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Automated Reminder System for Cervical Cancer Patient

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ABSTRACT

Cervical cancer is one of the leading cancer killers among women all over the world. Cervical cancer is the most common female cancer in developing countries, a woman dies of cervical cancer every two minutes. Its contribution to cancer burden is significant across all cultures and economies. However, in India, this disease is still killing up to 8,000 women annually. Fortunately, this cancer is preventable by screening for premalignant lesions but this is rarely provided and hardly utilized. So, to make them take screening test daily reminder must be sent and aware them about cervical cancer. The aim of this process is to assess the knowledge of cervical cancer screening among India women. An automated reminder is designed to send an automated message to the patient and remind them about the test and encourage them to take the regular test. These result in use of taking regular check-up and get knowledge about cervical cancer. These help to reduce the painful death of the women and get aware of the symptoms and causes of cervical cancer.

Keywords: Cervical Cancer, Premalignant Lesions, Pap Smear Test.

1. INTRODUCTION

India is 3rd largest HIV epidemic in the world. India has a population of 453.02 million women ages 15 years and older who are at risk of developing cervical cancer. Current estimates indicate that every year 122844 women are diagnosed with cervical cancer and 67477 dies from the disease. Cervical cancer ranks as the 2nd most frequent cancer among women in India and the 2nd most frequent cancer among women between 15 and 44 years of age. About 5.0% of women in the general population are estimated to harbor cervical HPV-16/18 infection at a given time, and 83.2% of invasive cervical cancers are attributed to HPVs 16 or 18.^[10]

Amongst the HIV positive population of India, the women population is highly prone to CERVICAL CANCER. Due to the similar symptoms of HIV positive and normal women, HIV positive women ignore the symptoms that cause cervical cancer. The patients are especially at risk for cervical cancer – 15% of women with cervical cancer were reported not to have an appropriate follow-up of abnormal results and 27% were reported to have had delayed or no referral for colposcopy. Surprisingly in Ethiopia, only 1% of age-eligible women receive effective screening for cervical cancer and 90% of women have never had a pelvic examination at all.

Given the complexity of the guidelines and lack of a single resource for evidence-based recommendations for cervical cancer screening and surveillance, an automated system that provides comprehensive guidance would be clinically useful. Therefore, we developed a system for deployment at the point of care. In order to solve this problem, an automated web application is being developed that acts as a remainder for the women to attend the routine test to reduce the painful effect of cervical cancer.

2. LITERATURE SURVEY

Mobile phones, or smartphones, give people with cancer, survivors, and caregivers a convenient way to access online health information. Below is a list of mobile applications (“apps”) for you to download or visit on your mobile phone. Cancer.Net provides these links as a convenience to its visitors. Cancer.Net and ASCO have no control over the applications and websites maintained by third parties. Cancer.Net and ASCO do not endorse the content, operators, products, or services of such applications and websites.

Cancer.Net and ASCO are not responsible directly or indirectly for any damages or injury caused by or in connection with the use of any such content, products, or services available through third-party applications and websites.

Cancer-Specific Apps

Breast Cancer Diagnosis Guide: This app walks you through your breast cancer pathology report and other tests and information that you and your doctor will use to help decide which treatments are right for you. Free. (Developed by Breastcancer.org)

Cancer Coach (iPhone and Android): Breast and colon cancer patients can access information about personalized cancer treatment options and use tools such as a calendar, note-taking and audio-recording functions, a list of questions to ask the doctor, a glossary of terms and links to additional resources. Free. (Developed by Breastcancer.org, Fight Colorectal Cancer, and Genomic Health, Inc.)

CancerSupportSource (iPhone): Track stress levels and side effects, access cancer information, and connect with a Cancer Support Community near you or online. Free. (Developed by Cancer Support Community)

CaringBridge (iPhone, Android, and mobile website): Visit CaringBridge pages to view and post updates by friends and family members with cancer. Free.

