

# Prescription digitization, online preservation, and retrieval on a smartphone

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## ABSTRACT

**Background:** Medical records are important documents that should be stored for at least 3 years after the commencement of the treatment of an adult patient in India. In a health care facility, patients' data is saved in an online or offline retrieval system. However, in the case of the primary care physician, the data is not commonly kept in an easily retrievable system. **Aim:** To test the feasibility of using a set of free web-based services in digitization, preservation, and retrieval of prescription on a smartphone by primary care physicians. **Methods:** This study was conducted with 12 primary care physicians. They were provided hands-on guides on creating an online form for uploading a prescription and using an application for retrieval of the prescription on a smartphone. Their feedback on the training material was collected by a telephonic survey, which had a 10-point Likert-type response option. Then, an in-depth interview was conducted to ascertain their perception on the tutorial and the process of digitization and retrieval system. **Results:** All of the participants were able to create an online form on their smartphone. They uploaded their prescription and associated data and were able to retrieve it. The physicians opined positively on the "cost of the system," "portability" on a smartphone and ease of the "tutorial". They opined negatively on the "limited storage," chances of "loss of data," and "time constraints" for entry of the patients' data. **Conclusion:** Free web-based and smartphone applications can be used by a primary care physician for personal storage and retrieval of prescriptions. The simple tutorial presented in this article would help many primary care physicians in resource-limited settings.

**Keywords:** Cloud computing, electronic health record, medical records, private sector, physician, smartphone, telemedicine

## Introduction

Medical records (e.g., prescription, diagnostic test reports, and medical certificates) are important documents for the patient, health care facility, and doctors.<sup>[1]</sup> In a developing country like India, most of the records are kept as a paper

document. There are several advantages (e.g., no need for personal computer or internet, no threat of cyber-attack) and disadvantages (e.g., decay in the paper, damage due to natural disaster, huge space requirement) of keeping the paper document.<sup>[2,3]</sup>

For easy retrieval and convenience of handling, private sector and government-run hospitals are gradually adopting electronic health records (EHR).<sup>[4]</sup> However, its implementation faces difficulty due to factors like low resource, high patient volume, less manpower, etc.<sup>[5]</sup>

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Keeping medical records requires 3 major components – hardware (i.e., computers), software (i.e., electronic-health record keeping application for computers), and manpower (e.g., doctors’ assistants). A primary care physician may face difficulty in acquiring and maintaining those costly and space-occupying system of EHR.<sup>[6,7]</sup>

However, for a medico-legal point of view in the Indian scenario, the medical record should be kept for at least 3 years from the initiation of treatment of an adult subject.<sup>[8]</sup>

“Google forms” is a web-based application, which can be used to create a form for data collection.<sup>[9]</sup> It is a free service and it can be utilized by a user to keep the data on the cloud.<sup>[10]</sup> To the best of our knowledge, its potential in digitization and retrieval of prescription has not been explored in any previous study.

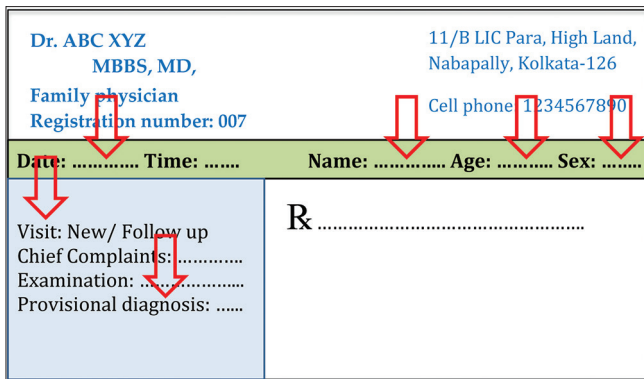
With this background, the aim of this study was 1) to train primary care physicians about creating a form, upload prescriptions, and retrieval of the data on a smartphone 2) to test the practicality of the training material (i.e., tutorial) with the help of a survey, and 3) to ascertain overall perception regarding the training material, the digitization, and the retrieval system by an in-depth interview.

