

# **E-Medical Checkup at the Naval Health Departments and Hospitals in Developing Countries**

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**Abstract:** In any country, the military aspect is an indispensable force in maintaining the country's survival. Individuals who join the military are those who have undergone various stages of selection. Health factors are important issues and should be carefully considered. One way to do so is to ensure the health of the military personnel via regular medical checkup. The implementation of medical checkup, however, would require an information system that supports, accelerates, simplifies, and improves the result accuracy. This study describes an information system that was developed to assist the implementation of medical checkup. The proposed system was capable of fulfilling the need for a Navy medical checkup system in developing countries despite limited budgets.

**Keywords:** Medical checkup, Electronic Health Record, EHR, Computerized Physician Order Entry, CPOE

## **1 Introduction**

An example of navy medical checkup system is that of the Indonesian Navy, in which two parties are interconnected, the Department of Health and Naval Hospital. Routine medical checkup is performed each year or as needed by the personnel. However, the current process of medical checkup still utilizes a manual process, which involves a lot of complicated bureaucratic processes. This in turn increases cost as well as various problems due to inaccuracies in the medical records.

The administration of health services in hospitals begins with a medical appointment, during which the physician documents the patient's physical record on paper forms. The data from these forms are then entered into a computer system to establish the patient's medical record. These records could then be distributed to various parties that request such records and used for documentation by the Department of Health or the hospital. Based on the health examination result, the physicians can then determine whether or not a navy personnel requires treatment. However, the absence of an integrated system between the Department of Health and hospitals results in an inefficient coordination of monitoring the health of the navy personnel. Additionally, the determination of a health condition is often done subjectively by the physicians rather than based on established medical standards.

Hence, there needs to be an information system that can meet the necessity for linking the database of the Department of Health and hospitals. Based on literature review, the system can incorporate some previously used concepts; among them are EHR (Electronic Health Record), CPOE (Computerized Physician Order Entry), and health portals. EHR is a system that provides physicians and other staff with an online access to patient data and decision support. Electronic Healthcare Record (EHCR) is a record of medical data in the form of text, numeric, graphics, audio, and video. EHCR compliance requirements are influenced by the ability of a healthcare organization to build an integrated access [1]. CPOE is a part of the HER, which requires the physicians, nurses, and other specialists to follow the procedure menus in order to run and perform a test, procedure, and treatment on patients [2]. Thus, the process can be standardized to reduce errors. Laflamme, Piotraszek, and Rajadhyex [2] also stated that with automation and standardized information in the healthcare field, organizations can provide efficient procedures, in which medical data can be managed transparently, and clear guidelines for procedures and tests are maintained. With these improvements, excess paperwork, redundant medical care, and treatment error can be greatly reduced, thereby improving the health care quality[3].

In order to implement CPOE and EHR concepts, an integrated database is required, in which the Department of Health and hospitals could enter the personnel's medical records, either as a single database in a data warehouse or as a data mart [4]; this would result in standard procedures to determine the health status of a patient. Additionally, the medical staff requires a health related portal that is user-friendly [5], which could be a stand-alone system, a local area network or a wide area network [6]. With the portal, the results can be entered and health status can be determined automatically, in accordance with the standards and procedures have been established. Thus, an increase in medical procedure efficiency and accuracy, as well as a reduction in cost and bureaucratic work, is expected.

## 2 Problem Formulation

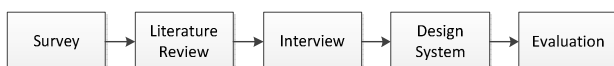
Due to manual processing, various problems occur in the navy medical checkup [7,8]. Some issues are in regards to the excessive and redundant documentation, along with the lack of standardization of the personnel's health status determination procedures. Other problems are related to inaccuracies of manually inputting medical records and the long delay in generating and maintaining manual medical records. Then, of course, there is lack of integration between hospitals and the Department of Health, resulting in an ineffective monitoring of health personnel. Therefore, the core of the problem is the quest to implement a computerized and integrated information system for medical checkup between Navy hospitals and the Department of Health.

Hopefully, the computerized and integrated system can solve most of the existing problems and improve the efficiency of existing infrastructure.

### 2.1 Methodology

To resolve the aforementioned problems, a step-by-step methodology is applied:

Figure 1. Methodological Steps



The first step taken was to conduct surveys on the Department of Health and hospitals in order to assess the current medical checkup procedure. Then, the literature review was performed in order to investigate medical checkup systems that have been designed by previous studies, which then served the benchmark for subsequent system design.

