

# 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:** Programming 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 were designed successfully and now it runs well.

**Key words:** Prenatal screening, neonatal screening, 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 date 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	Đóng ý
(04-12-2011)	Quảng Trị	Cho phép xem	Xóa Sửa Tất
(05-12-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tất
(05-12-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tất
(30-11-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tất
(01-12-2011)	Quảng Bình	Cho phép xem	Xóa Sửa Tất
(01-12-2011)	Bình Định	Cho phép xem	Xóa Sửa Tất
(26-11-2011)	Đà Nẵng	Cho phép xem	Xóa Sửa Tất
(27-11-2011)	Bình Định	Cho phép xem	Xóa Sửa Tất
(26-11-2011)			

**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: <input type="text"/>	Tuổi: 36	
Địa chỉ: <input type="text"/>	Điện thoại: 01664775207	
Bác sĩ chỉ định: <input type="text"/>	Bác sĩ siêu âm: <input type="text"/>	
Ngày sinh của mẹ	Dân tộc	Kinh
Chiều cao (cm)	Cân nặng (kg)	49
PARA	Có thai	Tự nhiên
Hỗ trợ sinh sản	Sử dụng thuốc rụng trứng	Không
Hút thuốc	Đai đeo type I	Không
Tiền sử gia đình T21-T18-T13	Ngày siêu âm	2011-05-31
CRL (mm)	Tuổi thai theo CRL	13
Ngày sinh dự kiến	Đơn / da thai	Đơn thai
Độ mờ da gáy (mm)	Xương mũi	Bình thường
PAPP-A	MOM	tuần
FreeBeta hCG	1062	ngày
B-RISK 21	2236	
B-RISK 18	1189	
B-RISK 13	10967	
	34332	

**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:	<input type="text"/>
Username của Moderator:	<input type="text"/>
<input type="button" value="Thêm tỉnh/Phòng khám"/>	
Thuộc tỉnh/Phòng khám:	<input type="button" value="Bình Thuận"/>
Họ và tên:	<input type="text"/>
<input type="button" value="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	khanhhoa

**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	Thái phụ	Tuổi	Ngày lấy mẫu	Ngày trả kết quả	Xem KQ	In KQ
PS18		28	01-06-2011	02-06-2011		
PS15		32	31-05-2011	02-06-2011		
PS14		33	31-05-2011	02-06-2011		
PS12		26	31-05-2011	02-06-2011		
PS10		26	26-05-2011	27-05-2011		
PS09		26	25-05-2011	27-05-2011		
PS08		18	24-05-2011	27-05-2011		
PS06		40	23-05-2011	27-05-2011		
PS05		24	23-05-2011	27-05-2011		
PS02		31	19-05-2011	27-05-2011		
PS04		43	23-05-2011	27-05-2011		
PS07		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		16-09-2011	2.041	2.148	
110002650		16-09-2011	1.998	2.8	
110002657		16-09-2011	1.902	2.265	
110002659		17-09-2011	1.898	1.133	
110002652		15-09-2011	2.077	4.16	
110002658		16-09-2011	2.161	2.181	
110002503		15-09-2011	2.177	2.524	
110002502		16-09-2011	2.021	6.362	
110002501		10-09-2011	1.668	1.296	
110002653		17-09-2011	1.475	1.73	
110002366		09-09-2011	3.419	12.171	
110002352		07-09-2011	1.73	3.216	
110002351		07-09-2011	1.88	2.936	
110002375		07-09-2011	1.994	3.202	
110002684		23-08-2011	2.086	2.213	
110002345		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.

THỦA THIÊN HUẾ

TÌM KIẾM Họ và tên, Code,...

**TẠO TRANG IN KẾT QUẢ XÉT NGHIỆM**

**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

**KẾT QUẢ SÀNG LỌC TRƯỚC SINH QUÝ I**

Ngày lấy mẫu:	01-06-2011	Ngày trả kết quả:	02-06-2011
Thái phụ:		Tuổi:	28
Địa chỉ:	Tỉnh Thừa Thiên - thành phố Huế	Số điện thoại:	098-XXXXXX
Bác sĩ chỉ định:	Võ Văn Đức	Bác sĩ siêu âm:	Võ Văn Đức
Ngày sinh của mẹ	: 01-01-1983	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	Đái 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 THỦA THIÊN HUẾ

TÌM KIẾM Họ và tên, Code,...

**TẠO TRANG IN KẾT QUẢ XÉT NGHIỆM**

**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

**KẾT QUẢ**  
**SÀNG LỌC SƠ SINH BỆNH THIẾU NĂNG GIÁP BẤM SINH**  
**VÀ THIẾU MEN G6PD**

**THÔNG TIN BỆNH NHÂN**

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

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

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

Điện thoại: [REDACTED] - Di động: [REDACTED]

**ĐƠN VỊ LẤY MẪU**

Họ và tên người lấy mẫu: [REDACTED]

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.

DANH SÁCH FILE KẾT QUẢ XÉT NGHIỆM XÉT CẬP NHẬT	
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

Năm 2011	
THÔNG TIN CHI TIẾT FILE KẾT QUẢ XÉT NGHIỆM	
Tên file:	Kết quả XN ngày 20-09-2011
Thông tin:	Kết quả XN của mẫu nhận từ ngày 13-09-2011 đến ngày 19-09-2011
	
<a href="#">Quay lại</a>   <a href="#">Trang đầu</a>   <a href="#">Lên trên</a>	

**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.

Tim kiem thong tin ket qua xet nghiem

Nhập thông tin tìm kiếm  
(Họ và tên, mã code, tên cha mẹ...)

Tìm kiếm tại: Nga

Tìm kiếm

▶ Ket qua tim kiem tai Thua Thien Hué ở dữ liệu Kết quả xét nghiệm Sàng lọc sơ sinh

NGA  
Ngày sinh: 2011-09-15  
BarCode : 110002652

NGA  
Ngày sinh: 2011-10-14  
BarCode : 110002557

▶ Ket qua tim kiem tai Thua Thien Hué ở dữ liệu Kết quả xét nghiệm Sàng lọc trước sinh

NGA  
Ngày sinh: 11-09-1985  
Mã số : PS12

**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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