



In association with
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Management Studies FZE

Informatics In Health Care

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Executive summary

Health informatics in the medical field is the intersection of information science, computer science, and health care. This field deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. Health informatics specialists analyse healthcare data and optimize the delivery of healthcare services in collaboration with healthcare providers. They gather pertinent healthcare data, develop effective information systems and procedures, and supply healthcare providers with access to shared information health and biomedicine.

The three main aspects of health informatics are **healthcare, informatics, and software**. Security are solutions and tools which may be utilized to implement security policies at different levels of health organization. There are four principles of health informatics: For convenience, we grouped the principles into four stages of HIS development and use: **(1) design, (2) data collection, (3) data storage, and (4) data use**. The Skills needed in health informatics specialists to work with and analyse complex data are numerous including but not limited to are Communication Skills, curiosity and drive, problem solving, ethics, computer programming and data analysis. Health informatics, which is also called health information systems, relies on information technology. Workers in the field organize and analyse health records to improve healthcare outcomes. Those workers also develop methods to gather, analyse, and implement patient solutions using existing resources and devices. A few examples include **patient portals, electronic medical records (EMRs), telehealth, healthcare apps, and a variety of data reporting tools**.

Specifically, public health informatics supports the mission of disease prevention and health promotion by leveraging information technology solutions, therefore enabling environmental health programs to achieve public health goals more effectively, efficiently, and inexpensively. Informatics ethics covers seven principles: privacy, openness, security, access, legitimate infringement, least intrusive alternatives, and accountability.

Introduction

While discussing this topic, the main target/aim is to focus on the importance of the health information systems that are being implemented and used in our health care organization to help the health care workers document and save their studies, information and all data related to patients in all health aspects. This includes imaging technology, hospital information systems, patients 'data and all other documents needed in health care facilities. Among the most common purposes served by health informatics are enabling better collaboration and coordination among healthcare providers, streamlining

medical quality assurance processes, improving cost-efficiency in healthcare delivery, and increasing accuracy and efficiency in facility/practice management, thus creating easier communication through the hospital departments which reflects its positive outcomes on the health care employees making procedures less complicated and saving money and time.

The structure of the report will be focusing on the analysis of informatics systems used in our health care organization where I chose to write about the **Oracle Information System** for what it has a lot of positive effects in the supporting the staff and the patients; information system where its importance can be obviously seen through its outcomes. Also, a clear and proper investigation of this informatics system in this organization discussing by the way the recommendations and its ethical issues and policies.

Dr. Sulaiman Al Habib Medical Services Group Company consists of more than 15 branches, is the first fully integrated digital health project with Digital Hospital system in the region, with the capacity of 400 beds and 290 clinics. It adheres to the highest standards of corporate governance and applies all the applicable provisions. It provides also Home Medical Services that seeks to work seriously to provide high-quality health care to the patient at his home through an integrated team that has experience. Dr. Sulaiman Al Habib Obesity Treatment Centres has been awarded the Centre of Excellency Accreditation by the Surgical Review Corporation (SRC) (American standards). The group is accredited by the CBAHI and the JCIA based on the excellent information system implemented, which support the patient's and staff secure and private information system. Examples includes: **PACS** imaging system, **VIDA** for patient's data information and **LYNX**.

LYNX which is an **ORACLE** system is an excellent example for automating the HR processes is one of the most common examples given. There are a lot of inter-personal meeting, manual routing, manual follow-ups, overflowing filing cabinets. While as after automating the process, the employee files a leave on system, the supervisor will have the ability to see the leave days left and approve accordingly the staff will be notified electronically with the approval. By applying this automation, information was automatically routed with automatic follow-ups and archiving, we increased the staff and supervisor satisfaction, all concerned department are kept informed about the leave.

1. Analysis of informatics systems used in the client organization (Oracle information system)

Brief history: The current version of Oracle Database is the result of over 30 years of innovative development. Highlights in the evolution of Oracle Database include the followings:

- Founding of Oracle: In 1977, Larry Ellison, Bob Miner, and Ed Oates started the consultancy Software Development Laboratories, which became Relational Software, Inc. (RSI).