Drug Trials (iPhone): Use this application to search clinical trials information from the National Institutes of Health's database, clinicaltrials.gov. Free. (Developed by FDABLE LLC)

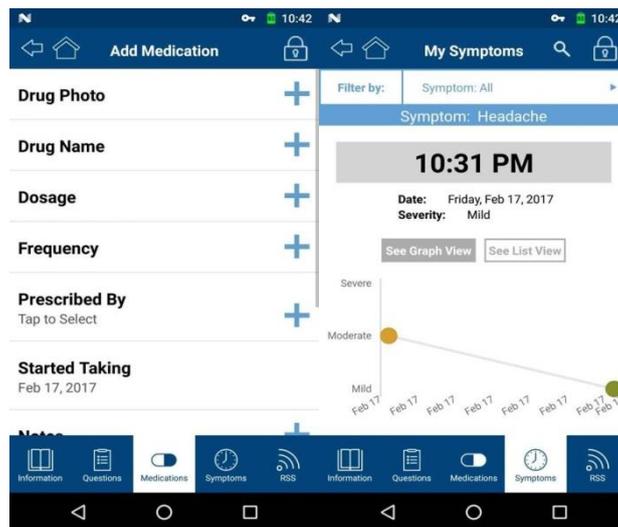
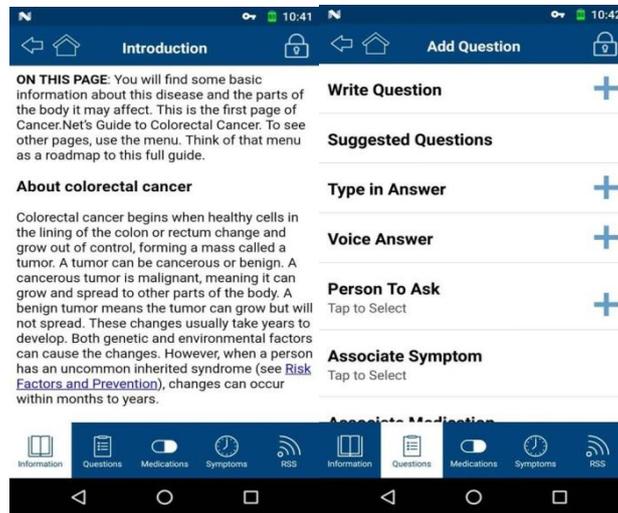
Find a Health Center (iPhone): Type in your zip code to find care at a federally funded health center near you. Free. (Developed by Health Resources and Services Administration)

iCANcer (iPhone): iCANcer is an app designed to help patients, caregivers, and cancer survivors manage their medical information. Developed by a two-time cancer survivor, iCANcer seeks to help personalize your cancer journey and store all your important medical information including cancer treatments, medications, medical issues, appointment information, and medical contacts. Fee applies. (Developed by Naomi Bartley)

LIVESTRONG English-Spanish Dictionary of Cancer Terms (iPhone): Search more than 6,000 English and Spanish cancer-related terms. Definitions provided by the National Cancer Institute. Free. (Developed by Springbox, Ltd.)

Pocket Cancer Care App (iPhone): Browse questions to ask your doctor based on your diagnosis, build a list of questions, and record and play back your doctor's answers. Free. (Developed by the National Coalition for Cancer Survivorship)





Intuitive, on-the-go tools keep track of questions, symptoms, and medications, allowing you to:

- Get Information – up-to-date guides on 120+ types of cancer, including treatment, managing side effects, cost of care, and living with cancer.
- Record Questions - easily jot down questions for your doctors and record their answers
- Log Medications - take photos of medication labels and bottles. Log dosage, frequency, and prescribing doctor
- Track Symptoms – note symptoms and side effects. Automatically plot severity, date, and time in an easy-to-read line graph
- Scheduling – add questions, symptoms, or medications to your mobile device calendar
- Link Questions - link any questions to ask at your next appointment with a current symptom or medication

Cancer.Net Mobile is a companion to the Cancer.Net website, a service of ASCO, the world’s leading professional organization representing physicians who care for people with cancer. All information on Cancer.Net was developed and approved by oncologists who are members of ASCO. Cancer.Net is supported by the Conquer Cancer Foundation, which funds breakthrough cancer research and supports the sharing of cutting-edge knowledge with patients and doctors worldwide

Over the past 50 years, there have been many studies attempting to assess whether a particular infection—such as gonorrhoea, syphilis, chlamydia, or genital herpes—was the sexually transmitted agent that led to cervical cancer. HPV causes cervical cancer, by showing that when inoculated into cell culture systems, HPV causes the cells to grow in an “out-of-control”, cancer-like fashion and that these out-of-control cells can then cause cancer when injected into mice. Thus, while definitively proving that an infectious agent causes a disease can be quite difficult, based on a large number of studies, there is now widespread consensus among cancer researchers that high-risk types of genital HPV clearly play a causative role in the development of cervical cancer, and probably other types of anogenital cancer, such as cancer of the penis and anus.^[7]

