

Competencies for Learning and Working in E-Health Environment  
Summer Institute of Health Informatics and Canadian Medical Association  
Electronic Medical Records case study

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Signature :) \_\_\_\_\_

Date :) \_\_\_\_\_

This report has been written by Rashoo Brar and has not received any previous academic credit at this or any other institution.

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Rashoo Brar

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Signature

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Date

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## Executive Summary:

Knowledge learned in academic settings is solidified and made practical via apprenticeship experiences. The internships in the Master of Health Informatics at Dalhousie University program helps students bridge their knowledge from a classroom setting to a real world setting. In today's climate, healthcare providers have an increasing burden of sorting through vast amounts of information with time constraints. One of the important tasks of health informaticians is to identify the requirement of the health professionals and provide them the knowledge and tools to do their day to day activities efficiently. The health informatician must distribute the available knowledge according to the stockholder's needs.

The main objective of this internship was to develop Decision Support exercises for the Division of Medical Education (DME)-Summer Institute of Health Informatics (SIHI). The other main objective was to encode an interview in a qualitative software ATLAS ti for the Canadian Medical Association (CMA)-Electronic Medical Record (EMR) Case Study. Both objectives aim was based on knowledge sharing within the learned communities.

The Dalhousie University Medical School has significant number of educational programs for their students. The Division of Medical Education (DME) is a division under the Faculty of Medicine which undertakes and fosters research and development in medical education with particular emphasis in faculty development, communication skills, medical informatics and health/medical education research. As part of this internship's objective; Clinical Decision Support Systems tools (CDSS) were explained with hands on experience on CDSS tools like ISABEL, Visual Dx, data analysis along with operations of SPSS, a statistical package, were explained for decision making to the faculty to help promote life long learning. The SIHI worked as a knowledge sharing model

through Community of Participation (CoP) which was effective according to the response of the participant; however an effective sharing of this knowledge gained through an online discussion forum should be implemented in the future.

Canada does not have full implementation of EMR and there is tremendous room for growth. The Canadian Medical Association (CMA)-Electronic Medical Record (EMR) Case Study is the first national collaborative effort among academic researchers and the Canadian Medical Association (CMA) representatives to examine the implementation and use of an Electronic Medical Record (EMR) system in primary care settings. The purpose of this research was to provide physicians with practical information on best practices and lessons learned with regards to implementation and use of EMR systems in clinical practice settings.

Systematic procedures were followed under the supervision of Dr. Grace Paterson. Moncton, New Brunswick was visited physically and the information was recorded, transcribed and a previously conducted interview by researchers was analyzed by this author using qualitative data analysis software Atlas-ti. The findings of EMR implementation case study will be published and will be recommended to the different stakeholders so that effective measures are taken to make an integrated health care system, the primary initiative of the Canada Health Infoway.

Both the above tasks should inspire the participants to use intelligent software's in case of clinical and other health related decision making. There should be continued and enhanced cooperation between health informaticians and health care providers to provide optimal delivery of health care.

# **1. Introduction:**

## **1.1 Overview**

Medical informatics is an emerging interdisciplinary program which supports decision making, information processing and communication for research, including the information science and the technology to support these tasks (Greenes, 1990). Health care institutions are beginning to make large-scale commitments to information systems and to services that will affect every aspect of their organization's function. Medical Informatics is vital in developing and advancing information management, improving health outcomes and handling vast amounts of information in an effective and efficient manner. As well, academic units of medical informatics are being established at a number of medical schools, medical informatics professionals are being sought to serve on faculties and hospital staffs, (Greenes, 1990).

In 2002 Dalhousie University began the first interdisciplinary program between Faculty of Medicine and the Faculty of Computer Science thus named as Masters of Health Informatics Degree Program. The aim of this program is to improve clinical care, teaching, research and health services using information technology. As well during this course students are given a 13 week internship to get hands on experience of informatics.

This author's 13 week internship was composed of two objectives:

1. Developing learning activities for Division of Medical Education (DME) Summer Institute of Health Informatics (SIHI) which was the major part of the internship.
2. Involved in Canadian Medical Association (CMA) –Electronic Medical Record (EMR) Case Study during last three weeks of internship.

### **Introduction to the Organizations**

The Dalhousie University Medical School has significant number of educational programs for their students. The Division of Medical Education (DME) is a division under the Faculty of Medicine which was established in 1994. The DME serves the continuum of medical education for undergraduate, postgraduate and continuing medical education. DME also undertakes and fosters research and development in medical education with particular emphasis in faculty development, communication skills, medical informatics and health/medical education research (Dalhousie University).