- First commercially available RDBMS: In 1979, RSI introduced Oracle V2 (Version 2) as the first commercially available **SQL**-based RDBMS.
- Portable version of Oracle Database: Oracle Version 3, released in 1983, was the first relational database to run on mainframes, minicomputers, and PCs.
- Enhancements to concurrency control, data distribution, and scalability: Version 4 introduced multisession **read consistency**. Version 5, released in 1985, supported client/server computing and **distributed database** systems. Version 6 brought enhancements to disk I/O, row locking, scalability, and backup and recovery.
- Oracle7, released in 1992, introduced PL/SQL **stored procedures** and **triggers**.
- Oracle8 released in 1997 supported partitioning of large tables.
- Oracle8i Database, released in 1999, provided native support for internet protocols and server-side support for Java.
- Oracle9i Database introduced Oracle RAC in 2001.
- Oracle Database 10g introduced **grid computing** in 2003. This release enabled organizations to virtualize computing resources by building a **grid infrastructure** based on low-cost commodity servers.
- Oracle Database 11g, released in 2007, introduced a host of new features that enable administrators and developers to adapt quickly to changing business requirements.

Every organization has information that must store and manage to meet its requirements. For example, a corporation must collect and maintain human resources records for its employees. This information must be available to those who need it. An **information system** is a formal system for storing and processing information. A **database management system (DBMS)** is software that controls the storage, organization, and retrieval of data. Typically, a DBMS has the following elements: Kernel code: This code manages memory and storage for the DBMS. Repository of metadata: This repository is usually called a **data dictionary**. Query language: This language enables applications to access the data.

A **database application** is a software program that interacts with a database to access and manipulate data. The first generation of database management systems included the following types: 1..Hierarchical: A **hierarchical database** organizes data in a tree structure. Each parent record has one or more child records, like the structure of a file system. 2.Network: A **network database** is similar to a hierarchical database, except records have a many-to-many rather than a one-to-many relationship. The preceding database management systems stored data in rigid, predetermined relationships. Because no data definition language existed, changing the structure of the data was difficult. Also, these systems lacked a simple query language, which hindered application development.

Relational Database Management System (RDBMS): is the basis for a **relational database management system (RDBMS)**. Essentially, an RDBMS moves data into a database, stores the data, and retrieves it so that it can be manipulated by applications. An RDBMS distinguishes between the following types of operations:

- Logical operations: In this case, an application specifies *what* content is required. For example, an application requests an employee name or adds an employee record to a table.
- Physical operations: In this case, the RDBMS determines *how* things should be done and carries out the operation. For example, after an application queries a table, the database may use an index to find the requested rows, read the data into memory, and perform many other steps before returning a result to the user. The RDBMS stores and retrieves data so that physical operations are transparent to database applications.

Oracle Database is an RDBMS. An RDBMS that implements object-oriented features such as user-defined types, inheritance, and polymorphism is called an **object-relational database management system (ORDBMS)**. Oracle Database has extended the relational model to an object-relational model, making it possible to store complex business models in a relational database.

Data Concurrency

A requirement of a multiuser RDBMS is the control of **concurrency**, which is the simultaneous access of the same data by multiple users. Without concurrency controls, users could change data improperly, compromising **data integrity**. If multiple users access the same data, then one way of managing concurrency is to make users wait. However, the goal of a DBMS is to reduce wait time, so it is either non-existent or negligible. However, the goal of a DBMS is to reduce wait time, so it is either non-existent or negligible. All SQL statements that modify data must proceed with as little interference as possible. A **lock** is a mechanism that prevents destructive interaction between transactions accessing a shared resource. Locks help ensure data integrity while allowing maximum concurrent access to data.

Data Consistency

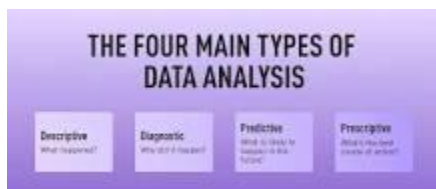
In Oracle Database, each user must see a consistent view of the data, including visible changes made by a user's own transactions and committed transactions of other users. For example, the database must not permit a **dirty read**, which occurs when one transaction sees uncommitted changes made by another concurrent transaction. Oracle Database always enforces statement-level **read consistency**, which guarantees that the data returned by a single query is committed and consistent with respect to a single point in time.