### Materials and Methods

A common prescription is shown in Figure 1. Keeping only the image of the prescription with an identification number may not be sufficient for easy retrieval. Hence, we aimed to keep searchable data (typed) such as name, age, sex, date, type of visit, and provisional diagnosis on the cloud storage. In this article, all the technical guideline is discussed for a smartphone running on the Android operating system.

### Materials required

1. A smartphone equipped with a camera
2. Internet connection
3. A Google account
4. Software application – Google Chrome, Google Drive, Google Sheets



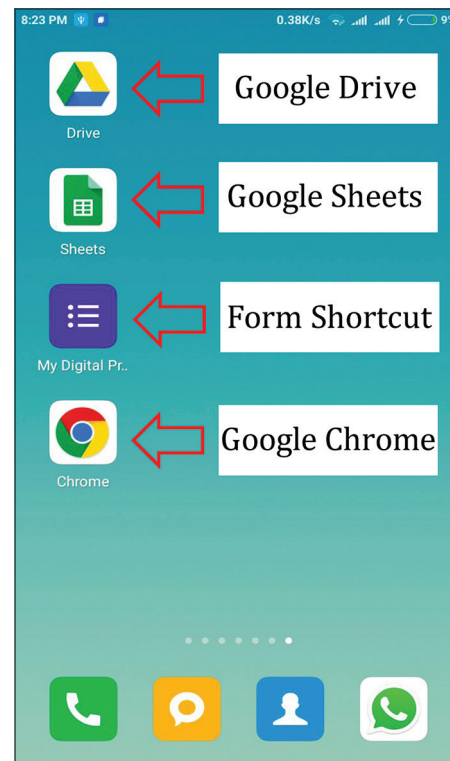
**Figure 1:** A typical prescription (red arrows show essential parts for data entry)

A dedicated smartphone home screen can be created with the application on the smartphone for easy navigation as shown in Figure 2.

