

# DESIGN MODULES FOR RETURNING PRENATAL AND NEONATAL SCREENING RESULTS ONLINE ON WEBSITE DITATBAMSINH.VN

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## **Abstract:**

**Background:** This study is aimed at (1) designing a system for the management, storage and sending of the results of prenatal and neonatal screening online, and (2) designing a search engine to find patients. **Materials and method:** Programing using PHP language was employed to store, query, and process data from the MySQL database management system and display the results on a website. **Results:** We designed four functions for administrators ((1) importing data from Excel files into MySQL, (2) editing and deleting patient information, (3) creating and assigning rights for users, and (4) uploading the neonatal screening result files) and four functions for users ((1) displaying a list of results, (2) previewing and printing the results, (3) downloading the neonatal screening result files, and (4) searching for patients). **Conclusion:** The modules was designed successfully and now it runs well.

**Key words:** Prenatal screening, neonatal srceening, getting results online

## **1. BACKGROUND**

The Center of Prenatal-Neonatal screening and diagnosis, based at Hue University of Medicine and Pharmacy, launched its operations in May, 2011, with the main tasks of prenatal & neonatal screening and diagnosis for 13 provinces and cities in the Central and Highland region. These operations are carried out under the framework of the national target program on Population-Family Planning for the improvement of population quality through the construction and expansion of prenatal-neonatal screening and diagnosis systems in the Central and Highland region.

The samples of prenatal & neonatal diagnosis are sent to the center for processing using EMS. After reception, testing and processing, the results are printed. The results must be sorted for return to provinces via post

or fax, or are transferred into PDF file and attached to emails. According to our survey, all screening centers in Hanoi and Ho Chi Minh return results by emailed PDF files. This method takes substantial time to process as the results must be sorted by province before being sent to recipients.

Ditatbamsinh.vn is the official website of the center. It is written in PHH language, runs on LINUX server and has been operating for two years. With the aim of optimizing the return process of test results, we decided to develop integrated modules for returning prenatal & neonatal screening results via ditatbamsinh.vn with two objectives:

- 1. Design a system for management, storage and return of screening results online for other provinces*
- 2. Design a search engine to find the patients.*

## 2. MATERIALS AND METHOD

### 2.1. Objectives

To develop programming using PHP language to store, query, and process data from the MySQL database management system and display the results on our website, enabling information to be directly updated using the fastest available method.

### 2.2. Research methods

#### 2.2.1. Design of MySQL database system

A database was installed relevant to each unit into a database tabular including columns: field name, data type & size and data connection part.

Tabular 1: User Management (Appendix)

Tabular 2: Prenatal screening results (Appendix)

Tabular 3: Neonatal screening results (Appendix)

Tabular 4: Management on uploading and downloading result files on neonatal screening (appendix)

#### 2.2.2. Design functions for the administrator

##### *a. Functions for importing data from Excel files into MySQL on website*

This function has been designed to operate by the following steps: connect to database on website, upload Excel file to server, read the data by row in Excel files, use function INSERT INTO to transfer data relevant to tabular structure designed in MySQL. Therefore, the value “0” is used for empty columns and as a default; this value is not displayed on the website.

##### *b. Functions for editing and deleting the information:*

The data QUERY command of PHP is used to retrieve information from MySQL and display it as a form for the edition on the website interface.

The UPDATE command is used to update the edited values in MySQL. Administrators use this function to edit incorrect information about patients on the website interface without deleting and importing information again from Excel files.

##### *c. Functions for creating and assigning authority for users*

In order to develop the module in an open way, we designed a function for creating and authorizing users in order to increase the numbers of users at hospitals and clinics in other provinces that send samples for screening. This function helps patients obtain results faster because hospitals and clinics can directly retrieve the results without waiting for a response from population agencies.

We designed forms for users on the user management tabular, with a login name and ID for each user. This ID is used to assign access authority for the retrieval of results.

##### *d. Functions for uploading neonatal screening result files*

This function is designed to upload the neonatal screening result Excel files to the website so that users in other provinces can download the file for statistical and management purpose on the numbers of children who have received screening.

This function has two tasks: uploading Excel files to the server and putting the address and described information into the tabular for file upload/download on MySQL, which enables the user to download information later.

#### 2.2.3. Design functions for users

##### *a. Functions for viewing updated results lists:*

Firstly, the system confirms if the viewer is an authentic user or not.

Basing on the ID of the users, the conditional command WHERE is used to filter the results

that do not belong to the user authority for display information on the website. We used the ORDER Command according to PID (Patient ID) to arrange the display of the latest patients.