Database and Instance: An Oracle database server consists of a **database** and at least one database **instance** (commonly referred to as simply an **instance**). Because an instance and a database are so closely connected, the term **Oracle database** is sometimes used to refer to both instance and database. In the strictest sense the terms have the following meanings:

- A: A database is a set of files, located on disk, that store data. These files can exist independently of a database instance.
- Database instance: An instance is a set of memory structures that manage database files. The instance consists of a shared memory area, called the **system global area (SGA)**, and a set of **background processes**. An instance can exist independently of database files.

An Oracle instance consists of three main parts: **System Global Area (SGA)**, **Program Global Area (PGA)**, and **background processes**. The SGA is a shared memory structure allocated when the instance started up and released when it is shut down. **4 Key Types of Data Analytics**

- Descriptive Analytics. Descriptive analytics is the simplest type of analytics and the foundation the other types are built on.
- Diagnostic Analytics. Diagnostic analytics addresses the next logical question, “Why did this happen?”
- Predictive Analytics.
- Prescriptive Analytics.



What is the advantage and disadvantage of Oracle?

The advantages and disadvantages of Oracle depend primarily on **user requirements and needs as well as costs, technical competencies, and programming skills**. A major advantage of Oracle Database is the optional Database-as-a-Service model. This enables relational databases to be stored and managed in the Oracle Cloud.

Advantages of Oracle Databases

- Reduces operations costs.
- Uses a single database for all data types.
- Provides a secure hybrid cloud environment.
- Offers better identity management and user controls.

- Executes quick backup and recovery.
- Offers multiple database support.
- Provides superior scalability.
- Includes Flashback technology.

Understanding the four stages of data: **collect, curate, analyse, and act** through the six categories in an Oracle application. **Oracle Applications by Category are:**

1. Oracle Human Capital Management (HCM)
2. Oracle Enterprise Resource Planning (ERP)
3. Oracle Customer Experience (CX)
4. Oracle Supply Chain Management (SCM)
5. Oracle Enterprise Performance Management (EPM)
6. Oracle Construction and Engineering.

The Top 10 Benefits of Cloud Computing (Oracle)

1. Accessibility anywhere, with any device.
2. Ability to get rid of most or all hardware and software.
3. Centralized data security.
4. Higher performance and availability.
5. Quick application deployment.
6. Instant business insights.
7. Business continuity.
8. Price-performance and cost savings
9. Virtualized computing
10. Cloud computing is greener

2. Investigation of one informatics system (Oracle) in the client organization + recommendations

When problems occur with a system, it is important to perform accurate and timely diagnosis of the problem before making any changes to a system. Often a database administrator (DBA) simply looks at the symptoms and immediately starts changing the system to fix those symptoms. However, long-

time experience has shown that an initial accurate diagnosis of the actual problem significantly increases the probability of success in resolving the problem.

For Oracle systems, the statistical data needed for accurate diagnosis of a problem is saved in the Automatic Workload Repository (AWR). The Automatic Database Diagnostic Monitor (ADDM) analyses the AWR data on a regular basis, then locates the root causes of performance problems, provides recommendations for correcting any problems, and identifies non-problem areas of the system. Because AWR is a repository of historical performance data, ADDM can be used to analyse performance issues after the event, often saving time and resources reproducing a problem. See "[Automatic Workload Repository](#)". An ADDM analysis is performed every time an AWR snapshot is taken, and the results are saved in the database. In most cases, ADDM output should be the first place that a DBA looks when notified of a performance problem. ADDM provides the following benefits:

- Automatic performance diagnostic reports every hour by default
- Problem diagnosis based on decades of tuning expertise
- Time-based quantification of problem impacts and recommendation benefits
- Identification of root cause, not symptoms
- Recommendations for treating the root causes of problems
- Identification of non-problem areas of the system
- Minimal overhead to the system during the diagnostic process

The Automatic Database Diagnostic Monitor (ADDM) provides a holistic tuning solution. ADDM analysis can be performed over any time defined by a pair of AWR snapshots taken on a particular instance. Analysis is performed top down, first identifying symptoms, and then refining them to reach the root causes of performance problems.