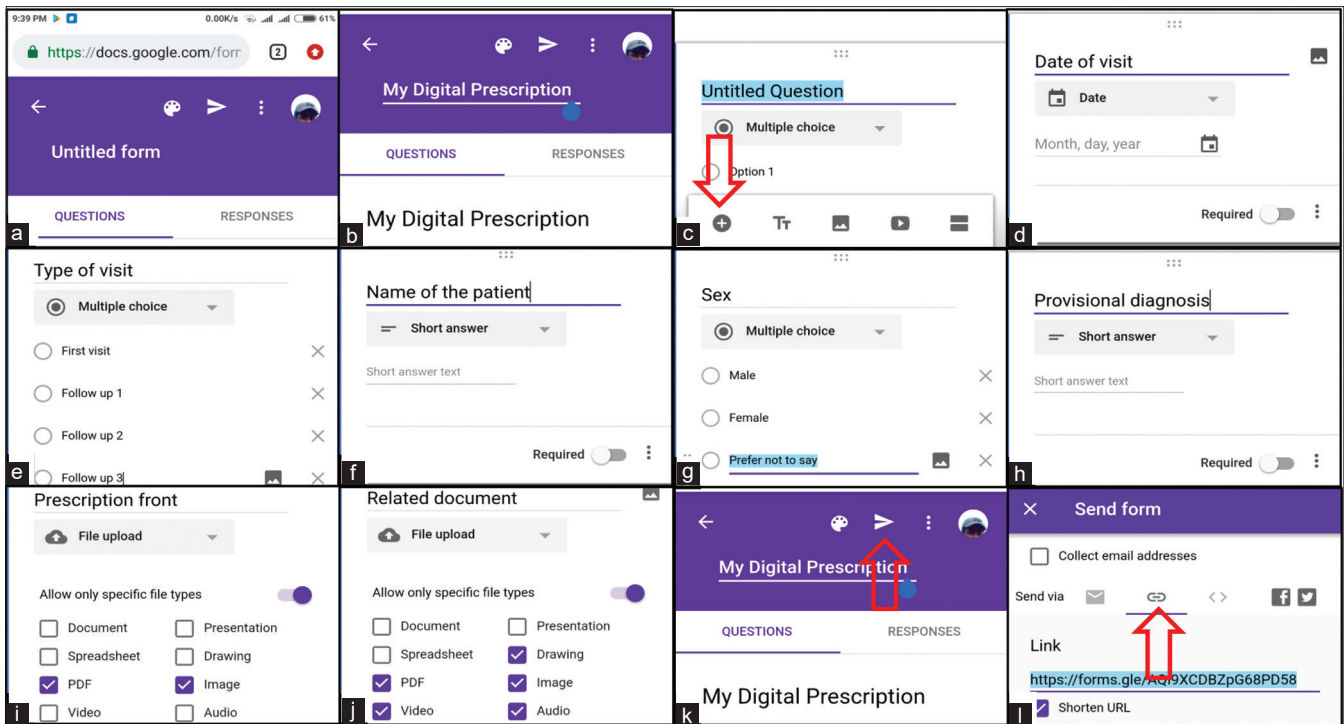
### Creating a form on Google forms

The method of Google form creation on a personal computer for a medical survey is available elsewhere.<sup>[9]</sup> In this article, Google form creation is shown for a smartphone (connected to the internet). Figure 3 shows the screenshots of the smartphone screen and the brief procedure is as follows:

- a. Open the Google Chrome and open the website <http://docs.google.com/forms> [Figure 3a]
- b. Type suitable title (e.g., My Digital Prescription) and description of the form [Figure 3b]
- c. Type the first question in “Untitled Question” and to add a new question, use the “+” sign [Figure 3c]
- d. The first question is typed as “Date of visit”. Google provides automatic response options according to the nature of the question. However, if the response option is not as desired, use the dropdown menu to select “Date” [Figure 3d]
- e. “Type of visit” is typed as the next question and response option is selected as “Multiple choice” [Figure 3e]
- f. The next question is “Name of the patient” and response option is “Short answer” [Figure 3f]
- g. The next question is to know the “Sex” of the patient and response option is “Multiple choice” [Figure 3g]
- h. To enter the “Provisional diagnosis,” the response option is selected as “Short answer” [Figure 3h]



**Figure 2:** A smartphone home screen showing essential components for storing and retrieving prescription



**Figure 3:** Process of creating a Google form (a) open the website (b) write the form title (c) write question on “Untitled Question” and for adding more, click on “+” icon (d) add “Date of visit” question (e) add “Type of visit” question (f) add “Name of the patient” question (g) add “Sex” question (h) add “provisional diagnosis” question (i) add “Prescription front” and keep “File upload” as response option (j) add “Related document” question (k) click on the share icon (l) generate web link

- i. For uploading the prescription image, the question “Prescription front” is typed and the response option is selected as “File upload” and only “PDF” and “Image” are allowed to be uploaded. Similarly, the prescription back question may also be added [Figure 3i]
  - j. Diagnostic reports, consent form, or any clinical images for research purposes can be saved under any question (e.g., Related document) and the response option is selected as “File upload.” [Figure 3j]
  - k. After entering all the desired questions, click on the share icon to get options for sharing. [Figure 3k]
  - l. Click on the link button to get the URL (you may shorten the URL too) and copy it. [Figure 3l]
- b. You need to be logged in for entering data on the form and your email address will be shown on the screen. Enter the date of the visit as desired [Figure 4b].
  - c. Type the name, age, and sex (demographics) of the patient [Figure 4c]
  - d. Type the provisional diagnosis or any other comments about the consultation [Figure 4d]
  - e. Click on the “ADD FILE” for uploading a prescription [Figure 4e]
  - f. Click on the “Select files from your device” [Figure 4f]
  - g. Select “Camera [Figure 4g] and it will open the camera application of the smartphone. Capture the image of the prescription keeping it flat on a surface with adequate light.
  - h. Click on the “Upload” for uploading the prescription [Figure 4h]
  - i. Allow time for the upload (depends on the internet speed) [Figure 4i]
  - j. A successful upload is indicated by the image file icon below the question [Figure 4j]
  - k. After uploading “Prescription back” or “Related documents” (in the figure no files uploaded under these questions), click on the “Submit” button [Figure 4k]
  - l. “Your response has been recorded” is the success message [Figure 4l]