Interviews were also performed to garner the views and opinions of the medical staff and health officials on the current existing system.

Based on both data obtained and literature review, a system of computerized and integrated medical record database was designed. The final step was to evaluate the design based on its accordance with the literature review conducted, and its ability to resolve the current system's setbacks.

## 3 Problem Solution

Based on the implemented methodology (Figure 1) and the identified problems, the following system is proposed. By using the existing portal, patient mobile phone information can be used with the supervision of the head section [9,10]. Subsequently, the Department of Health staff and hospitals can easily generate and send notifications regarding upcoming medical appointments (Figure 2), thereby reducing the frequency of missed appointments by the personnel. During examination, the officer or doctor can immediately update a patient's file with the recently collected medical results through the portal (Figure 7). A list of general symptoms and diagnoses were provided in the form of options, which could then be selected using the check box system. This would then accelerate data entry process. However, a description box is also included if additional diagnosis is necessary. Through these portals, health status and its corresponding treatment can be immediately calculated by the system, based on the data entered by physicians. The results of medical checkups are also automatically saved in a database of medical records.

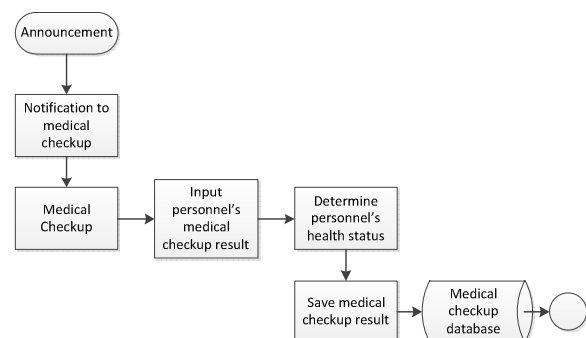


Figure 2. General System for Medical Checkup

Furthermore, the health status result can be known if the person needs treatment (Figure 3). If the necessary treatment required, the person is to be notified, and details of treatments can be seen in the portal.

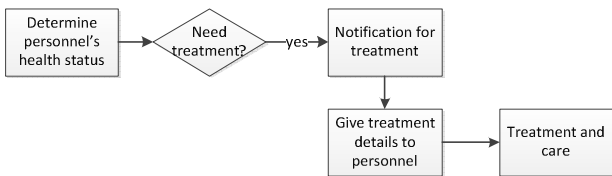


Figure 3. Treatment and Care

The personnel’s medical record would then be updated, according to the health status post treatment (Figure 4). Based on the new health status, it would be determined whether a follow-up treatment is necessary; if it still needed, the patients would be notified again for further treatment until their health status shows no need for further treatment. Thus, the health of the personnel can be monitored properly, leading to better performance of duties.

With the medical checkup system above, the Department of Health or hospital can also use available examination tools, which would lead to a maximally updated inventory on available medical checkup equipments.

The database server also contains the data or information that can be processed directly into the system, including information from medical devices that can be linked with this information system [10]. This would offer a solution that would maximize the existing infrastructure while also avoiding the need to purchase new equipment with high cost.

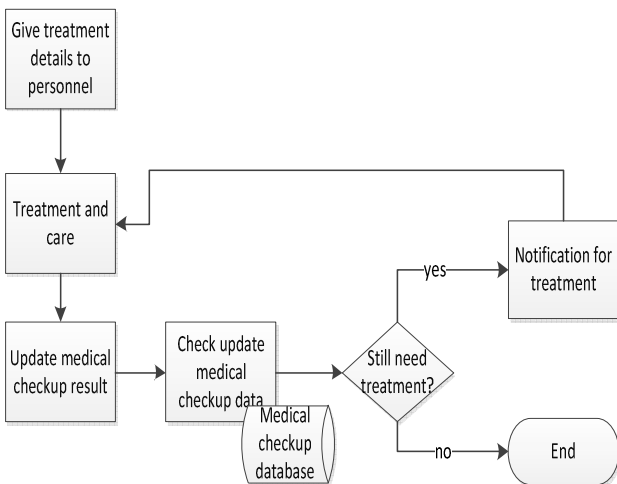


Figure 4. Controlling Health Status of Personnel

Notifications are sent in the form of short messages on mobile devices and through the portal personnel (Figure 5). If the personnel does not attend a medical appointment, a second notification via short messages and portal to the personnel would be sent. If the personnel then is still absent for treatment and rescheduling, then a third

notification would be sent to personnel as well as the supervisor of personnel’s work unit.