The types of problems that ADDM considers include the following:

- CPU bottlenecks - Is the system CPU bound by Oracle or some other application?
- Undersized Memory Structures - Are the Oracle memory structures, such as the SGA, PGA, and buffer cache, adequately sized?
- I/O capacity issues - Is the I/O subsystem performing as expected?
- High load SQL statements - Are there any SQL statements which are consuming excessive system resources?
- High load PL/SQL execution and compilation, as well as high load Java usage
- RAC specific issues - What are the global cache hot blocks and objects; are there any interconnect latency issues?

- Sub-optimal use of Oracle by the application - Are there problems with poor connection management, excessive parsing, or application-level lock contention?
- Database configuration issues - Is there evidence of incorrect sizing of log files, archiving issues, excessive checkpoints, or sub-optimal parameter settings?
- Concurrency issues - Are there buffer busy problems?
- Hot objects and top SQL for various problem areas

After the initial configuration, Oracle Database Quality of Service Management is an automated system. As a result, most of the problems you might encounter are related to configuring Oracle Database QoS Management. The following sections illustrate the most common problems, and how to resolve them:

1. Cannot Enable Oracle Database Quality of Service Management
2. Cannot Enable Oracle Database QoS Management for a Database
3. Oracle Database Resource Manager Not Enabled and Resource Plan Errors
Oracle Database Quality of Service (QoS) Management requires Database Resource Manager to use a specific resource plan.
4. Do Not Have Access to a Server Pool
5. Server Pool Is Marked as Unmanageable
6. Metrics Are Missing for a Performance Class
7. Oracle Database QoS Management is not Generating Recommendations
8. Recently Added Server was Placed in the Wrong Server Pool
Servers are moved within a cluster by Oracle Cluster ware, or as directed by an administrator.
9. RMI Port Conflict Detected

Each ADDM finding can belong to one of three types:

1. Problem: Findings that describe the root cause of a database performance issue.
2. Symptom: Findings that contain information that often led to one or more problem findings.
3. Information: Findings that are used for reporting non-problem areas of the system.

In addition to problem diagnostics, ADDM recommends possible solutions. When appropriate, ADDM recommends multiple solutions for the DBA to choose from. ADDM considers a variety of changes to a system while generating its recommendations.

Recommendations include:

- Hardware changes - Adding CPUs or changing the I/O subsystem configuration: To avoid system hanging and save the health care worker's time
- Database configuration - Changing initialization parameter settings: To simplify health records savings and documentations
- Schema changes - Hash partitioning a table or index, or using automatic segment-space management (ASSM)
- Application changes - Using the cache option for sequences or using bind variables: To make it easier for the health care workers to use
- Using other advisors - Running the SQL Tuning Advisor on high load SQL or running the Segment Advisor on hot objects: Having system resources from the health care workers to advice regarding system issues if needed

Other recommendations may include the followings:

- Oracle Database could improve by making migration less difficult and having better integration. For example, having the ability to communicate, using native features, to different databases especially those for health records that include patient information system. Mostly connectivity to different databases, such as open-source databases or any other database.
- The pricing of all the additional tools that Oracle provides is very complicated. The pricing model is very unfriendly for the user, and for the web vendors. Being too expensive, I believe, is a major issue for our organization.
- When it comes to new features, we don't desire anything at this moment. We are completely dependent on this ERP system which applied at our organization, and we only need the tools from Oracle that our ERP system needs, and nothing more.
- There is an important concern which is the performance of the database. If Oracle could make the performance better on low-end hardware, that would be nice.
- There are a few errors for which Oracle doesn't provide detailed information. It doesn't clearly indicate the columns or lines for which we are getting an error. It would be better if they provide more detailed information for such errors. This issue is always reported to the IT department and still with no clear solution.