The Canadian Medical Association (CMA)-Electronic Medical Record (EMR) Case Study is the first national collaborative effort among academic researchers and the Canadian Medical Association (CMA) representatives to examine the implementation and use of an Electronic Medical Record (EMR) system in primary care settings. The purpose of this research was to provide physicians with practical information on best practices and lessons learned with regards to implementation and use of EMR systems in clinical practice settings.

## **Objective I: DME-SIHI**

### **Background**

In practice, people work in teams and collaborate to acquire and share knowledge in order to address knowledge gaps inherent within the system (Curran, Abidi, 2006). Knowledge sharing is a technique used to manage knowledge which also has a great potential for using or sharing existing knowledge thus reducing the knowledge gap.

There are explicit, implicit or tacit types of knowledge. For example, explicit knowledge is laid out in a text books, journals etc, where as implicit knowledge is in organizational practices thus an expert uses tacit heuristics e.g. facts, judgments and experiences (Mackintosh, 1999). The quality of the knowledge depends on its correctness ranging from “logically proven” through “experimentally proven” and “best practice” down to “majority opinion”; on its completeness compared with either current world knowledge on the topic or with potential knowledge on the topic and whether the knowledge is up to date (Mackintosh, 1999). One of the tacit knowledge creation modes is socialization that transfers one person’s tacit knowledge to another person. Socialization can be achieved by community of practices (CoP). According to (Wenger et al), in a community of practice (CoP) members interact and learn from each others. As mentioned earlier DME emphasis on the faculty development programs and those faculty development programs are called Summer Institutes which were established in 2001. The aim of the DME-SIHI was to increase awareness about the scope of the Health Informatics (HI) field and its significance in the distributed learning environment. The SIHI was designed to equip an inter-professional and interdisciplinary community of learners with health informatics knowledge and skills. The SIHI incorporated presentations by clinical health informaticians on their practical application of health informatics in



a clinical setting. In other words the goal of SIHI was to inform and educate professionals and empower them for teaching, planning, decision making and change management.

### **Objective and lessons learned**

Developing Clinical Decision Support System (CDSS) exercises for the institute was the main objective of the internship. The intern developed exercises using three decision support tools:

- 1) VISUAL Dx: a dermatological decision support system.
- 2) ISABEL: a Diagnosis Reminder and Knowledge Mobilizing System
- 3) National Health and Nutrition Examination Survey (NHANES): a descriptive analysis by using Statistical Package for the Social Sciences (SPSS) software.

Visual Dx and ISABEL are web based tools using a web-browser which made faculty members comfortable with a diagnosis reminder system. Selecting a good tool for the institute was an important task. It was learned that identifying effective tools and providing hands on experience allowed the faculty members to learn a new system easily with better long term retention of using that system.

Data utilization is also one of the main objectives in computerization. Statistical packages provide menu driven functionality to infer many things from data. In real life such an exercise is good for many decision making purposes. Choosing software like SPSS was also a good decision as it provides functionality that is easy to learn for the professionals who have time constraints.

## **Objective II: CMA-EMR case study**

### **Background**

Despite the promise of electronic medical record (EMR) technology, and available solutions on the market, the overall adoption of EMR systems remains low among medical group practices and faces several barriers( Jelic et al, 2006). CMA-EMR study is done using case study methodology to document both the success stories and challenges of EMR implementation and use in a range of primary care settings nationwide. This particular project is funded by Canada Health Infoway, with its aim to assess how technology may contribute to improving the quality and efficiency of patient care. By gathering in-depth data from face-to face interviews with the physicians and then coding the interviews by using a qualitative software i.e. Atlas ti , CMA-EMR case study researchers will provide the primary care physicians with a better understanding of the potential value of EMR systems and how they may use them to improve the quality and efficiency of care delivered to their patients thus hopefully inspiring professionals to implement EMR.

### **1.4.2 Objective and lessons learned**

Information gathered will be analyzed and reported in the form of evidence-based “short stories” format in health care future IT of Canadian Medical Journal Association (CMAJ). During this CMA-EMR case study this author was able to make a visit to a primary care clinic in Moncton, New Brunswick. During this visit the intern was able to observe each member of clinic staff and physician during their working hours. The time was spent shadowing the physician for approximately one third of the time with two thirds of the time spent with the secretarial staff. The intern was able to understand the efficiency and effectiveness of electronic record systems.

