

IMPACT OF DATA WAREHOUSE ARCHITECTURE ON COVID-19 CONTROL

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ABSTRACT

This thesis presents a study about a data warehouse architecture model for the Data of patients and Their health. The study combines two areas: health care and information systems areas. It was conducted using two research methodologies: system development and case study of the Data of patients and their health. The model aims at integrating data from different sources in the Data of patients and their health. This research is a contribution to the current process of data and information integration in the Data of patients and their health. Integration of information and data warehouse technology are tools that offer resources to obtain managerial information needed to establish control over management process. Data warehousing aims at providing, managing and exploiting a set of integrated data for decision support within an organization.

Keywords: *Clinical Data Warehouse, Data Integration, Data Warehousing, Data Design, Data Warehouse Architecture.*

Introduction

There are relatively few institutions that have developed clinical data warehouses, containing patient data from the point of care. Because of the various care practices, data types and definitions, and the perceived incompleteness of clinical information systems, the development of a clinical data warehouse is a challenge. The world largest, fast growing and most information are available in the health care industry. In health care industry data may be recorded as doctor's name, patient's name, patient's record, individual patient report, physician order entry, doctor's decision support system, medicine. Most of the health care centers are still stand along, they are not communicating with other health care center, and they don't share their documents with others.

I am going to store corona patient's data in data warehouse. At first the death rate was very high because no country was ready to avoid such a disaster, neither were there so many beds in the hospitals nor ventilators. As a result there is a huge loss of life and money. In this health care data warehouse, doctors can share patient record to others; they can take decision from others. Most of the health care center designs their patient record in individual group but in my design group are created based on disease i.e. same disease patients are in the same group. This work is based on the Corona disease, the cost of treatment, treatment using drug and vaccine, treatment at hospitals, isolation at home, and death rate.

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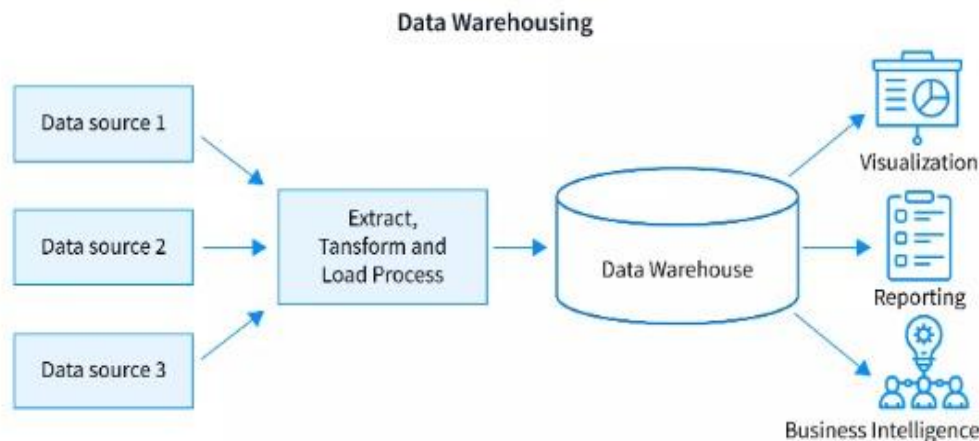
Data Warehouse

First of all we should study about Data warehouse. Data warehousing is the only viable solution for providing strategic information, it is a simple concept for information delivery. Data warehouse provides an integrated and total view of the enterprise to make the enterprise's current and historical information easily available for decision making. It also presents a flexible and interactive source of strategic information. It is an ideal environment for data analysis and decision support. It is fully user-driven, fluid, flexible, interactive, subject oriented, integrated, and non-volatile and time variant collection of data in support of management's decisions. Architecture is the proper arrangement of the all software and hardware components. As per requirements of organization arrange those building blocks in a certain way that gives maximum benefit. Just like any software development project, data warehouse also follow a set of steps to ensure that a working system is delivered on time and to ensure that all user requirement has been fully captures by the design.