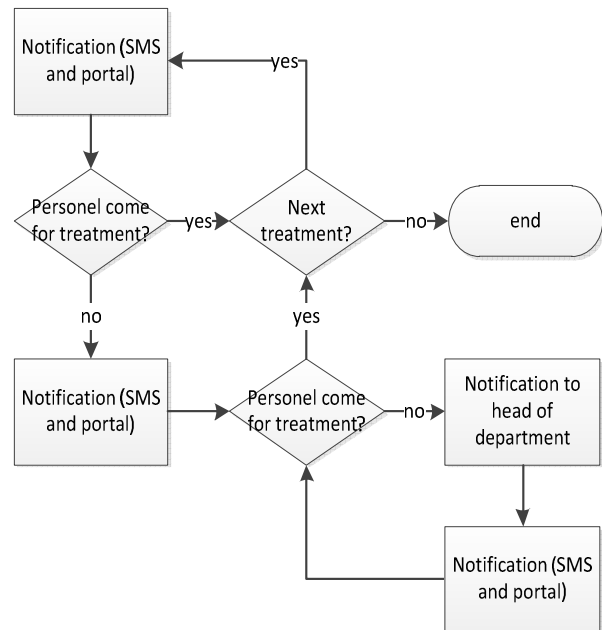


Figure 5. Alert Management System

The implementation of the system for special forces personnel, such as warships members, divers, marines and frogmen corps, must be carried out in more comprehensive medical checkups (Figure 6). But this applies to personnel with good health status in general medical checkups. It is necessary to determine the feasibility of their health condition in the execution of a military operation. Because in each execution of operation, there is always chain of command function that is supported by troops with excellent level of health in order to carry out their duties optimally and always ready to face all conditions in the area of operation [11]. Health testing includes routine medical checkups administered routinely and coupled with a more intensive physical examination, such as the body mass index (anthropometry), pulmonary (spirometry), heart (ergometry), the strength of the hands and feet (dinamometry), hearing (audiometry), and respiratory / oxygen tolerance test (OTT).

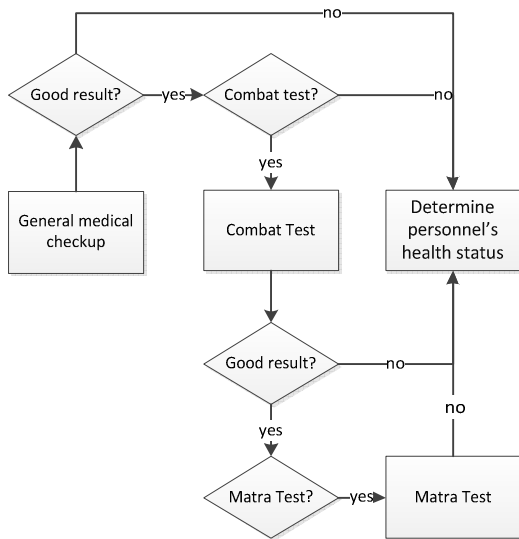


Figure 6. Combat Test and Matra Capability

Matra test is an examination on the capabilities of a personnel who joined in the special forces but also have expertise in the navy. Through the same portal, data from the tested capabilities would be incorporated into the database of medical checkups, so it can be processed as a report. Below is an example of a portal that would be used:

Figure 7. Medical Checkup Portal

With one of these portals (Figure 7), personnel and health officers can create and print the reports related to a medical checkup in accordance with the access provided. By using existing systems and portals, health monitoring personnel can be more efficient. In addition, all modules are password-protected such that user access is limited only to a predetermined modules [8]. In one form of reports, the officer can find the personnel who do not perform advanced health care, personnel who have a schedule of further treatments, as well as the

personnel who do not perform medical checkups (Figure 8).

Figure 8. Medical Checkup Portal-Report and Notification

The medical staff could also easily find personnel with poor health condition, further categorized based on those are in the process of a treatment and those who are not receiving medical attention; this would allow for the creation of a list of people to be notified. Thus, the health conditions of personnel are expected to improve.

With this system, all procedures are standardized in order to accurately determine the health status of the personnel. The medical records would be integrated, leading to the reduction of unnecessary documents and the improvement of the medical checkup procedure efficiency.

## 4 Conclusion

From the discussions above, it can be theorized that the use of information systems technology can help improve the efficiency of the process by which the Department of Health and hospitals perform the personnel's medical checkups. Implementation of an information system should not require a high investment cost, as long as the information system can be aligned with the organizational needs.

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