Also this author was also able to use ATLAS ti qualitative software to code the interview sent by CMA-EMR researchers which previously conducted by them. While coding the interview, the intern was able to gain knowledge about the best practices and lessons learned with regard to implementation and use of EMR systems in clinical settings. However due to confidentiality issues this author is not able to write explicit information regarding those interview. However, this exercise gave the author an opportunity to code the text data and process that data in qualitative software like Atlas ti, conduct an observational study, thus complementing the lesson learned in research methods class with practical experience.

## **2. Description of Initiatives**

### **2.1 DME-SIHI**

As a course coordinator for DME-SIHI 2008, this author' role was to develop exercises using Decision Support Systems along with examining the Medical Council of Canada's objectives. The reason for developing these exercises was to introduce faculty members the various Clinical Decision Support Systems (CDSS) for clinical knowledge management. CDSS is the provision of "clinical knowledge and patient-related information which is intelligently filtered and is presented at appropriate times to enhance patient care (HIMSS, 2004). In other words clinical decision support is based on diagnostic recommendations derived from best evidence available from the patient data collection thus serving as a decision support reminder tool to design a decision logic model that is structured to support clinical decisions made by health practitioners. A clinical decision support system (CDSS) is an example of an implementation intervention based on reminders providing feedback whose goals are to replace memory and to inform decisions with useful, timely and relevant information (Lobach, 1997). CDSS is a reminder system that compares patient characteristics with a knowledge base and then guides a health provider by offering patient

specific and situation specific advice (Eccles, 2002). Knowledge base is involved in CDSS which solves problems and make better use of patient data, perform a noticeable action and make decisions at point of need i.e. targeting drug dosing, preventative care and “other medical care” (a variety of conditions and outcomes, primarily assessing the process of care) showed the greatest effects (Abidi, 2005).

Newly trained physicians, physicians in rural areas and non-specialists deal with complicated issues and can greatly benefit from CDSS in their unique clinical environment. They can guide them into avenues of logical and sound clinical management at the point of need that may not be easily and accurately available to them. Thus having knowledge based decision making tools and performing noticeable actions affects and supports all tiers of health care. Following are the descriptions of CDSS used in SIHI:

### **2.1.1 VISUAL Dx**

Visual Dx ( [www.logicalimages.com](http://www.logicalimages.com)) is a visual CDSS that guides primary care clinicians, emergency care clinicians, and public health personnel in the diagnosis, treatment, and management of dermatologic disorders. Visual Dx allows clinicians to develop differential diagnoses by entering lesion morphologies and patient findings. It employs graphical search tools, a computerized knowledge base of relationships between findings and diagnoses. There are thousands of images to present the clinician with a list of diseases that most closely match the criteria entered. For SIHI, this author developed an exercise for Actinic Keratosis (AK) a skin disorder which is formed in the epidermis skin layer. This exercise and reading manual are attached in Appendix A.

### **2.1.2 ISABEL: A diagnosis reminder and knowledge mobilizing system** (<http://www.isabelhealthcare.com>)

Health care providers work in stressful situations and often work with limited resources and time. These factors can lead to misdiagnosis. One study finds that lack of knowledge is not the important factor in diagnosis error (Graber, 2005). So, it is important that there is a system which reminds physicians to consider all possible diagnosis. Isabel is a CDSS and knowledge mobilizing system which delivers a web-based stand alone system which has been interfaced with electronic patient medical record. This powerful approach permits users to search by concept matching as well as word matching. Specifically it matches clinical presentations with the potential differential diagnoses which allows the clinician to keep a broader prospective of diagnosis and treatment options thus reducing medical errors. This author was able to develop some exercises and reading manuals which are attached in the appendix A.

### **2.1.3 National Health and Nutrition Examination Survey (NHANES) a descriptive analysis.** (<http://www.cdc.gov/nchs/nhanes.htm>)

National Health and Nutrition Examination Survey (NHANES) is arguably the largest and longest-running national source of objectively measured health and nutrition data. NHANES provides a snapshot of the health and nutritional status of the U.S. population through physical examinations, clinical examinations, laboratory tests, and personal interviews. Findings from NHANES provide health professionals and policymakers with the statistical data needed to determine rates of major diseases and health conditions. As well it allows researchers to identify, monitor trends in medical conditions and emerging public health issues, so that the appropriate public health policies and prevention interventions can be developed. For descriptive analysis of NHANES data sets, intern

developed a manual for guiding the faculty members for analysis by using a Statistical Software (SPSS). The author was not only able to show the students the different datasets available for analysis, how these data sets can be extracted, and how a particular data can be converted in a required format thus choosing a menu driven customized statistical software which is easy to learn and operate. Showing the entire process gave the students a good understanding to communicate with other technical professional to format and convert the datasets to a desired format for analysis.