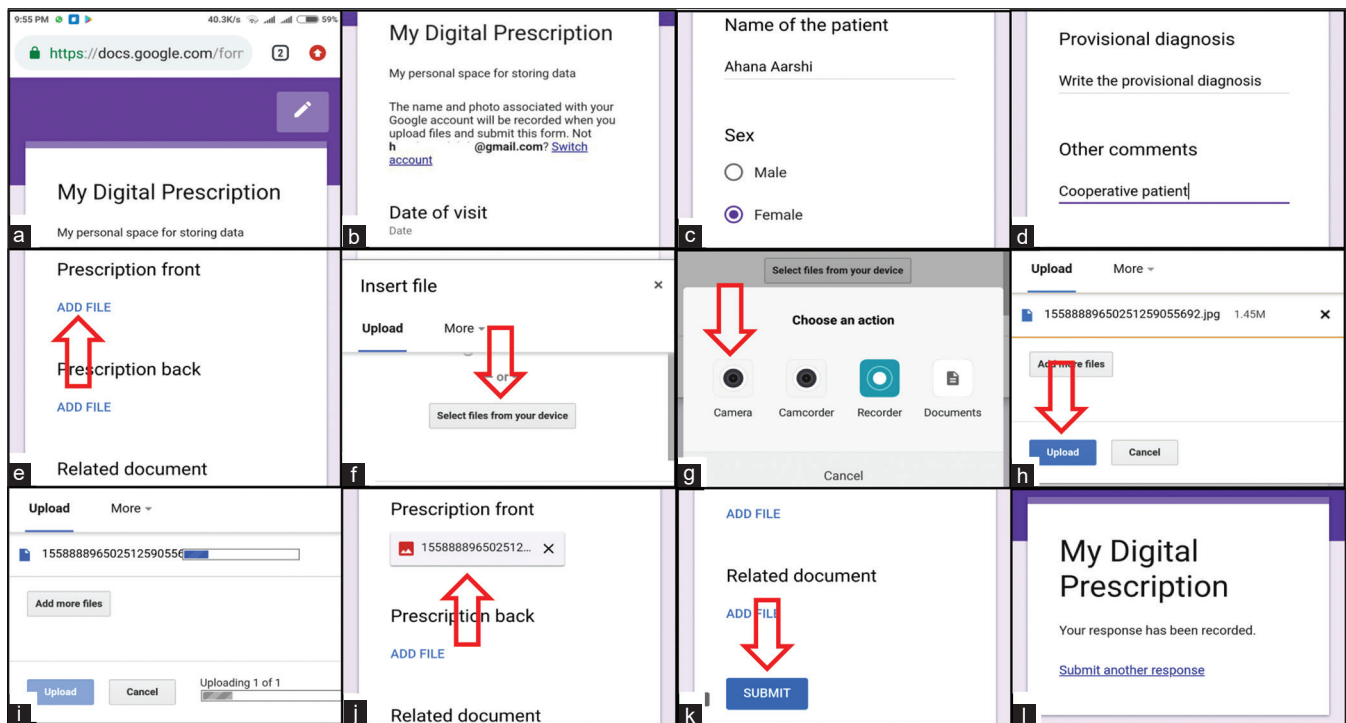
Open the link on the Google Chrome browser and click on the “more vertical” icon (i.e., three vertical identical dots) and click on the “Add to Home screen” to take the link of the form to your smartphone home screen, which is basically a shortcut of the URL. Its appearance on the smartphone screen is shown in Figure 2 (Form Shortcut). Now the smartphone is ready for capturing prescription and other data.