Data warehousing is a process requiring a set of hardware and software components that can be used to better analyze the massive amounts of data that organizations, companies and research disciplines are accumulating to make better operational and/or strategic decisions. The data warehousing process does not consist of just adding data to the DW, but also requires the architecture and tools to collect, query, analyze and present information. "Data warehousing is a process, not a product, for assembling and managing data from various sources for the purpose of gaining a single, detailed view of part or all of a business".

Data warehousing is the only viable solution for providing strategic information, it is a simple concept for information delivery. It also presents a flexible and interactive source of strategic information.

Figure: Overview of our approach.



Data warehouse architecture

A healthcare data warehouse is a centralized repository for healthcare organization's data retrieved from disparate sources, processed and structured for analytical querying and reporting. A DWH can help improve clinical outcomes, optimize staff management and procurement, reduce operating costs.

Three Types of Data Architecture

They are:

- **Conceptual Data Model:** This is high-level data concepts and their relationships.
- **Logical Data Model:** This is the recording of data requirements and structural business process regulations.
- **Physical Data Model:** This is the physical implementation of data models, such as message formats and file structures.

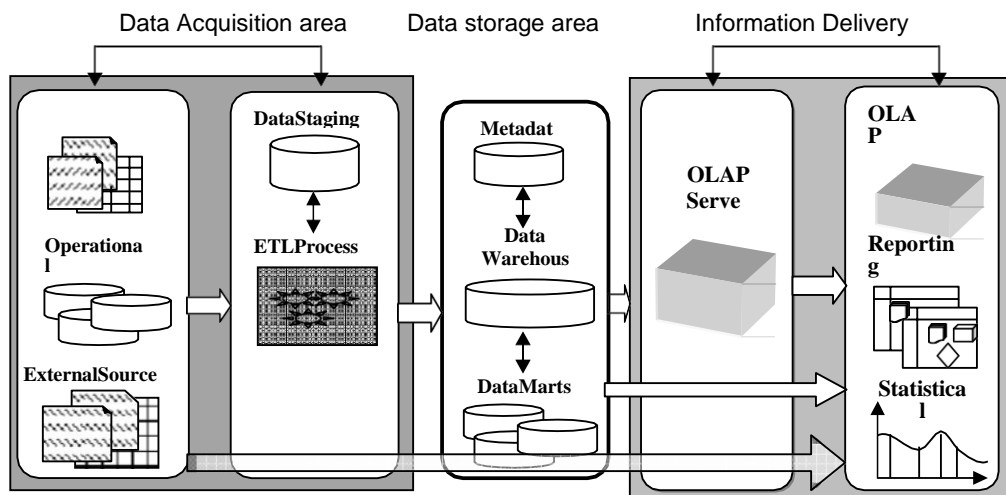


Figure: Data Warehouse Architecture

Review of Literature

A literature review surveys books, scholarly articles, and any other sources relevant to a particular issue, area of research, or theory, and by so doing, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated. Literature reviews are designed to provide an overview of sources you have explored while researching a particular topic and to demonstrate to your readers how your research fits within a larger field of study.

Literature reviews aim to answer focused questions to: inform professionals and patients of the best available evidence when making healthcare decisions; influence policy; and identify future research priorities.

Objectives

- To design a module for treatment which have higher recovery.
- To develop a module to determine the cost of the treatment.
- To analyse the treatment type according to patient health.
- To design a platform for user past health details.

To enhance the Medical knowledge and to study the pattern of disease in local perspective. The hospital provides the general medical care encompassing all the departments like Medicine, Surgery, Gynecology, Pediatrics, Burn and plastics and others etc.

Objectives of health systems are:

- Improving the health of the population they serve.
- Responding to people's expectations.
- Providing financial protection against the costs of ill-health.

Need of the Study

Pursuing a hospital administration degree can lead to advancement into higher healthcare management roles. Diverse career paths within health services administration, such as director of managed care, pharmaceutical project manager, clinical manager, and nursing home administrator, are open to exploration.

The IT department of a hospital is not only responsible for managing clinical software and the other processes that help administrative staff to keep patient records and admissions systems ticking along, they also have an important role to play in ensuring medical wards, operating rooms, labor and delivery suites and emergency departments run smoothly.

With the help of this study doctors can share their data with each other and with the help of data warehouse they will be able to take particular decision.

