Reports generated from the laboratory were sent to the health care administrators and the inputs from them were used to detect outbreaks early and plan preventive measures. CDC Atlanta, the apex organisation in disease surveillance issued guidelines on how to judiciously use the digital media.³

As an advancement to this, efforts were made to send reports of critical value to the ordering clinician, either by way of short message service (SMS) or paging.⁴ The aim of this was to provide actionable report to the clinicians and aid treatment of patients. The reports generated were sent to the clinicians, who formulated the treatment plan, and the patients or her/his relatives were not in picture of the results. The system had its advantage in patient management; however, its use was restricted to only critical cases/reports, and most of the time the patients/clientele were not aware of the results.

In the OPD setting of any hospital, sending of actionable reports alone was not meeting the needs of the clientele. The need of the hour is to provide all the report to the patient, preferably as soon as it got generated, so as to let them know their values, and also prevent them from the ordeal of standing in lines and searching their results. In a busy hospital, where the number of samples being tested is very high, manual sorting and distributing of results are a painful, labour intensive process and invariably there is verbal altercation between the report distributing agency and the patient, when a particular report is not found.

Inspired by the fact that one gets an SMS from the bank as soon as money is transacted from the ATM, it was proposed to send laboratory reports to patients on SMS. After studying the setup of how the SMS in the banking sector works,⁵ a module was developed to send laboratory reports to the patient in the form of SMS. The present article deliberates the steps taken in achieving this and the impact it has had on the quality of patient care and the challenges therein.

The process of generating SMS reports

The most commonly asked investigation in clinical practice includes the complete blood count (CBC) and clinical biochemistry investigations. These two investigations together comprise nearly 80% of the workload of a clinical laboratory. Hence it was first proposed to send these reports to patient as SMS and evaluate both the feasibility of sending the SMS and impact it had on the clientele. After the initial evaluation of the impact of SMS of haematology and biochemistry reports, it was proposed to expand the scope to other laboratory investigations also after making the due amendments if required.

Automation of biochemistry and haematology reports

For sending the reports to patient as SMS it was essential that all the reports of biochemistry as well as haematology be computerised. This was achieved by developing in-house modules in MS Access. The data from the biochemistry analyzer – Transasia EM 360 was directly acquired from the machines database to the host computer. The data for haematology however needed to be entered manually by a data entry operator. Most of the reports of haematology were numerical in nature and hence the data entry time was not too much, although it warranted a full time data-entry operator.

Mapping the patient report with her/his telephone number

One of the biggest challenges in sending SMS reports was to map the patient's telephone number to the report of the patient. All patients reporting to the OPD were given a unique serial number. It was a number made in two parts; the first part had the date in figures, and the next consisted of the serial number of the patients registering for that day. Together, it formed a unique Visit ID (Primary Key – a jargon used in computer language meant to uniquely identify a record). The Visit ID was used to map the patient's name and telephone number with the haematology and biochemistry report (Foreign Key – a jargon used in computer language that links the primary key of one table to a similar value on other tables).

The database structure

The database structure for sending SMS was simple and consisted of three tables. The first table contained the Visit ID of the patient, her/his name and the telephone number. The second table consisted of the haematology report, which included the Visit ID and all the haematology reports of that patient (which were manually entered). The third table consisted of the biochemistry report, which also consisted of the Visit ID along with a string that consisted of all the biochemistry results generated directly from the machine. The common link between all the three tables was the Visit ID. Each record of the haematology and biochemistry table had a separate field that tracked, whether the SMS was sent or not. The default value for this field was set to 'No'. After the SMS was sent, this field was automatically changed to 'Yes', thus ensuring that the SMS was not sent for another time.

Validation of reports

All the haematology and biochemistry reports were screened first by the computer to flag off reports that were beyond the acceptable range. These reports were then analysed by the pathologist/biochemist for validation. Further investigations if required were done. Once all the reports were found to conform to the patient profile, they were validated. Only validated reports were sent as SMS.

Algorithm for sending the SMS

The SMS module was made on MS Access by a third party vendor. The module was based on a scheduler, which periodically check the biochemistry and haematology table to verify if any new and validated reports were available or not. In case, a validated report was available and the same had not been sent, then the module would check the table, in which the Visit ID along with the patient detail and her/his telephone number was entered. If the module picked a validated report, in which the Visit ID matched with the Visit ID in the patient detail, it would send the SMS report to the SMS gateway along with the details of the patient and her/his report. On successful sending of the SMS report, the field tracking the SMS status of the report would be marked as sent. These reports would not be re-sent in future. As a result, only the fresh, validated reports that had not yet been sent as SMS would be picked for dispatch the next time the scheduler even occurred. As the Visit ID for both the haematology and biochemistry was the same, the effort of entering the Visit ID, the patient name and her/his telephone number was only a single event. The scheduler was programmed to check up for fresh data every minute. Therefore within one minute of the patient report being validated, the patient would get the SMS of her/his report. A typical SMS is shown in Fig. 1. This has three parts, in

introduction specifying the date, Visit ID and the patient name. This is followed by the body, which has the actual report, followed by an end line specifying from whom the report has been sent. Sending text messages as SMS has a limitation that only 255 characters can be sent in one SMS. If the characters used in the report were more, then the text would be sent out as two SMS. In our case, we sent the reports of haematology and biochemistry as two separate SMS because of clarity of report as well as the fact that together both the reports had invariably more than 255 characters. The only limitation to this system is that if some people have a Do Not Disturb option activated on their mobile number, then they will not get the SMS.