### Data entry process

In Figure 4, the processes of typing data and uploading a prescription are shown and the steps are following:

- a. Click on the form shortcut on the home screen [Figure 2] of the smartphone and the form will be opened on the default internet browser (e.g., Google Chrome) [Figure 4a]

There is an option for “Submit another response.” Physicians can keep their phone on this screen for the next patient. If this option is not desired, then open the form shortcut from the home screen [Figure 2] to start filling the form afresh.



**Figure 4:** Process of uploading a prescription (a) open the form on the browser (b) form will be shown with the Google account you are logged in (c) write name of the patient (d) write provisional diagnosis (e) click on “ADD FILE” under “Prescription front” (f) click on “Select files from your device” (g) choose “Camera” and capture image (h) click on “Upload” (i) progress will be shown (j) prescription file uploaded (k) after completion of data entry, click on “SUBMIT” (l) confirm message will be shown

### Retrieving prescription

For smooth retrieval, once we need to create the spreadsheet from the form and next time onwards entered data will be automatically updated on the spreadsheet. Figure 5 shows the screenshots and the process is:

- a. Open the form on the browser from the shortcut [Figure 2] and click on the edit button [Figure 5a]
- b. Click on the “RESPONSES” [Figure 5b]
- c. The page will show the responses captured on the form. Click on the spreadsheet icon (green icon) [Figure 5c]
- d. Prompt to “Create a new spreadsheet” will appear and click on “CREATE” [Figure 5d]
- e. A spreadsheet with responses will appear on the browser [Figure 5e]. You may view responses from the browser. However, we suggest exiting the browser to do the next step.
- f. Open the “Google Sheets” application from the home screen [Figure 2] and the created sheet will appear [Figure 5f]
- g. Entered data will be shown on a spreadsheet on the application [Figure 5g]
- h. Click on the corresponding prescription file link and it will open the prescription on the Google Drive [Figure 5h]

### Training of the physician

Twelve primary care physicians, after taking verbal consent, were recruited as a convenience sample. We distributed the tutorial via email for training on the creation of Google form

on the smartphone, uploading a prescription, and retrieving the prescription from the cloud via Google Drive. We declare that we have conducted this study with full accordance with the WMA declaration of the Helsinki.