The need of this study was needed so that in future if the pandemic like corona comes again, then we know in advance that which treatment can reduce the death rate.

It should be also in the record of the doctors which type of patient is to be given which treatment. For example, which treatment is to be given to the patients of diabetes, heart patients and normal patients.

Research Methodology

Methodology discusses the research framework for this study. The various datasets were taken through primary data as well as secondary data. The primary data were taken from PHCs of district Hisar, Haryana, India and Secondary data to be collected from various sources such as:

- The research papers published by experts.
- Government of Haryana publications.
- Website of Ministry of Health. Data collected from these databases consist of diagnosis data with patient’s medical and personal information of last 2 years.

Multiple Structured Query Language (SQL) queries were run to create these datasets. For purposes of this study, a sample of 2-year dataset was created in order to mine for knowledge discovery. Attributes that describe each entity with appropriate relationship are then fed into a data warehouse, which is designed using star schema.

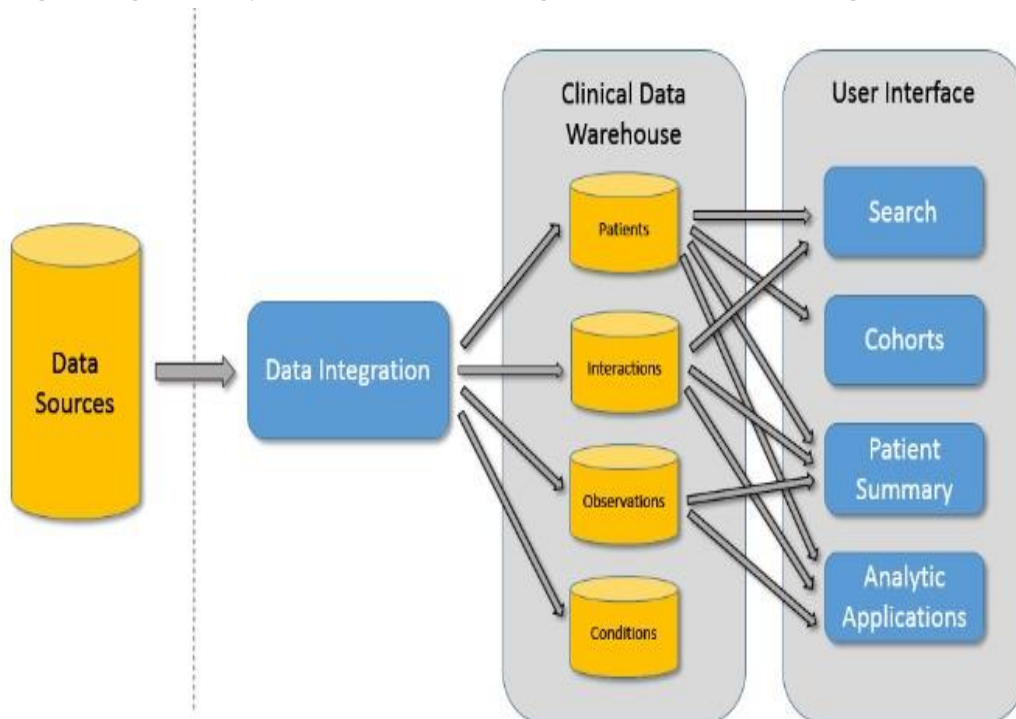
Decision Support System (DSS)

The result we get, used for making decisions. DSS provides a systematic method for decision-making that enables users to examine multiple views of the data that are generated using knowledge about the environment and decision problem.

Clinical Decision Support System

A clinical decision support system (CDSS) is intended to improve healthcare delivery by enhancing medical decisions with targeted clinical knowledge, patient information, and other health information.

Fig. 1: Diagram of key interactions in knowledge-based and non-knowledge based CDSS.



Purposed Work Plan

- A Work Plan is a schedule, chart or graph that summarizes the different components of a research project and how they will be implemented in a coherent way within a specific time-span.

Year I

In this year the following work has been done:

- Fulfil the coursework for Research.
- Detailed assignments of different subjects related to the study problems and subjects of the Coursework.
- Complete the exam for coursework.
- Doing the introductory study of the literature related to the healthcare data warehouse system for different Covid-19.
- Detailed analysis and preparation of the literature review related to the subject.