- An area for improvement would be query performance - in some cases, it's really hard to make it run faster. For example, it could be more user-friendly and should be easier to integrate into the cloud.
- They have improved a lot, however, recently it has been known that Oracle Database is very complex and need skilled people to manage it these days in the industry. The ease of management for non-technical individuals could be better. Technical support quality is recommended to be better.
- The monitoring of processes that are executing could be better. Security should be improved.
- The release of new updates is needed if products did not require improvement. Oracle shall offer very good products that are stable and scalable.

3. Ethical issues and policies

A. Ethical issues and implications of dealing with data

Electronic health record (EHR) is increasingly being implemented in many developing countries. When patient's health data are shared or linked without the patients' knowledge, autonomy is jeopardized. The patients may conceal information due to lack of confidence in the security of the system having their data. Consequently, their treatment may be compromised. Leaders, health personnel and policy makers should discuss the **ethical implications** of EHRs and formulate policies in this regard. The electronic medical record (EMR) is the tool that promises to provide the platform from which new functionality and new services can be provided for patients.

Potential benefits: EHRs have several advantages over paper records. Production of legible records reduces many problems of wrong prescriptions, doses, and procedure. Moreover, adverse drug reactions can be reduced substantially when the EHRs are connected to drug banks and pharmacies. Easy accessibility from anywhere at any given time is also beneficial. They reduce the number of lost records, help research activities, allow for a complete set of backup records at low cost, speed data transfer and are cost-effective. Hence, EHRs have been shown to improve patient compliance, facilitate quality assurance and reduce medical errors. The followings are four major ethical priorities for EHRS:

- **Privacy and confidentiality:** Health care institutions, insurance companies and others will require access to the data if EHRs are to function as designed. The key to preserving confidentiality is to allow only authorized individuals to have access to information. This begins with authorizing users. The user's access is based on preestablished role-based privileges. The

administrator identifies the user, determines the level of information to be shared and assigns usernames and passwords.

- **Security breaches:** Security breaches threaten patient privacy when confidential health information is made available to others without the individual's consent or authorization. The data with password protected, but unencrypted, which means anyone who guessed the password could have accessed the patient files without a randomly generated key. By encryption, we mean encoding of information in such a way that only authorized parties can read it. It is usually done with the help of encryption key, which specifies that how the information should be decoded. Cloud storage, password protection, and encryption are all measures health care providers can take to make portable EHRs more secure.
- **System implementation:** Health care organizations encounter major challenges during EHR implementation these challenges result in wasted resources, frustrated providers, loss of confidence by patients and patient safety issues. Many EHR implementation projects fail because they underestimate the importance of one or more clinician to serve as opinion leaders for providers in the clinic. Thus, clinician must guide colleagues in understanding their roles in the implementation and enlisting their involvement in tasks as EHR selection, workflow design, and quality improvement.
- **Data inaccuracies:** Integrity assures that the data is accurate and has not been changed. EHRs serve to improve the patient's safety by reducing healthcare errors, reduce health disparities and improve the health. Inaccurate representation of the patient's current condition and treatment occurs due to improper use of options such as “cut and paste”. This practice is unacceptable because it increases the risk for patients and liability for clinicians and organizations. The loss or destruction of data occurs during data transfer; this raises concerns about the accuracy of the data base as patient care decisions are based on them. A growing problem is of medical identity theft. This results in the input of inaccurate information into the record of the victim.

B. General Oracle policies:

Financial Integrity: Financial and Other Records Accurate and reliable financial and business records are of critical importance in meeting Oracle’s financial, legal, and business obligations. No false entries shall be made on the books or records of Oracle for any reason. For example, billing of time or expenses by consultants, entry of orders by sales administrators and reporting of petty cash disbursements shall be made accurately and in compliance with Oracle policy.

Business Courtesies that may be Extended: Furnishing meals, refreshments, and entertainment in conjunction with business discussions with non-government personnel is a commonly accepted practice. Oracle employees may furnish meals, refreshments, or entertainment appropriate to the circumstances. This furnishing must not violate the standards of conduct of the recipient's organization or of any contractual agreement with a customer.