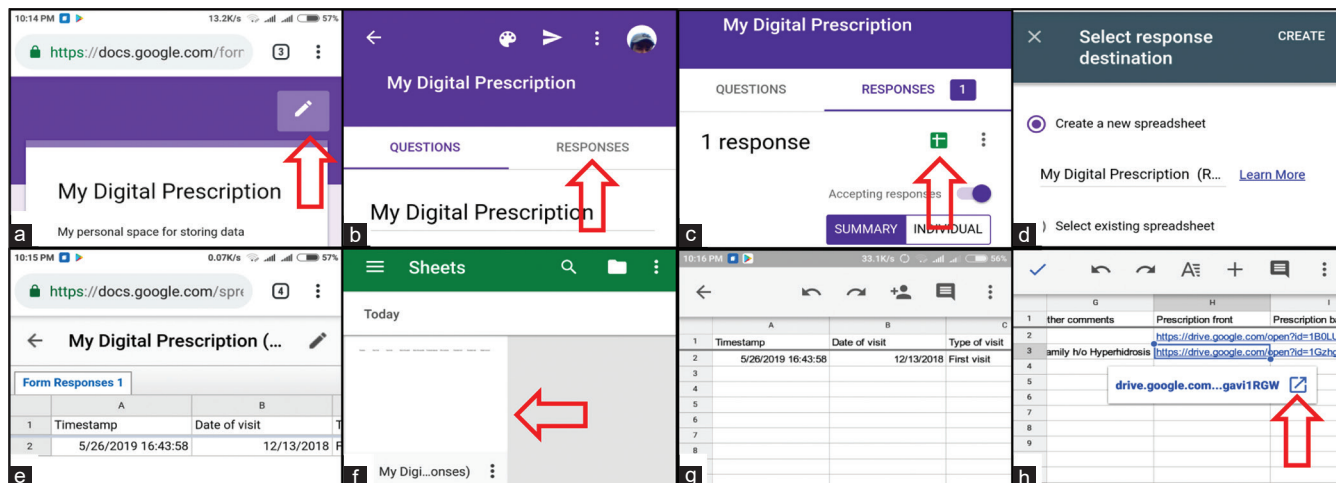
### Survey and interview

After 30 days, a telephonic survey was conducted to know the experience of the doctor in creating forms and its usages. Verbal consent was taken for recording the telephone call. The participants were also informed that after transcription, the call would be deleted. Predesigned questions were asked with response options on a 10-point Likert-type scale where 0 indicates “extremely difficult” and 10 indicates “very easy.”

After this, in the same telephonic session, an in-depth interview was conducted to know the perception of the participant about this method of prescription digitization and retrieval.

### Data analysis

Continuous variables were expressed in mean and standard deviation and mean of male and female was compared by unpaired *t*-test. Categorical data were expressed in number and percentage and tested statistically by the Chi-square test and Binomial test. For all the tests a *P* < 0.05 was considered statistically significant. Statistical analysis was carried out in IBM® SPSS® Statistics Version 20 software package (IBM Corporation, USA) and Microsoft Excel® 2010 (Microsoft, USA).



**Figure 5:** Process of retrieving data (a) after opening form, click on the edit icon (b) click on “RESPONSES” (c) click on the green spreadsheet icon (d) click on “CREATE” to create a new spreadsheet (e) spreadsheet is shown on the browser (f) open “Google Sheets” application and click on sheet icon (g) sheet is shown in the application (h) click on the link of the prescription to view it

## Results

A total of 12 doctors participated in this study. All of them successfully created the form for their personal use. Characteristics of the participants are shown in Table 1.

The score of response received on experience on creation, uploading, and retrieving prescription is shown in Table 2. All of them found it to be an easy method of prescription digitization and retrieval.

For average measures, the intraclass correlation coefficient was 0.915 (95% confidence interval 0.820–0.971,  $P < 0.0001$ ). This indicates “excellent” inter-rater agreement on the usefulness of the tutorial.

Result of the in-depth interview was categorized thematically and presented here. The participants’ identity is expressed serially in age, sex, practicing experience (e.g., 30M2Y indicates a 30-years-old male practicing for 2 years). Additional notes were added after a colon.

### Cost factor

Google form is free for users. All participants liked the system as it is a free service. Ease of uploading data with some clicks on the smartphone also partially eliminates the requirement of a data entry operator.

“...the icing on the cake is that it is totally free service” (28F1Y)

“It could have been saving my money and space if I were aware of it.” (35M3Y: One who keeps carbon copies of the prescriptions)

### Portability

All the components – creating form, data entry, and retrieval can be done on a smartphone. A total of 9 participants opined its

advantage of being a smartphone-based system. This eliminates carrying a personal computer to all the chambers. Rest 3 participants think that a laptop computer with a camera may also be tried if data is entered by physicians’ assistants.

“It’s great! We can just do it on our smartphone.”(31M2Y).

### The tutorial

The lucid presentation of the tutorial helped the participant, which was praised by 6 participants. The rest 6 participants, though agreed that the presentation was lucid but opined that a video tutorial could help them more. However, one participant requested to add a segment on how to remove a question.

“...and the tutorial is really easy to understand. I created the form in 5 min. Everybody else would be benefited by the tutorial.” (29M1Y)

### Storage limitation

Google Drive allows a free user to store a maximum of 15 GB of contents. Three participants pointed out this issue. Six participants would digitize only important prescriptions to save space. Rest 3 had their personal tricks on how to avoid the limits. However, we are not sharing it here. A user can buy extra space from Google.