Year II

In this year the following work has been done:

- Submit a research Data Warehouse Architecture Covid-19.
- Presentation of Data Warehouse Architecture Covid-19 in front of Doctoral Research Committee.
- Creating a data warehouse.
- Collecting data of Corona patients from various PHCs.

Year III

In this year the following work has been done:

- Exploration and the analyses of the result to finalise the conclusion.
- Preparing the final documentation.
- In the form of the thesis, apply the research work and verify the plagiarism.
- Deliver pre-thesis viva and, if any, add modifications.
Final viva in order to protect the research work conducted.

Using the Code

Coding

```
<?php
session_start();
error_reporting(0);
include('includes/config.php');
if(strlen($_SESSION['alogin'])=="") {
    header("Location: index.php"); }
else{
    ?>
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
<meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1">
<title>Hospital Management System | Report</title>
<link rel="stylesheet" href="css/bootstrap.min.css" media="screen" >
<link rel="stylesheet" href="css/font-awesome.min.css" media="screen" >
```

```

<link rel="stylesheet" href="css/animate-css/animate.min.css" media="screen" >
<link rel="stylesheet" href="css/lobipanel/lobipanel.min.css" media="screen" >
<link rel="stylesheet" href="css/toastr/toastr.min.css" media="screen" >
<link rel="stylesheet" href="css/icheck/skins/line/blue.css" >
<link rel="stylesheet" href="css/icheck/skins/line/red.css" >
<link rel="stylesheet" href="css/icheck/skins/line/green.css" >
<link rel="stylesheet" href="css/main.css" media="screen" >
<link rel="icon" href="images/hospitalbg.jpg" sizes="32x32" />
<script src="js/modernizr/modernizr.min.js"></script>
</head>
<body class="top-navbar-fixed">
<div class="main-wrapper">
<?php include('includes/topbar.php');?>
<div class="content-wrapper">
<div class="content-container">
<h2 class="title">Report</h2>
<span class="name">Regd Users</span>
<span class="name">Patients Condition</span>
<span class="name">Total Hospital listed</span>
<span class="name"> Declared Final Treatment</span>
<section class="section">
<div class="container-fluid">
<div class="row">
<!-- /.col-lg-3 col-md-3 col-sm-6 col-xs-12 -->
<div class="col-lg-2 col-md-2 col-sm-6 col-xs-12">
<a class="dashboard-stat bg-primary" href="manage-students.php">
<p>When should a COVID-19 patient take tocilizumab ?</p>
<?php
$sql1 ="SELECT marks from tbresult where SubjectId = 'When should a COVID-19 patient take
tocilizumab?' AND marks=Tocilizumab is an immunosuppressive drug used to treat rheumatoid arthritis
and systemic juvenile idiopathic arthritis - a severe form of arthritis. This drug should be given only when
a COVID-19 patient's condition worsens despite other treatments like steroids, anticoagulants, etc.'";
$query1 = $dbh -> prepare($sql1);
$query1->execute();
$results1=$query1->fetchAll(PDO::FETCH_OBJ);
$totalstudents=$query1->rowCount();
?>
<span class="number counter"><?php echo htmlentities($totalstudents);?></span>
<span class="name">Patients Condition 6</span>
<p>Stopping the spreadstarts with you (Precautions), Wear a mask., Clean your hands., Maintain safe
distance., Get vaccinated.</p>
<span class="bg-icon"><i class="fa fa-users"></i></span></a>
<!-- /.dashboard-stat --> </div>
<!-- ===== COMMON JS FILES ===== -->
<script src="js/jquery/jquery-2.2.4.min.js"></script>
<script src="js/jquery-ui/jquery-ui.min.js"></script>
<script src="js/bootstrap/bootstrap.min.js"></script>