Table 1. Crude incidence rates of HPV-related cancers

	Male	Female
Cervical cancer	-	20.2
Anal cancer	0.0-0.6	0.1-0.4
Vulva cancer	-	0.2-0.5
Vaginal cancer	-	0.2-0.8
Penile cancer	0.3-1.8	-
Pharynx (excluding nasopharynx)	4.9	1.1

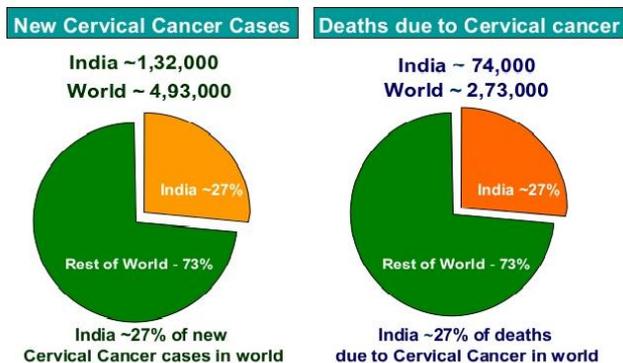
Table 2. Burden of cervical cancer

	Incidence	Mortality
Annual number of new cases/deaths	122844	67477
Crude rate	20.2	11.1
Age-standardized rate	22.0	12.4
Cumulative risk 0-74 years (%)	2.4	1.4
Ranking of cervical cancer (all years)	2nd	2nd
Ranking of cervical cancer (15-44 years)	2nd	2nd

Table 3. Burden of cervical HPV infection India

	No. Tested	% (95% CI)
HPV prevalence in women with normal cytology	35349	7.0 (6.7-7.2)
HPV 16/18 prevalence:		
Normal cytology	8845	5.0 (4.6-5.5)
Low-grade cervical lesions	177	28.2 (22.1-35.3)
High-grade cervical lesions	253	62.8 (56.7-68.6)
Cervical cancer	2006	83.2 (81.5-84.8)

Cervical Cancer – Disease Burden in India



Bhatia N et al; Vaccine 2008; 26: 2811-17

Programs to Assess Burden of Infection

Monitoring systems to provide information about rates of various types of Pap smear abnormalities and of type-specific genital HPV infections in targeted populations will be important in planning and evaluating vaccine programs, as well as in tracking the distribution of HPV infection in the population. Such studies may be particularly useful in clarifying rates and types of infections in men about which far less is known than for infections in women.

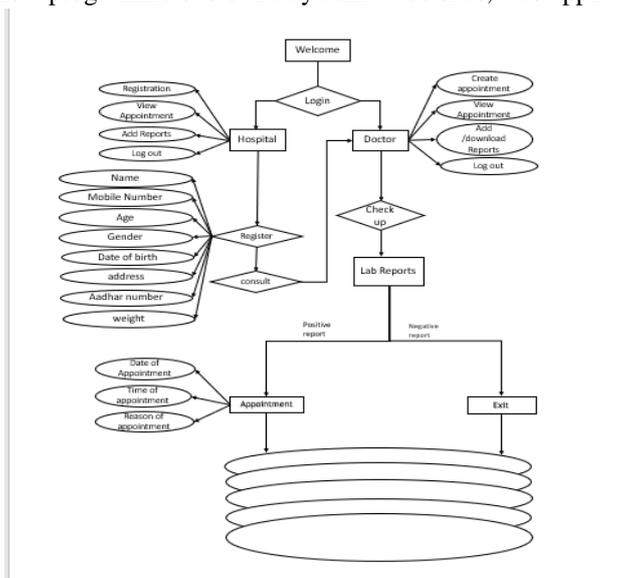
3. PROPOSED WORK

The application was designed to send a reminder to the patient. The application sends a notification/reminder about the check-up with the help of scheduler. The scheduler is set in such a way that it sends a reminder just three days before the appointment date. Further for the convenience of the patient/doctor, we provide a function of uploading and downloading the patient medical record in the system itself. There is need to improve the public knowledge. As both the vaccination and screening are the new standards for the prevention of cervical cancer, it can be possible by providing the awareness messages. This application is divided into different types of modules. These modules are explained below:

a. Graphical User Interface

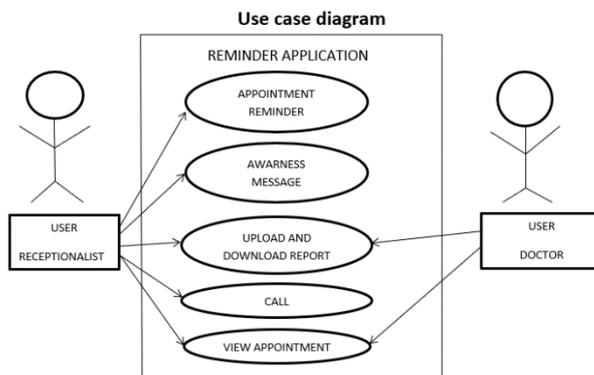
In our application to design the front end of the application, we used asp.net.

ASP.NET is an open-source server-side web application framework designed for web development to produce dynamic web pages. It was developed by Microsoft to allow programmers to build dynamic web sites, web applications, and web services.



b. Scheduler

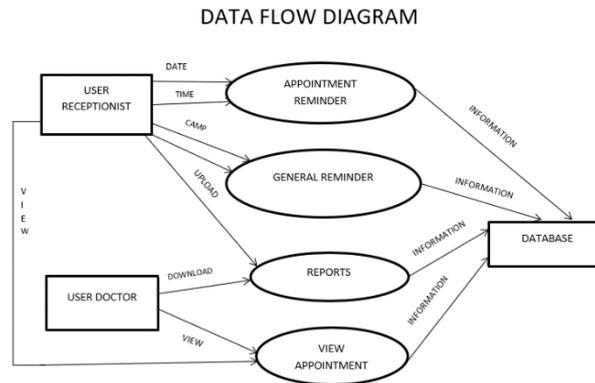
Task Scheduler is a component of Microsoft Windows that provides the ability to schedule the launch of programs or scripts at pre-defined times or after specified time intervals: job scheduling (task scheduling). The Task Scheduler service works by managing *Tasks*; *Task* refers to the action (or actions) taken in response to a trigger(s). A task is defined by associating a set of actions, which can include launching an application or taking some custom-defined action, to a set of triggers, which can either be time-based or event-based. In addition, a task also can contain metadata that defines how the actions will be executed, such as the security context the task will run in. Tasks are serialized to job files and are stored in the special folder titled *Task Folder*, organized in subdirectories. Programmatically, the task folder is accessed using the *ITaskFolder* interface or the *TaskFolder* scripting object and individual tasks using the *IRegisteredTask* interface or *RegisteredTask* object.



c. Database

In our application, we use SQL server 2012 (version-11.0, code name -Denali). MS SQL Server is a relational database management system (RDBMS) developed by Microsoft. This product is built for the basic function of storing retrieving data as required by other applications. It can be run either on the same computer or on another across a network. SQL Server Management Studio is a

workstation component\client tool that will be installed if we select workstation component in installation steps. This allows you to connect to and manage your SQL Server from a graphical interface instead of having to use the command line.



d. Awareness message

Sending an SMS or MMS is one of the most common tasks performed on the Twilio Platform. Sending a message is as simple as Posting to the Messages resource. We'll outline required and optional parameters, messaging services, alphanumeric sender ID, rate limiting, and handling message replies below.

POST Parameters

The 'To' parameter is required in your POST to send the message: *The destination phone number for SMS/MMS or a Channel user address for other 3rd party channels. Destination phone numbers should be formatted with a '+' and country code e.g., +16175551212 (E.164 format). If you are sending messages while in trial mode, the 'To' phone number must be verified with Twilio. You can verify your phone number by adding it to your Verified Caller IDs in the console.*

The 'From' parameter is required in the POST: A Twilio phone number (in E.164 format), alphanumeric sender ID or a Channel Endpoint address enabled for the type of message you wish to send. Phone numbers or short codes purchased from Twilio work here. You cannot (for example) spoof messages from your own cell phone number. *The 'MessagingServiceSid' parameter is required in the POST:* The 34-character unique id of the Messaging Service you want to associate with this Message. Set this parameter to use the Messaging Service Settings and Copilot Features you have configured. When only this parameter is set, Twilio will use your enabled Copilot Features to select the 'From' phone number for delivery.