Financial implication

As the module of automation of biochemistry and haematology was done in-house, the only financial implication was that of the SMS package and the module for sending the data from the in-house module to the SMS gateway. The cost of each SMS (taken as a bulk SMS @ Rs. for 5 lac SMS) was approximately 10 paisa per SMS. The cost for making the SMS gateway module was Rs. 25,000 which was a onetime investment. The only additional charges required for this system was that of paying for the Internet connection. There are more inexpensive Internet options for setting online SMS gateways. The step-by-step method of how to make such a gateway could be found by searching www.youtube.com. An example of one such video can be found in the following URL <https://www.youtube.com/watch?v=FHIwdRkLfvs>.

Medico legal aspect of the SMS module

The article would not be complete without a word on the medico-legal aspect of sending patient reports as SMS. When the project was first started, it was basically an outreach program aimed at giving the patient their report. Printed reports are still being issued to every patient. It needs to be once again emphasised that the reports generated, be it automatic or manually fed is initially put up to the specialists, who require to validate each and every report. Once the reports have been validated, only then they can be sent as SMS, and these reports are locked for further editing. With the good response the project has received, it is hoped that with the passage of time, routine printing of reports will gradually be phased out, and they will be printed only 'On Demand' basis. Such demands will include routine/special medical check-up etc.

Discussion

ELR has been in vogue for over a decade. In its initial form, the ELR was used predominantly as a tool for surveillance of notifiable diseases. Reports generated from the laboratory were sent to the health care administrators and the inputs from them were used to detect outbreaks early and plan preventive measures.^{1,2} Soon after its introduction, it was realised that the reports being transmitted electronically was better than that of the hand written reports and provided

Fig. 1 – A typical SMS which any patient would receive.

information at a significantly earlier time to administrators in the health care system.⁴

The experiment of sending SMS reports to patients is a novel one and not been tried by many authorities worldwide. The effort for doing such a thing had its own share of problems, which we plan to discuss in greater detail.

For the success of this system, the first most important thing is to automate/computerise the process of data entry for reports. In most of the hospitals, the data being entered is manual transcription. There are few hospitals that do generate computerised reports, but they are mostly on a text document formation and not arising from a database structure. It would not be possible to make the SMS module work in such system, where the data are being manually transcribed/written in a text document.

One more critical link in this concept is the mapping of the patient report with her/his telephone number. By mapping our results with the Visit ID, we were able to deliver all the patient reports. It would have been desirable to link the patient details including her/his telephone number via a barcode. The limitation to this method was the fact that it requires a robust network system, in which the patient details are mapped. Due to the layout constraints of the hospital, this idea was not feasible and hence an offline concept of using a data entry operator and mapping reports to Visit ID was resorted to.

After the few initial resistance from the laboratory staff to transform from the manual transcribing to computerising of all laboratory reports, the system was well accepted by the staff. Computerisation of the reports was not much of a paradigm shift from their routine work and hence was acceptable. This was mainly facilitated by the fact the computerisation was achieved by in-house software development, which was tailor-made for the laboratory staff and not the conventional way, where the staff had to mould to the software provided. This transformation was one of the key features in making the project a success.

The patients too have received the concept in a very positive way and are highly appreciative of the effort taken by the hospital to provide such a facility. As such a facility is not seen even in corporate sector, it has installed feeling in the patients that the hospital is technologically more advanced than most of the other medical centres nearby. This has significantly improved the clientele satisfaction. The queues for collecting laboratory reports is fast dwindling and patients are now showing their reports received on mobiles to the clinicians for further management. This system had its own teething problems in its inception. It was not uncommon for the patients especially those coming from remote villages to give their landline number and then quarrel that they did not receive their SMS. They would insist that they had written their telephone number, and it was only after a long search into the records, the fact was established. Another common problem was the fact that due to poor writing of telephone numbers and the fact that the telephone numbers had to be manually entered, at time, people would not get the SMS. These, however, constituted only 0.5% of all the SMS, and were not a big issue. On analysing the SMS reports sent, it was found that a few SMS on valid numbers were actually received by the patients. When the software firm was approached with this problem, they confirmed that the SMS gateway had tried to

send the SMS three times to the number at different times of the day. In case the phone was switched off or out of coverage area during those three times, the computer was forced to think that the number was not a valid one and stop sending the SMS to the number after that. There were also few rare instances, when the report of one person was sent to another. These errors were thoroughly analysed when brought to our notice, and invariably it was found to be due to duplication of the Visit ID or wrong entry of the telephone number. Diligent corrections and checks instituted on occurrence of such errors have significantly brought down this error rate.

In the second phase of this project, other laboratory investigation such as histopathology report and microbiology reports too will be sent to the patients. Considering the emotional elements associated with histopathology report and the fact that it will not be possible to send the entire report as an SMS, it has been decided to send a message that the report (along with its reference number) is ready and could be collected. This will help inform the clientele as and when exactly the reports are ready, thereby saving on unnecessary visits to the laboratory.

Recently, a new module has also been incorporated in the SMS system, where in case any haematology or biochemistry results are out of the acceptable range and considered as critical/needs to be brought to the notice of the clinician.

With gradual progress in computerising the various sections and merging them with the SMS module, it will be possible to have a laboratory, where no reports are routinely printed. All reports will be sent in an eco-friendly SMS format and only physical reports required for documentation purpose will be printed, on demand. The manpower utilised in distributing laboratory reports will be reduced significantly and the patients will get actionable reports as soon as the reports are validated. This is a dream, which had been converted into reality in a very short interval of time.

Conflicts of interest

The authors have none to declare.

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