```

```

<script src="js/pace/pace.min.js"></script>
<script src="js/lobipanel/lobipanel.min.js"></script>
<script src="js/iscroll/iscroll.js"></script>
<!-- ===== PAGE JS FILES ===== -->
<script src="js/prism/prism.js"></script>
<script src="js/waypoint/waypoints.min.js"></script>
<script src="js/counterUp/jquery.counterup.min.js"></script>
<script src="js/amcharts/amcharts.js"></script>
<script src="js/amcharts/serial.js"></script>
<script src="js/amcharts/plugins/export/export.min.js"></script>
<link rel="stylesheet" href="js/amcharts/plugins/export/export.css" type="text/css" media="all" />
<script src="js/amcharts/themes/light.js"></script>
<script src="js/toastr/toastr.min.js"></script>
<script src="js/ichack/ichack.min.js"></script>
<!-- ===== THEME JS ===== -->
<script src="js/main.js"></script>
<script src="js/production-chart.js"></script>
<script src="js/traffic-chart.js"></script>
<script src="js/task-list.js"></script>
    // Welcome notification
    toastr.options = {
        "closeButton": true,
        "debug": false,
        "newestOnTop": false,
        "progressBar": false,
        "positionClass": "toast-top-right",
        "preventDuplicates": false,
        "onclick": null,
        "showDuration": "300",
        "hideDuration": "1000",
        "timeOut": "5000",
        "extendedTimeOut": "1000",
        "showEasing": "swing",
        "hideEasing": "linear",
        "showMethod": "fadeIn",
        "hideMethod": "fadeOut" }
    toastr["success"]("Hospital Management System!");    });
</script>
</body>
</html>
<?php } ?>

```

This Out Put Of Coding

#	Patients Condition Name	Patients Condition Code	Creation Date	Updation Date	Action
1	When should a COVID-19 patient take tocilizumab?	(Extreme Serious Patients) Condition 1.	2020-10-29 09:30:00		
2	What medications can doctors use for patients diagnosed with COVID-19?	(Serious Patients) Condition 2.	2020-10-29 09:30:17		
3	What about favipiravir and ivermectin? Are they safe and effective for treating COVID-19?	(Not Very Serious) condition 3	2020-10-29 09:47:34		
4	Many people with COVID-19 may have (mild illness)and can be treated with supportive care	Condition 4	2022-11-29 06:43:52		
5	During this time, remember to take care of yourself and manage your stress. (Covid Stress Management	Condition 5	2022-11-29 06:44:01		
6	Stopping the spreadstarts with you (Precautions)	Condition 6	2022-11-29 06:44:23		

#	Hospital Name	Hospital Name Numeric	Specialisation	Creation Date
1	Hisar Best Hospital, Hisar Haryana, India Pincode: 125001	100	COVID	2020-10-22 05:11:17
2	Bhiwani Hospital, Bhiwani Haryana, India Pincode 125125	101	COVID	2022-11-29 07:02:19
3	Sukhda Hospital Hisar	5	Lungs	2022-12-01 09:06:43
4	Bharat Multispeciality Hospital	3	Multi	2022-12-01 09:08:13
5	Jindal Multispeciality Hospital	115	Multi	2022-12-01 12:12:12
6	Hospital 1	20	COVID	2023-06-28 07:01:26
7	Hospital 2	12	COVID	2023-06-28 07:01:43
8	Hospital 3	10	COVID	2023-06-28 07:01:53
9	Hospital 4	10	COVID	2023-06-28 07:02:10
10	Hospital 5	12	COVID	2023-06-28 07:02:17

Limitations of the Study

Interventions may be unavailable, their harms may exceed benefits, or evidence may incorrectly suggest more benefit than harm because study results reflect biases and are not trustworthy.

- **Such Problems Include:** Heavy software development, implementation and upgrade costs. Difficulty switching from manual processes because both the staff and patients are accustomed to manual processes and are therefore unable to deal with the new method quickly.
- The study can only be viewed as a preliminary study and more follow up tracing investigations at different stages need to be conducted in order to monitor the continuing impact of the pandemic and the effectiveness of public policies and firms responses.
- This study focuses on Haryana (India), which was among one of the country to recover from this pandemic.
- The outcome of research based on data provided by the respondents/ secondary Resources may not be true representation of the population.
- The study is limited to only Covid-19 patients and hence the results may not be generalised for all disease.
- The quality and authenticity of data provided by secondary resources/ respondents may not be true.