“...and the 15 GB may become very less space because smartphone images are now high-quality, and it uses higher space per image. It is also difficult to upload a large-sized image with a slow-speed internet.” (33M4Y)

### Loss of data

Anyone having access to the mobile may view the medical records. The medical records are confidential data, which should have limited access to doctors, patients, and the health care facility except for some health care needs or medico-legal cases.

**Table 1: Characteristics of the participants**

		Overall (n=12)	Male (n=9)	Female (n=3)	Statistics
Age (years) (mean±SD)		35.08±5.84	36.22±6.16	31.67±3.51	t=1.19, P= 0.26
Experience in private practice (years) (mean±SD)		6.92±6.26	8.33±6.65	2.67±1.53	t=1.42, P=0.19
Smartphone usage (years) (mean±SD)		6.08±0.99	6.11±1.05	6±1	t=0.16, P=0.88
Highest qualification (n (%))	Graduate	4 (3.33)	4 (44.44)	0	$\chi^2=2$ , P=0.37
	Postgraduate degree	6 (50)	3 (33.33)	3 (100)	
	Postgraduate diploma	2 (16.67)	2 (22.22)	0	
Type of smartphone (n (%))	Full touch screen	11 (91.67)	8 (88.89)	3 (100)	P=0.006*
	Touch screen with physical keyboard	1 (8.33)	1 (11.11)	0	
Internet connection (n (%))	Intermittent	0	0	0	P=0.0005*
	Continuous	12 (100)	9 (100)	3 (100)	
Having a Google account (n (%))	Yes	12 (100)	9 (100)	3 (100)	P=0.0005*
	No	0	0	0	
Keeping copy of prescription (n (%))	Yes	2 (16.67)	2 (22.22)	0	P=0.039*
	No	10 (83.33)	7 (77.78)	3 (100)	

SD: Standard deviation, n number, \* Statistically significant P value of Binomial test

**Table 2: Experience on creation, uploading, and retrieving prescription**

Item	Score (Mean±SD)	Range	95% CI
Resource acquisition (e.g. smartphone, internet connection)	9.83±0.39	9-10	9.59-10.08
Application download from Google play store	9.75±0.45	9-10	9.46-10.04
Home screen addition on the smartphone	9.83±0.39	9-10	9.59-10.08
Form creation on Google forms	9.5±0.80	8-10	8.99-10.01
Form shortcut generation for home screen	9±1.21	7-10	8.23-9.77
Data entry (e.g., name, age, sex)	9.58±0.79	8-10	9.08-10.09
Capturing and uploading prescription image	9.58±0.79	8-10	9.08-10.09
Retrieval of data	9.42±0.79	8-10	8.91-9.92
Viewing prescription	9.5±1	7-10	8.86-10.14
Understanding tutorial (equivalent to Figure 3-5)	9.83±0.39	9-10	9.59-10.08

Three participants were worried about this factor. The rest of the participants were opined that keeping data on smartphones have a similar threat as keeping data on personal computers.

“What if I lose the mobile? All the data would be in the hands of the thief.” (32F4Y)

### Time constraints

On average, participants take 1 min 30 s (average 92.5 ± 23.79 s, range 60–120 s, n = 12) for uploading a prescription. Two participants thought the time to be an important inhibiting factor. However, the rest of the participants were ready to invest the time.

“It is really a hectic job to keep all the prescriptions in digital format. However, it is a good practice to avoid any legal complication.” (44M14Y)

## Discussion

A total of 12 primary care physicians used the tutorial to successfully create Google form, upload the prescription, and retrieve those from cloud storage. The tutorial was designed purposefully for a smartphone to help the busy physician who can easily do it even in their spare time. One participant created the form in just 5 min.