Business Courtesies that may be Received: Gifts Oracle employees generally may accept unsolicited gifts or other business courtesies from actual or potential customers, suppliers or other business partners provided they are not of material value and are not given with the purpose of influencing one's judgment. It is never appropriate to solicit gifts or other courtesies, directly or indirectly. If you are offered a gift of material value from an individual who has or seeks a business relationship with Oracle, you must demonstrate that the gift could not be construed as an attempt by the offering party to secure favourable treatment and obtain written approval from the Senior Vice President of your organization and from your designated Business Conduct Officer before accepting the gift.

Conflict of Interest: This term describes any circumstance that could cast doubt on an employee's ability to act with total objectivity regarding Oracle's interests. Oracle wants its employees' loyalty to come easily, free from any conflicting interests. All employees have a duty to avoid financial, business, or other relationships that might be opposed to the interests of Oracle or might cause a conflict with the performance of their duties.

Protecting Confidential Information: No employee may at any time, directly or indirectly, profit from confidential information obtained by the employee during performing his or her duties on behalf of Oracle. As a rule, all information related to Oracle's business should be considered confidential. For example, confidential information includes, but is not limited to, software and other inventions or developments, marketing and sales plans, competitive analyses, product development plans, pricing, potential contracts or acquisitions, business and financial plans or forecasts, and prospect, customer, and employee information.

Gathering Information about Competitors: Oracle employees may appropriately make observations about competitors' products and activities if such observations are based on publicly available information, such as public presentations, public marketing documents, journal and magazine articles, advertisements, and other published information. Oracle employees should not seek information about competitors.

Use of Oracle Resources: Oracle property may not be sold, loaned, given away, or disposed of, without proper authorization. All Oracle assets must be used for proper purposes during employment with

Oracle. Improper use includes unauthorized personal appropriation or use of Oracle assets, data, or resources, including computer equipment, software, and data.

Internal hospital policy regarding the oracle information system

- All information is private and confidential: Example: The staff and the patient information should be treated at high level of privacy. Nobody is allowed to share any information with others. Sharing information with others who are not employees or other employees that are not involved in the same patient care is classified as policy violation and corrective actions are implemented.
- Usernames and passwords are only given to the official employees who had finished their probation period after employment and are capable to perform their job with complete understanding of the policy of the health information system.
- Any document or imaging which is requested should be given for the patient and/or his guardian after showing a file number or evidence that prove his identity.
- All usernames and passwords of the employees to access the health information system should be changed on quarterly basis and should be deactivated if the employee is on annual leave or he/she no more on the head of the job.
- Any intended false information entered by the employee should be treated as forgery and he/she will be accountable for his/her act and corrective actions are applied.
- Technical issues should be reported to the Information Technology team and incident report should be initiated in the system and will be sent to the quality department for investigation and evaluation.

Conclusion

Regardless of one's role, everyone will need the assistance of the computer. Creating a useful EHR system will require the expertise of physicians, technology professionals, ethicists, administrative personnel, and patients. Although EMRs offer many significant benefits, the future of health care demands that their risks be recognized and properly managed or overcome. Multiple strategies are available to reduce risks and overcome barriers in the implementation of digital health records. Leadership, teamwork, flexibility, and adaptability are keys to finding solutions. EMRs capacities must be maximized to enhance improve the quality, safety, efficiency, and effectiveness of health care and health care delivery systems. Knowing the relation between data and information, we can break down our daily processes to more regulated points and organize them in useful way of knowledge that can be extracted and practiced. This can help in a good financial planning to reduce the costs and expenses of an organization. Automation, improvement, and reengineering is the ultimate way to increase your

profitability and ensure a healthy growth for you organization. Some companies don't know that there is a chance of improvement and where can these improvements and automations be applied. Also, they can use some diagrams to clear the processes out and use technology to ensure efficiency and decrease duplications at work. Using new technologies can turn the table around and either decrease costs, or give a huge competitive advantage in the market, but always there are challenges that an organization should be aware of before implementing and plan it through. Using the information in systematic way and applying some of the most famous strategies in business will project more profitable and stable businesses.

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