We used two variables - \$offset and \$row\_pid\_list - to divide pages in the list.

#### ***b. Functions for previewing and result printing:***

After confirming the user's ID, we used the query function in PHP to get the data from the tabulars on MySQL under the authorization of the user. Document format tabs were used to create result display pages under the web form.

##### **+ Creating a printable page:**

This function is similar to the above result reviewing function with all the processes of checking user authorization, displaying information and test results. A printable page is opened by pop-up, is only displayed in the format of a results page of testing information and is ready to print by using the combination keys Ctrl-P.

#### ***c. Functions for downloading result files on neonatal screening***

After authentication of the user and display of Excel files uploaded by admin, we used the conditional command IF to check the link to the file. A download button will be displayed if the links are not empty.

#### ***2.2.4. Designing patient search engine on website***

Each user can only search the information of patients related to his field by using the \$mod\_name key. We used a code to authenticate if the user's name is relevant to \$mod\_name regulated in the patient data tabular.

Necessary information is inputted using a POST protocol form.

Query information according POST protocol will be queried into the database using the WHERE function in SQL in order to compare the inputted information to stored information in the patient data tabular.

If the information is relevant, the patient's code and a link to the patient information page will be displayed.

### **3. RESEARCH RESULTS**

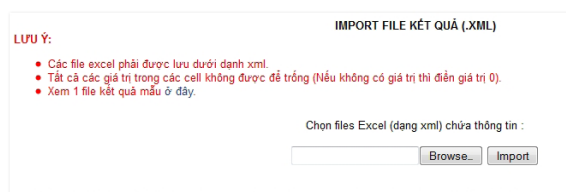
We were successful in designing two modules that meet our objectives and operate the website to serve the process of prenatal and neonatal screening at our center.

#### **3.1. Functions for administrators**

##### ***3.1.1. Functions for importing data in Excel files to MySQL***

The center's staff or the website administrator are responsible for fulfilling this function after creating or receiving the test results in Excel file format.

- Login using given account (admin or authority-relevant account)
- Upload Excel file containing information and screening results.
- The website will automatically process the information in the Excel file and import results relevant to each patient



**Picture 3.1.** Functions for importing Excel files in prenatal screening returning result module

### 3.1.2. Functions for editing and deleting information

An administration page displays the patient lists of all provinces. Administrators can edit incorrect information. In addition, administrators can delete or not allow a user's page to display.

Tổng cộng 157 kết quả sàng lọc sơ sinh

Họ và tên	Thuộc tỉnh/Phòng khám	Trạng thái	Đồng ý
(04-12-2011)	Quảng Trị	Cho phép xem	Xóa Sửa Tắt
(05-12-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tắt
(05-12-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tắt
(30-11-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tắt
(01-12-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tắt
(26-11-2011)	Bình Định	Cho phép xem	Xóa Sửa Tắt
(27-11-2011)	Đà Nẵng	Cho phép xem	Xóa Sửa Tắt
(26-11-2011)	Bình Định	Cho phép xem	Xóa Sửa Tắt

**Picture 3.2.** List of neonatal screening results with Delete/Edit/Log out functions

One webpage will be displayed after clicking the edit function. The administrator can delete, edit or change information relevant to the patient.

MÃ SỐ: PS17

**KẾT QUẢ SÀNG LỌC TRƯỚC SINH QUÝ I**

Ngày lấy mẫu: 2011-05-31 Ngày trả kết quả: 2011-06-02

Thai phụ: Tuổi: 36

Địa chỉ: Điện thoại: 01664775207

Bác sĩ chỉ định: Bác sĩ siêu âm:

Ngày sinh của mẹ		Dân tộc	Kinh
Chiều cao (cm)	158	Cân nặng (kg)	49
PARA	1011	Có thai	Tự nhiên
Hồ trợ sinh sản	Không	Sử dụng thuốc rụng trứng	Không
Hút thuốc	Không	Đái đường type I	Không
Tiền sử gia đình T21-T18-T13	không	Ngày siêu âm	2011-05-31
CRL (mm)	69	Tuổi thai theo CRL	13 tuần 1 ngày
Ngày sinh dự kiến	2011-12-05T00:00:00.000	Đơn / đa thai	Đơn thai
Độ mở đa gây (mm)	2.1	Xương mũi	Bình thường

PAPP-A 4.8 MOM 1062

FreeBeta hCG 89.5 MOM 2236

B-RISK 21 219 RISK 21 1189

B-RISK 18 548 RISK 18 10967

B-RISK 13 1717 RISK 13 34332

Lưu thay đổi

**Picture 3.3.** A demonstration on information edits function at prenatal screening result page

### 3.1.3. Functions for creating and assigning rights for users

With the aim of achieving the fastest updated result, this function is designed to allow administrators to add or remove users in order to expand the number of accounts that can access results. At present, we provide only one account for every population agency of each province to retrieve the neonatal screening results. However, this means that patients still cannot obtain their results as soon as they wish because the population agency gets the results first, then classifies the results by center, and later returns the final results to patients.