### **3. Relationship to health informatics learning**

This 13 weeks internship in medical informatics has allowed this intern to utilize the knowledge gained through the health informatics courses. Following are the instances outlined relating to health informatics education gained:

#### **Research Methods and Statistics**

- This author's previous knowledge of statistical software was helpful in searching for other statistical packages that was easy to use by professionals who are not technically inclined and familiar with programming. Finally a user-friendly statistical package, SPSS, was identified.
- Additionally the author used SPSS for other analyses which help the author to identify how to present and interpret the data sets.

#### **Project Management for Health Information Projects**

- The knowledge and skills gained from the IT project management course played a vital role for success during this internship.
- Working with faculty members of DME-SIHI to coordinate all the educational material and working with different speakers through various phases of SIHI.

- During this internship all the golden principles of project management were kept in mind in each phase i.e. objectives, tasks, resources, responsibilities, contingencies, deliverables and complete task.

### **Networks and Web for Health informatics**

- There were distant speakers and learners for the DME-SIHI which was an asset in understanding of networking issues which played an important role during the internship.
- The Intern was able to understand Dalhousie BLS and helped the Faculty members in troubleshooting.
- The intern used the knowledge of the networking course to find software that is web based, which is updated automatically by the provider and can be used by the user without any difficulties.

### **Health Information Flow and Use**

- All this data collection played an important role during this internship. Health information flow and use helped the intern to explain major issues regarding the flow of health information, how to collect, use and reuse information.

### **Health Information Systems and Issues**

- A key component of this course was how the data is collected and submitted in the data repository. Further more how this data is evaluated by considering all the privacy and confidentiality issues as it regards to e-health as mentioned in privacy and security legislation.

### **Healthcare Knowledge Management**

- Understanding the concepts related to Clinical Decision Support System (CDSS) for DME-SIHI.

- CMA-EMR and DME-SIHI both fall under the knowledge management category. The Knowledge management course helped the author to learn about knowledge management and how gained knowledge can be shared among like minded professionals through community of practice (CoP) and sharing knowledge thus reducing the knowledge gap.

Overall, the intern's medical background along with all the knowledge gained from the above outlined courses helped the intern during this placement period.

#### **4. E- Learning an Educational Initiative for Faculty Development in Medical Education**

North America has advanced tools and technology for promotion and education of health care. This continent is also known for its quick to adopt E-learning technologies into their curricula. Following are some of the institutions in health informatics which are currently using E-learning technologies:

- **American Medical Informatics Association**

This <http://www.amia.org/e-learning> is a Web-based portion which is provided through readings, on-line lectures and interactive discussions. According to this website, the courses are taught primarily in an asynchronous manner there are Voice-over-PowerPoint, interactive discussions and reading assignments. Students engage in discussion on important issues using the on-line bulletin board.

- **Oregon Health and Science University**

The University (<http://www.ohsu.edu/>) has E-Learning System in Health Informatics and uses a blackboard learning system. It allows lecturers to establish an online presence for their university



activity. Blackboard's online learning application is a widely-adopted course management system among U.S. and Canadian colleges and universities.

- **University of Waterloo Institute's Health Informatics Boot camp:**

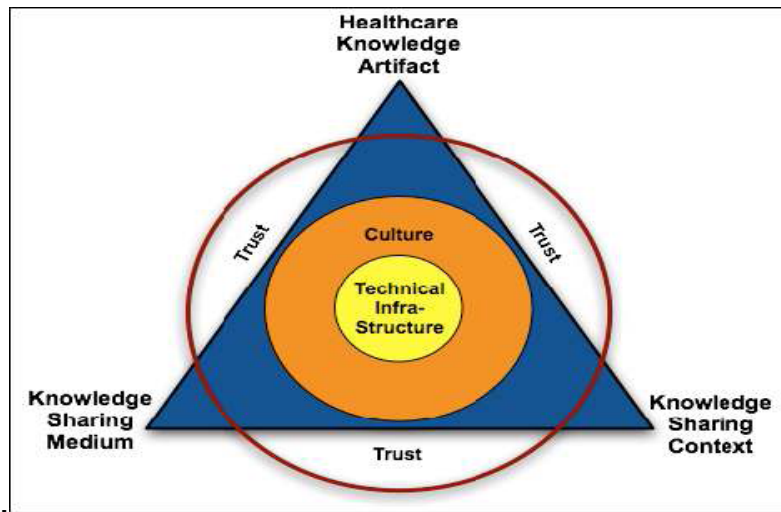
The Waterloo Institute for Health Informatics Research [http://hi.uwaterloo.ca/hi/HIC\\_Project.htm](http://hi.uwaterloo.ca/hi/HIC_Project.htm) has a program to offer health informatics field in issues such as information management, and information and communication technologies research.