The result of this study shows that the participant had no technical difficulty in the generation of the form on their smartphone. Hence, the tutorial, presented in this article can be used by the physicians who would like to keep their prescription digitized. Primary care physicians frequently need to issue certificates of death, illness, or fitness. Those who are not ready to digitize all of their prescriptions can digitize these important certificates for any medico-legal cases. However, it is wise to keep all the records for 3 years. Patients, their representatives, or legal authorities may demand the document in this period and physicians need to submit it within 72 h.<sup>[11]</sup>

Primary care physicians in India are not commonly participating in research. However, they have the potential to participate in research activity.<sup>[12]</sup> Preservation of patient particulars, treatment details, and images of any lesion may contribute to research output with collaboration with other primary care physicians.<sup>[13]</sup>

Informed consent (verbal) for treatment by a primary care physician is rarely documented. However, as telemedicine is being started in India due to the COVID-19 pandemic, saving the consent may be necessary for all the telemedicine consultations for avoiding legal complications.<sup>[14]</sup>

Although EHR was introduced long back, its implication is still not achieved due to several factors, major being cost, time,<sup>[15]</sup>

manpower,<sup>[16]</sup> and the technology being a complicated one.<sup>[17]</sup> Even digitization of data in EHR may take more time than the consultation time.<sup>[18]</sup> Lack of universal EHR software further limits the use of the national-level data.<sup>[19]</sup> The method we described in this article is for resource-limited settings for those who cannot afford EHR.

Portability is the issue, which was favored by the majority of the participants. However, many issues rose by the participants on the in-depth interview, which may be the inhibitory factors for the physicians to adopt this method for prescription preservation. Storage limitation was one of the major concerns in free accounts. To overcome this, a user can upgrade the storage capacity by opting for premium packages. Further, users can limit the data per patient by decreasing the quality of the prescription images (e.g., setting quality of the image as “low” of an image of resolution 3120 × 4160 pixel takes 855 KB whereas same resolution “high” quality image takes 4.54 MB). According to EHR standards for India, the image should be of minimum of 1024 × 768 pixels at 300 dpi.<sup>[20]</sup>

Security of the data is an important issue, which should be taken care of by the physicians. A smartphone is vulnerable to be stolen. That is really a threat to data security. However, this can be prevented by using a strong password for the smartphone and setting the password or fingerprint compulsory for opening any application. Losing a phone does not mean loss of data. As soon as you get a new smartphone, the whole stored data can be loaded on the new device as it is stored on the Google drive. It is also recommended not to use the Google account (in which prescriptions are kept) in public computers or any computer without proper security (i.e., without internet security application). Using an antivirus application on the smartphone is a good choice.

Although, there are several disadvantages of the paper document, major being the difficulty in retrieval from remote location or retrieval from a huge bunch of paper, its robustness in data storage cannot be questioned. In contrast, despite the chances of device malfunction or loss, cloud storage is relatively safe, devoid of disadvantages of the paper document, and easily retrievable.<sup>[21]</sup>

Time for uploading the prescription may be a burden for many physicians. A physicians’ assistant can help in this case. The Google form link [Figure 2] can be shared with the assistant and she/he can upload the prescription from her/his smartphone. However, remember not to share the link with any untrusted person who can enter spam entry or can upload malware via the file upload option. Hence, cautiously physicians can allow only “image” and “audio” in the file upload option as PDF and other files may contain malicious JavaScript.

In the current COVID-19 pandemic, many primary care physicians have started teleconsultations despite several limitations.<sup>[22,23]</sup> They can use these free services for storing patients’ data for any future legal needs.

## Conclusion

Primary care physicians can use Google forms for saving patients’ particulars and upload prescription images. Google Sheets, another free application, can be used for easy retrieval of entered data. The smartphone-based tutorial available in this article can be used to learn the creation, upload, and retrieval of the data. This free, portable, and easily manageable system can help many of the primary care physicians. However, careful and secure usage should be ensured by the physicians to prevent any misuse of the medical records.

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## Conflicts of interest

There are no conflicts of interest.

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