No study is perfect, no matter how elegant its design may be, and many journals require authors to write a section at the end of the discussion about the limitations of their study. For some studies, these limitations will be obvious: small sample size, multiple comparisons without corrections, observational design and risk for confounding. For other designs, the limitations may be less obvious, but you'll still need to list them.

Scope of the Study

We can only work in hospitals after completing this course. But it's not 100% true. The healthcare field is such a vast field in growth at present. You can find various opportunities. One main area is hospital where you can work in administration department. Again there are many fields in hospital. You can work as a floor administrator, or in hospital departments heading or supporting operations, quality, marketing, finance, purchase, HR and logistics. Actually you learn all major management subjects in this course. This knowledge helps to enhance the efficiency of the hospital and increasing the productivity.

Healthcare consultancy is one of the fields which involves in playing an advisory role to the hospital to improvise the care and service. It is one of the booming field. The role will be helping the hospitals to expand, stay updated with technology and helping them to grow. If someone is interested to set up a hospital a healthcare consultant can help from scratch like financial planning, feasibility analysis, architectural planning, branding, equipment planning, operation and human resource planning.

There are huge opportunities in IT sectors also. The role will be a business consultant, playing a mediator role between the software developers and the hospital.

Likewise, we can support any healthcare company like biomedical companies, pharm company in managerial perspective. The managerial skills help to set everything right. So opportunities for healthcare management is huge.

PhD Thesis Questionnaire

Hospital Information	
Name of Hospital	
Contact number of Hospital	
Location of Hospital	
Number of Beds	
Area of Specialization	
Doctors Information	
Name of Doctor	
Contact number	
Education	
Specialization	
Patient Information	
Name of Patient	
Contact Number	
Address of Patient	
Age	
Weight	
Covid-19 Symptoms during OPD	
Date of hospitalization for Covid-19 Treatment	
About Treatment	
Initial Precaution taken	
Initial Treatment Given	
How many days Patient was admitted	
Major Medicine Given	
Whether Oxygen Given to the patient	
If oxygen given then how many hours	
Blood Pressure during Hospitalized	
RTPCR	
Oxygen Level	
CVC Details	
X-Ray Details	
Sputum Test Details	
Most Successful Treatment	

About Treatment

- **Extreme Serious Patients:** Remdesivir, steroids, Tocilizumab, Favipiravir, Ivermectin & HFNC oxygen.
- **Serious Patients:** Azithromycin + Cetirizine + Paracetamol & HFNC oxygen.
- **Normal COVID Infection:** Azithromycin +Cetirizine+ Paracetamol and Kadha.
- **Mild illness:** Cough Syrup + Paracetamol, COVID Stress Management.
- COVID Stress Management - Eat healthy meals, Get enough sleep, Get physical activity, deep breathing, stretching and meditation.
- **Precautions:** Wear a Mask, Clean your hands, Maintain safe distance, And Get vaccinated.

Conclusion

The COVID-19 pandemic demonstrates that the world remains vulnerable to public health emergencies with significant health and other socio-economic impacts. The pandemic takes variable shapes and forms across regions and countries around the world. The pandemic has impacted countries with inadequate governance of the epidemic, fragmentation of their health systems and higher socio-economic inequities more than others. We argue that adequate response to public health emergencies requires that countries develop and implement a context-specific national strategy, enhance governance of public health emergency, build the capacity of their health systems, minimize fragmentation, and tackle socio-economic inequities. This is possible through a PHC approach that provides universal access to good-quality health services through empowered communities and multi-sectorial policy and action for health development. The pandemic has affected every corner of the world; it has demonstrated that “no country is safe unless other countries are safe”. This should be a call for a strong global health system based on the values of justice and capabilities for health.

Healthcare technology refers to any IT tools or software designed to boost hospital and administrative productivity, give new insights into medicines and treatments, or improve the overall quality of healthcare provided. Everyone needs to be well informed and concerned about the quality of care. Everyone means patients and their families, consumer agents and advocates, health professionals, administrators of health plans and facilities, purchasers of health care services, and policymakers at all levels.

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