- **DME-SIHI, Faculty development program**

DME-SIHI an Educational Initiative for Faculty Development in Medical Education is one of the first institutions in Canada who came with faculty development program. This program has collaborative learning environments where faculty members shared their experiences, support others to solve problem, guide members to information/knowledge sources and simply seek advice to understand the changing clinical environment. DME-SIHI's aim was to develop skills in finding and using information for decision support during clinical care and teaching. Also it explores the attitudes towards Electronic Medical Records (EMRs); for health professionals with specific emphasis on use of health informatics. This institution gave access to the health care providers to share their knowledge with the Community of Participation (CoP) where tacit knowledge of experts was shared among other users. This knowledge sharing in the community made a positive effect on the capacity of the health care providers in their working environment. CoP allowed like minded group of health care professionals to collaborate, seek knowledge, discuss and process their tacit knowledge to instigate creation of explicit knowledge in a community. This sharing of knowledge played a vital role in increasing the capacity of the healthcare providers in retaining, managing and sustaining their current knowledge. Overall, DME-SIHI was a representation of social relationship in a CoP which was useful in depicting the flow of information in the community leading to a

social network that depicts social relationships, such as friendship, co-working or information exchange (Garton, 1997). Following discussion will be on the proposed knowledge sharing model for DME-SIHI:

### **PROPOSED KNOWLEDGE SHARING MODEL**



(Figure: 1)..... (HINF 6230 class notes)

In the above model (Figure: 1), knowledge artifacts are the explicit and tacit knowledge related to increase awareness about the scope of the Health Informatics (HI) field and its significance in the distributed learning environment. The contexts are activities like CDSS, lectures, and other HI related topics. The medium was through class discussions, hands on experience and on-line material. DME-SIHI helped develop trust among the faculty members and also made a culture of collaborative problem solving practice resulting in accessing knowledge on time along with new and innovative methods to overcome any barriers in the delivery of health care with potential strategies to deal with them (Abidi, 2007).

## 5. Conclusion

Knowledge sharing addresses the important issue of reusing the existing knowledge in a tacit, explicit or implicit form which can be shared in the community at appropriate times to reduce the knowledge gap. This externalization of knowledge can be through CoP involving a group of like-minded individuals to share their experiences, knowledge, resources, and insights for a defined objective of collaborative-problem solving. DME-SIHI is a collaborative knowledge sharing between the faculties or non faculty members and health informaticians to reduce the knowledge gap. In other words the goal of SIHI was to inform and educate professionals and empowers them for teaching, planning, decision making and change management through CoP.

CMA-EMR case study is also a knowledge sharing project where physicians share there experiences and challenges in implementing EMR. All these experiences worked as a source of tacit and implicit knowledge gained through the learning experience. During this period physician's knowledge was shared between the CMA researchers where these researchers will share physicians lessoned learned in an explicit form to the various stakeholders.

Thus the objective of this internship was based on knowledge sharing between different communities and the above proposed model also has the potential to identify the experts in the community. It is a system that would allow participants of a community to collaborate, seek Knowledge and to discuss virtually thus reducing the knowledge gap and helping promote more efficient and effective delivery of health care.

## **6. RECOMMENDATION**

Physical Community of Participation may not be a good solution for virtual members in such a busy and excessive workload environment. This paper recommends Knowledge Sharing Model (KSM) as an online discussion forum. This online discussion forum will help to share knowledge among virtual members by means of Community of Practice/Participation (CoP) of likeminded people with similar goals. This online discussion forum should be on Dalhousie BLS and virtual class. To access these online forum students should sign up with their username and password.

An online discussion forum will disregard the difficulties generated by distance and other environmental constraints. A feed back system of a solution that would indicate the effectiveness of any given suggestion would also increase the reliability of knowledge sharing activity in the proposed solution. However, there should be a systematic evaluation of the training, content, procedures used, which will help provide input in using better techniques and procedures in the future. A database containing all the participants and their comment should be uploaded in the BLS where participant can communicate with each other in the near future. Since the faculty members were from a distant environment, they do not have an integrated way to share knowledge, extend their team and share their mission. By implementing this knowledge sharing model, there would be a larger community for the centers to draw from, regarding knowledge and problem issues, and hence making a more unified and consistent approach in adoption and implementation of health information technology research, and its role in the continuum of medical education programs.