With this function, each center is provided with an account to log into the website. This account is associated with a definite ID (CID) and the results will be automatically classified according to CID to ensure that each center only has its own results and not of the others.

Thêm tỉnh/Phòng khám:

Username của Moderator:

Thêm tỉnh/Phòng khám

Thuộc tỉnh/Phòng khám:

Bình Thuận

Họ và tên:

Thêm mục con

**Picture 3.4.** Functions for creating and assigning rights for users

CID	TỈNH	USERNAME
1	Quảng Bình	quangbinh
2	Quảng Trị	quangtri
3	Thừa Thiên Huế	tthue
4	Đà Nẵng	danang
5	Quảng Nam	quangnam
6	Quảng Ngãi	quangngai
7	Bình Định	binhdinh
8	Khánh Hòa	khankho

**Picture 3.5.** List of accounts and created CID

### 3.1.4. Functions for uploading results files of neonatal screening

It is a feature of neonatal screening that a large proportion of results are negative. The results obtained after the screening process is input in an Excel file; the content includes a barcode, the concentration of G6PD, TSH and an evaluation of the screening result. This Excel file is uploaded to the website so that the other centers can download the file and refer to the barcode before announcing the result to patients. The information of those children who have positive or high-risk results must be adequately inputted. The import function has been added to create a viewing page and allow printing of the result as demonstrated in the above picture.

**Picture 3.6.** Functions for uploading result file on neonatal screening

## 3.2. Functions for users

The staff of the satellite centers will be provided with an account to log into the website to retrieve results. The **username** and **password** should be entered and the Enter key pressed.



**Picture 3.7.** How to login to the system

### 3.2.1. Functions for viewing updated results lists

After logging in successfully, users can access the **Test results** menu and choose **prenatal screening** or **neonatal screening**



**Picture 3.8.** Access to result return module on prenatal or neonatal screening



Prenatal screenings have five sections:

- Guide for printing test results
- Update list of test results
- Internal prenatal screening software of the first quarter
- Internal prenatal screening software of the second quarter
- Find information by name, barcode, etc













Neonatal screening has four sections:

- Guide on printing test results
- Update list of test results
- Download Excel file of neonatal test results
- Find information by name, barcode, etc

### 3.2.2. Functions for previewing and printing results

















After logging in successfully, a user can access the test results menu and choose prenatal screening or Neonatal screening, and click Update list on the test results menu to view the latest test results tabular of the patients.

**CÁC KẾT QUẢ XÉT NGHIỆM MỚI CẬP NHẬT**

Mã số	Thai phụ	Tuổi	Ngày lấy mẫu	Ngày trả kết quả	Xem KO
PS18	Nguyễn Thị Lan	28	01-06-2011	02-06-2011	
PS15	Nguyễn Thị Lan	32	31-05-2011	02-06-2011	
PS14	Nguyễn Thị Lan	33	31-05-2011	02-06-2011	
PS12	Nguyễn Thị Lan	26	31-05-2011	02-06-2011	
PS10	Nguyễn Thị Lan	26	26-05-2011	27-05-2011	
PS09	Nguyễn Thị Lan	26	25-05-2011	27-05-2011	
PS08	Nguyễn Thị Lan	18	24-05-2011	27-05-2011	
PS06	Nguyễn Thị Lan	40	23-05-2011	27-05-2011	
PS05	Nguyễn Thị Lan	24	23-05-2011	27-05-2011	
PS02	Nguyễn Thị Lan	31	19-05-2011	27-05-2011	
PS04	Nguyễn Thị Lan	43	23-05-2011	27-05-2011	
PS07	Nguyễn Thị Lan	41	24-05-2011	27-05-2011	