There is a slight difference in API response when specifying the MessagingServiceSid parameter When you only specify the 'From' parameter, Twilio will validate the phone numbers synchronously and return either a queued status or error. When specifying the MessagingServiceSid parameter, Twilio will first return an accepted status. Twilio then determines the optimal 'From' phone number and any delivery errors will be sent asynchronously to your StatusCallback URL. *The 'Body' parameter is required in the POST:* The text of the message you want to send limited to 1600 characters.

4. RESULT AND DISCUSSION

The reminder is sent to the patient for the check-up using the scheduler. The scheduler sends a message to the patient from three days before the appointment date. A day before the appointment a call is also made to remind them and motivate them to take the test. Awareness message is sent to motivate the patient, which includes information on various programs being held for cervical cancer, camps and awareness programs. When the patient comes for the next appointment they do not have to carry there reports or file. The doctor uploads and downloads the patient medical record in the system itself.

Registration of the patient is done by the hospital management system.

Here is the link to registration page <https://screenshot.net/58063bg> . The patient is registered which includes the patient personal information. In personal information the patient details are registered such has a name, mobile number, date of birth, age, weight, Aadhar card number, gender, address. All the detail gets stored in the database as the user clicks the "SUBMIT" button. If the user wants to cancel the registration, "CANCEL" button is used. When the "SUBMIT" button has pressed the list of the patient which are registered is shown below the registration form along with their basic detail. The list consists of patient name, mobile number, and address of the patient. If the new patient report shows the negative result then the user can delete that patient name from the list as the patient as no need of taking treatment.

The appointments are shown in the form of a list. Here is the link for appointment page <https://screenshot.net/wp4g7uw>. It consists of patient name, its appointment date, appointment time and the reason for which the appointment is scheduled. The user can easily get to know how many patients have the appointment on the current day and at what time.

The doctor does the treatment of the patient and the report is created. If the report is negative then the patient is free from the further treatment but if the patient report is positive then the patient has to attend regular treatment. The doctor then schedules the appointment of the patient for further treatment/test of the patient. Here is the link for creating appointments of the patients <https://screenshot.net/xqyl7ul>. Here doctor first searched the name of the patient has the patient is already registered. The doctor then fixed the appointment date and timing of the patient, along with these the doctor also mentions the reason for the appointment of the patient. The appointment is then stored in the database has the "SUBMIT" button is a click.

When the "SUBMIT" button is clicked the patient appointment detail is shown below the "SUBMIT" button in the form of a list. The list consists of the patient name, appointment date and appointment time. The doctor can also cancel the appointment of the patient by clicking the "X" cross sign.

The doctor scheduled the appointment of the patient has per the stages of the patient. If the patient has the last stage of cervical cancer then his appointment is fixed first. Similarly, every other appointment is fixed.

The doctor does the treatment of the patient and handover the reports to the patient. The patient has to carry their reports every time whenever the appointment is scheduled. So, to sort out these problems the user can scan the report of the patient and can store it in the system itself. Here is the link for adding report page <https://screenshot.net/lqom8ue>. This includes search name where the patient whose report has to be download is searched, report number which is used as a unique ID for the patient report and which can also help to search the patient by its report number and it contains the upload option through which we can upload the report of the patient in the system. The user first searches the patient by patient name or the report number and upload the patient report. The report gets stored in the database as the "SUBMIT" button is a click. The "CANCEL" button is used to cancel the event of uploading the file.

When the "SUBMIT" button has pressed the list of patients whose reports are uploaded is shown below the "SUBMIT" button. The list contains the patient name, type of the report, upload date and download button through which the user can download the patient report when needed. The doctor can also download the reports to know the patient health condition whenever the patient do their check-up. It is shown in these link <https://screenshot.net/w2kp7b4>.

The application also contains the dashboard which shows the total number of every event such as it shows the total number of patient registered, the total number of appointments which are scheduled and the total number of reports of the patients.

The patient receives a message from three days before the appointment which reminds them of the appointment. The patient also receives the awareness message or the camp message which are held for a cervical cancer patient and which includes some general information related to cervical cancer which increases their knowledge about cervical cancer. The patient also receives the call one day before the appointment which reminds them of the appointment and which help the user to confirm the patient's arrival.

5. CONCLUSION

Though cervical cancer is leading cancer among women in India, our study has shown that they are ignorant about this completely preventable disease. Hence, reminder reminds about the regular schedule for the screening test and will prevent the women from the painful death. Also, utilization of the services of media like television, newspaper, and radio can have a massive impact in improving the knowledge.

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