This proposed solution will not work unless there is a virtual leadership for virtual teams and knowledge management strategy. Basically a system performs well when it is placed in a favorable

environment. It is helpful if the people in the community understand the benefits of the system thus virtual leadership has to be established. Virtual leaders will be able to recognize the needs of the organizations, communicating to the vested interest groups while establishing the trust and intimacy. The leadership support would prevent any obstacles related to power structure and would encourage to have a culture favorable to knowledge sharing. This also allows decision makers to develop incentive systems for the experts who managed to contribute more in the system. Defining and designating experts as resourceful should help others to identify the knowledge source. It is through the philosophy and mechanisms that occur by virtual leaders that can allow for better unification of programs of DME-SIHL.

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## Appendix A:

### **DME-SIHI**

#### Objectives Endocrine Case

#### **Sydney Johnson – A Case of Hyperglycemia**

1. To understand the presentation, clinical course and pathophysiology of Diabetes Mellitus (DM),
2. Differentiate between Type 1 and Type 2 Diabetes.
3. To understand the diagnostic determinants of Type 2 DM
4. To think of DM 2 as more than simply a disorder of glucose metabolism.
5. To understand its importance as a risk factor for micro and macro vascular disease including coronary artery disease.
6. List and interpret critical clinical and laboratory findings which are keys in the process of exclusion, differentiation and diagnosis.
7. Select appropriate investigations for diagnosis of diabetes mellitus and its complications.
8. Discuss HbA1C and glycemic monitoring.
9. Discuss urine micro albumin and nephropathy diagnosis.
10. To assess for other risk factors for Coronary Artery Disease (CAD).
11. Conduct an effective initial plan of management such as:
  - A. Outline appropriate immediate and long term management of DM, including blood pressure control
  - B. Primary and secondary prevention of complications of both Micro and Macro vascular.
  - C. A brief weight reducing diabetes meal plan,
  - D. Quit smoking.
  - E. Cut back on his drinking,
  - F. Physical activity programme
  - G. Advised to start one baby Aspirin (81mg) daily.
10. Conduct education and counselling to patients with diabetes mellitus and their families. Including life style modifications.
11. Advised for follow-up.

## Objective

### Haematology Case

#### Michael meets the many faces of Anemia

#### Objectives:

1. To have a differential diagnosis for microcytic anemias in infants.
1. To develop an understanding of normal red blood cell development and iron balance
- 2 To develop an approaches to hemolytic anemia in newborns
3. To develop an approach to microcytic anemia in infants, including iron deficiency and thalassemia
4. To have a understanding of the Rh disease in newborns
5. To develop an understanding of the acute and chronic risks of blood transfusion, including complications of iron overload.
6. To develop an understanding of bone marrow transplant.
7. List and interpret critical clinical and laboratory findings which are keys in the process of exclusion, differentiation and diagnosis.
8. Select appropriate investigations for diagnosis of Microcytic Anemia in infants and its complications
9. To have a understanding of clinical presentations for Hemoglobinopathy.
10. Conduct and effective plan of management for the patient
  - A. Physical examination
  - B. Cardiac examination
  - C. Management of Rh disease in newborns
  - D. Blood Transfusion
  - E. Bone marrow transplant
11. Advised for follow-up.



## Objectives

### Haematology

#### As the Bruise Turns

1. Understand the mechanisms and causes of adult thrombocytopenia.
2. Understand the mechanisms and causes of neonatal thrombocytopenia.
3. Understand the normal function of the spleen.
4. Understand the physiology of normal hemostasis.
5. To understand the mechanisms of action of steroids and Intravenous gamma globulin.
5. Understand the management of Immune thrombocytopenia ( ITP).
6. Understand the risks and benefits of blood product transfusion.
7. Understand the causes and management of DIC.
8. Understand the consequences of splenectomy.
9. Understand the differential diagnosis of thrombocytosis.
10. List and interpret critical clinical and laboratory findings which are keys in the process of exclusion, differentiation and diagnosis.
11. Select appropriate investigations for diagnosis of
12. To have a understanding of clinical presentations for Hemoglobinopathy.
13. Conduct and effective plan of management for the patient
  - A. Physical examination
  - B. Blood transfusion
14. Advised for follow-up