Picture 3.9. Update list on prenatal screening result

**CÁC KẾT QUẢ XÉT NGHIỆM MỚI CẬP NHẬT**

Barcode	Họ và tên mẹ (người đại diện)	Ngày sinh của trẻ	G6PD	TSH	
110002648	Nguyễn Thị Lan	16-09-2011	2.041	2.148	
110002650	Nguyễn Thị Lan	15-09-2011	1.999	2.8	
110002657	Nguyễn Thị Lan	16-09-2011	1.902	2.265	
110002659	Nguyễn Thị Lan	17-09-2011	1.898	1.133	
110002652	Nguyễn Thị Lan	15-09-2011	2.077	4.16	
110002668	Nguyễn Thị Lan	16-09-2011	2.161	2.181	
110002503	Nguyễn Thị Lan	15-09-2011	2.177	2.524	
110002502	Nguyễn Thị Lan	16-09-2011	2.021	6.362	
110002501	Nguyễn Thị Lan	10-09-2011	1.668	1.296	
110002653	Nguyễn Thị Lan	17-09-2011	1.475	1.73	
110002356	Nguyễn Thị Lan	09-09-2011	3.419	12.171	
110002352	Nguyễn Thị Lan	07-09-2011	1.73	3.216	
110002351	Nguyễn Thị Lan	07-09-2011	1.88	2.936	
110002375	Nguyễn Thị Lan	07-09-2011	1.994	3.202	
110002684	Nguyễn Thị Lan	23-08-2011	2.086	2.213	
110002345	Nguyễn Thị Lan	23-08-2011	1.685	1.736	

Picture 3.10. Update list on neonatal screening result

A user clicks the result view button if they want to view the result and clicks on the print button if they want to print the result.

THỪA THIÊN HUẾ

TÌM KIẾM

BỆNH VIỆN ĐẠI HỌC Y DƯỢC HUẾ

TRUNG TÂM SÀNG LỌC VÀ CHẨN ĐOÁN TRƯỚC SINH VÀ SƠ SINH

Số 41 - Nguyễn Huệ - Huế - Điện thoại: 054.3931910

MÃ SỐ: PS18

Tạo trang in kết quả xét nghiệm

KẾT QUẢ SÀNG LỌC TRƯỚC SINH QUÝ I

Ngày lấy mẫu:	01-06-2011	Ngày trả kết quả:	02-06-2011
Thai phụ:	<input type="text" value="Nguyễn Thị Huệ"/>	Tuổi:	28
Địa chỉ:	<input type="text" value="Thị trấn Phú Mỹ - thành phố Huế"/>	Số điện thoại:	098 <input type="text" value="123456789"/>
Bác sĩ chỉ định:	Võ Văn Đức	Bác sĩ siêu âm:	Võ Văn Đức

Ngày sinh của mẹ	: <input type="text" value="01-01-1980"/>	Dân tộc	: Kinh
Chiều cao (cm)	: 156	Cân nặng (kg)	: 52
PARA	: 0	Có thai	: Tự nhiên
Hỗ trợ sinh sản	: Không	Sử dụng thuốc rụng trứng	: Không
Hút thuốc	: Không	Đai đường type I	: Không
Tiền sử gia đình T21-T18-T13	: không	Ngày siêu âm	: 01-06-2011
CRL (mm)	: 62,2	Tuổi thai theo CRL	: 12 tuần 2 ngày
Ngày sinh dự kiến	: 12-12-2011	Đơn / đa thai	: Đơn thai
Độ mờ da gáy (mm)	: 1,3	Xương mũi	: Bình thường

KẾT QUẢ: TRONG GIỚI HẠN BÌNH THƯỜNG

■ PAPP-A: 3,52 IU/L (MOM: 0,984)

■ FreeBeta hCG: 66,7 IU/L (MOM: 1,55)

Picture 3.11. Preview page on prenatal screening result

TỈNH THỪA THIÊN HUẾ

TÌM KIẾM

BỆNH VIỆN ĐẠI HỌC Y DƯỢC HUẾ

TRUNG TÂM SÀNG LỌC VÀ CHẨN ĐOÁN TRƯỚC SINH VÀ SƠ SINH

Số 06 - Ngô Quyền, TP. Huế, ĐT :054.3931910

BARCODE 110002957

Tạo trang in kết quả xét nghiệm

KẾT QUẢ

SÀNG LỌC SƠ SINH BỆNH THIẾU NĂNG GIÁP BẨM SINH VÀ THIẾU MEN G6PD

THÔNG TIN BỆNH NHÂN

Họ và tên trẻ:  - Ngày sinh: 28-11-2011 - Giới tính: Nữ

Họ và tên mẹ hoặc người đại diện hợp pháp của trẻ:

Địa chỉ: QUẢNG LỢI - PHONG XUÂN - PHONG ĐIỀN - THỪA THIÊN HUẾ

Điện thoại:  - Di động:

ĐƠN VỊ LẤY MẪU

Họ và tên người lấy mẫu:

Đơn vị lấy mẫu: TTYT PHONG ĐIỀN

Picture 3.12. Preview page on neonatal screening result

### 3.2.3. Functions for downloading neonatal screening result files

Users can download Excel files on neonatal screening results and choose results displayed by testing date to download. Test results are inputted in Excel files and uploaded to the website.

Provinces/hospitals can download the results to compare them to each child's barcode and then return results to families.

Tên file	Chú thích
Kết quả XN ngày 20-09-2011	Kết quả XN của mẫu nhận từ ngày 13-09-2011 đến ngày 19-09-2011
Kết quả XN ngày 31-08-2011	Kết quả XN của mẫu nhận từ ngày 24-08-2011 đến ngày 29-08-2011
Kết quả XN ngày 24-08-2011	Kết quả XN của mẫu nhận từ ngày 15-08-2011 đến ngày 23-08-2011
Kết quả XN ngày 16-08-2011	Kết quả xét nghiệm của tất cả các trẻ đến ngày 16/08/2011

Tất cả có 4 file thuộc 1 Mục

**Picture 3.13.** File list on neonatal screening result

Click **Download** for the Excel file



**Picture 3.14.** Detailed information on test results

For the children whose have positive test results, users can access **Updated list of test results** to view or print the results. A user chooses results view to view the format of the results received.

### 3.3. Patient search engine

To facilitate patient searching, we designed a search engine that searches by full name and code in order to produce the fastest results for any patient

The search box can be found at two locations. The first is on the prenatal screening or neonatal screening page. The second one is at each preview page of the prenatal screening or neonatal screening results.



**Picture 3.15.** Two locations of search box

After typing the information into the search box and clicking enter, the results in both the prenatal screening module and neonatal screening module will be searched. All results related



to the search information will be displayed by individual section together with other information such as date of birth and barcode. The user can click the result that they want to view and the page of patient results will be displayed and is ready to print.

**Picture 3.16.** Search result page formatted by definite sections

## 4. DISCUSSION

### 4.1. Convenience

These two modules, which were integrated into our website ([ditabamsinh.vn](http://ditabamsinh.vn)), have been prior operated without any installation on stations. The number of steps has been reduced so that printed screening test results can be obtained in the fastest way. Screening software will provide risk parameters on the export of raw data in Excel files. These modules allow us to upload data in Excel file format and process the data; the results are automatically displayed and allow for the finding of thousands of patients at the same time.

Satellite centers do not have to store any information because the information is securely managed at the server of the website [ditatbamsinh.vn](http://ditatbamsinh.vn) and can be printed or reported at any time.

### 4.2. Accuracy

These modules do not interfere with processed information in the prenatal and neonatal screening software. Rather, they

are based on risk parameters and make comparisons to predefined risk thresholds to export results and conclusions by displaying forms designed for each kind of risk on the website.

### 4.3. Security and confidentiality

These modules, which are integrated into our website ([ditatbamsinh.vn](http://ditatbamsinh.vn)), are run on a Linux server provided by PA Vietnam. This is to ensure no damage to computers when carrying out installation at the station. If the server is out of order, PA Vietnam always keeps a reserved backup and restores the database after problems occur. Moreover, in order to ensure security, a technician will copy the data weekly.

Accounts with passwords are provided to ensure the confidentiality of information. Only account holders have the authority to view and create printed pages. Furthermore, in order to confirm the confidentiality of each patient's information, the modules only allow users to view and print the results of patients

that belong to their own center.

#### **4.4. Economization**

By running automatically, the modules help to save the time of staff who are responsible for returning results such as: classifying risk, saving results in files, printing via hard copy or PDF file, classifying results by satellite centers or provinces, sending results via postal services, email or fax to each satellite center.

The staff who are responsible for receiving results in each province or city are provided with an account to access their results. Users only access and perform some specific

operations before printing the results for the patients.

#### **5. CONCLUSION**

We come to two conclusions after a period of research and operation:

- We have successfully designed and efficiently operated a system for managing and storing test results to return online screening results to relevant provinces.

- We have successfully designed a patient search engine to ensure quick access to information.

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