# Sarah's Swollen Leg

## Objectives

1. To identify the symptoms of deep vein thrombosis, and have an approach to the differential diagnosis of a swollen leg.
2. To determine whether the pain is articular or non-articular and related to exertion or not( Constant night pain suggest inflammation /neoplastic process)
3. To understand the work-up for an acute DVT.
4. To learn the risk factors for both congenital and acquired venous thromboembolism.
5. List and interpret critical and laboratory findings which were key in the processes of exclusion, differentiation and diagnosis.
  - List radiographic, magnetic resonance imaging, Doppler and ultrasound examination.
6. To learn about the pathophysiology of thrombosis associated with malignancy.
7. To learn about the complications of thrombotic episodes, and anticoagulation in cancer patients.
8. To learn about the pregnancy complications associated with hypercoaguable conditions.
9. To understand the treatment for venous thromboembolism, and the side effects and monitoring of patients receiving low molecular weight heparin and warfarin.
10. Conduct an effective plan management for a patient with Deep vein Thrombus.
  - A. Refer to a haematologist for advice regarding long term management.
  - B. outlines multidisciplinary management for the prevention of peripheral vascular disease.
  - C. Select patients in need of specialised care.
  - D. Provide enough education regarding the disease
11. Advised for follow-up.

## Matthew's Difficult Decision

### Objectives

1. To know the general causes of splenomegaly
2. To understand the differential diagnosis of basophilia and the cause of elevated white cell count.
3. To know the general causes of a leukocytosis
4. To interpret the clinical setting in which the leukocyte abnormality occurs (including repeat testing) since it will often suggest the correct diagnosis and direct further investigations.
5. To have a thorough, efficient, focused data gathering:
  - A. Distinguish between conditions requiring non-urgent evaluation and acute life threatening illnesses such as overwhelming sepsis (fever, hypotension, tachycardia, hypothermia or clinical signs of infection) requiring hospital admission.
  - B. Examine the patient for abscess, abdominal rebound, tenderness, signs of pulmonary consolidation or pleural effusion, joint swelling, erythema, hepatosplenomegaly, lymphadenopathy.
  - C. Examine the oral cavity, teeth, peri-rectal area, genitals, skin for signs of infection.
  - D. In evaluating a patient with a leukemoid reaction, rule out chronic myelogenous leukemia.
6. List and interpret critical clinical and laboratory findings which are key in the process of exclusion, differentiation and diagnosis.
  - A. Interpret a leukocyte differential
  - B. Interpret combined abnormalities on the complete blood count (e.g. anemia, polycythemia, thrombocytopenia, nucleated RBCs)
  - C. List the indications for blood culture, bone marrow aspiration and biopsy.
7. To understand the clinical presentation and natural history of Chronic myelogenous (myeloid) leukemia (CML)

8. To understand the molecular abnormality in CML and CML is involved in the pathogenesis of chronic myeloid leukemia (CML)
9. To understand in general terms how an allogeneic bone marrow transplant is used in the treatment of CML
  
11. To review the elements of informed consent and the challenges faced in surrogate decision-making
12. Conduct an effective plan management for a patient with leukocyte abnormalities:
  - A. Diagnose/exclude infection as the cause of neutropenia/leukocytosis.
  - B. Select patient with specialized care (WBC>250,000/ul, leukemia's, overwhelming sepsis)
  - C. Counsel and educate patients with chronic leukocyte abnormalities.
  - D. Recommend effective infection preventing strategies (e.g. dental care) and avoid those without benefit( e.g. reverse isolation since,origin of infection is usually endogenous)
  
13. Advised for follow-up.

## OBJECTIVES

### A Pharmacy Student with an Unanticipated Problem

1. To differentiate between galactorrhea and breast discharge.
2. To differentiate between physiology and pathology of galactorrhea.
3. To do a thorough efficient focused data gathering:
  - A. Determine whether discharge is expressed or spontaneous, unilateral or bilateral, color of discharge, medication use, which patients have menstrual irregularities, infertility, headaches or visual changes, symptoms of hypothyroidism.
  - B. Examine breast for lesions, unilateral/ Uni-ductal discharge, breast mass.
4. List and interpret critical clinical and laboratory findings which are key in the process of exclusion, differentiation and diagnosis:
  - A. If nipple discharge is bloody, order cytology.
  - B. Select and interpret laboratory and diagnostic imaging in a patient with galactorrhea.
  - C. Blood work and magnetic resonance imaging (MRI).
  - D. To understand the normal pituitary/hypothalamic feedback control of specific target organs.
5. To have a understanding of how elevated prolactine levels can cause amenorrhea.
6. To understand the long term effects of untreated hyperprolactinemia.
7. Conduct an effective pain management for a patient with breast discharge:
  - A. determine which patients likely have a breast neoplasm.
  - B. Outline the role of dopamine agonists(e.g. Cabergoline, Bromocriptine) in the management of patients with hyperprolactinemia and galactorrhea.
  - C. Counsel and educate patients with galactorrhea about to minimize it.
  - D. Select patients in need of specialized care.
8. To understand how endocrine evaluation involves correlation with the other investigative techniques including imaging, ophthalmology investigations and with neurosurgical consultation.
9. To plan long-term follow-up of patients requiring hormone replacement, surgical intervention or radiation therapy.

## **Objective:**

### **Like mother, like daughter.**

1. To understand the risk factors for the development of osteoporosis and for fractures associated with osteoporosis with a particular emphasis on the geriatric population.
2. In a patient with a fracture or dislocation, determine other aspects of the medical history that might have an impact on the alteration of management (e.g. previous similar injuries) and outline initial management.
3. Through, efficient, focused, data gathering:
  - A. Determine the etiologic process underlying the injury.
  - B. Determine neurologic and vascular status distal to level of injury.
  - C. Determine location of pain, closed or open fracture, local soft tissue changes
  - D. If minimal trauma causes a fracture, elicit history of conditions associated with pathologic fractures.
4. List and interpret critical clinical and laboratory findings which were key in the process of exclusion, differentiation and diagnosis:
  - A. Select skeletal elements to be included in the diagnostic imaging required special views.
  - B. List circumstances requiring additional diagnostic imaging such as computerised tomography, imaging of opposite for comparison, bone scans, MRI.
  - C. Outline investigation in a patient with a pathologic bone fracture.
5. To discuss the assessment of patients with osteoporosis including clinical, laboratory and radiology evaluations.
6. To be familiar with guidelines for the management of osteoporosis including non-pharmacologic management (calcium, vitamin D, falls prevention strategies).
7. To discuss the pharmacologic options for the treatment of osteoporosis.

8. To prevent falls by asking all patients? 75 years (70-74 with risk factors) old about falls and balance/gaits, difficulties
9. Identify the potential causes of falls by considering intrinsic or extrinsic factors (or combination of both)
10. To have a thorough efficient, focused ,data gathering:
  - A. In a patient with one or more falls, elicit a description of the fall
  - B. Determine whether factors extrinsic to the patient may have caused the fall (drugs, alcohol, environmental hazards such as poor illumination, lack of stair rails, rugs, bathmats, footwear, uneven/slippery surface).
  - C. Determine whether factors intrinsic to the patient may have caused the fall ( ataxia, impaired vision, gait disturbances, other disease entities).
  - D. Conduct a physical and performance evaluation.
11. List and interpret critical clinical laboratory findings which were key in the process of exclusion, differentiation, and diagnosis:
  - A. Conduct an environmental assessment for hazards : order test based on clinical indications.
  - B. Request CBC , electrolytes ,creatinine/urea, glucose , vitamin B12, thyroid function test.
12. Conduct an effective plan management for a patient with the tendency to fall:
  - A. Counsel for prevention, recommend balance/gait training, muscle strengthening exercise, reeducation in home hazards and gradual discontinuation/dose reduction of medications.
  - B. Counsel and educate the patient or caregiver about the multifactorial nature of most falls.
  - C. Outline a management program that includes control of risk factors and provision of an active rehabilitation program that focuses on gait and balance retraining for seniors.
  - D. List possible modifications in the living environment that reduce the risk of falling.

## **Objectives**

### **Endocrine**

#### **The Irritable Secretary**

To recognize the signs and symptoms of hyperthyroidism and hypothyroidism.

To understand that hyperthyroidism has multiple etiologies, some with very different presentations.

To understand the investigative strategies based on pathophysiologic principles.

To understand the normal pituitary – thyroid axis.

To feel confident that management principles are understood



# ISABEL

A DIAGNOSIS REMINDER AND KNOWLEDGE MOBILIZING  
SYSTEM

**8th Annual  
Summer Institute  
Division of Medical Education  
Wednesday, June 4, 2008  
to  
Friday, June 6, 2008**  
Prepared by: Dr. Grace Paterson/Dr. Rashoo Brar

## Outline

- Introduction
- Interface
- History
- Technical details
- Components of Isabel
- Isabel in action
- Experiments with Isabel
- Outstanding points

## Introduction

- It is a web based system that helps physicians to diagnose diseases in patients.
- It is not an expert system
- It is a reminder system i.e.. to give a differential diagnosis in a timely manner
- It suggests causative drugs

## Interface

- It is a web based system so as a result the user does not need to download any program and install anything onto their local computer
- A subscriber with his user ID and password can connect to ISABEL and use the system from any computer that is online
- A computer, browser, and internet connection is required to get the benefit of the system
- It can also be used in a PDA, where the PDA requires connecting to a separate web address to have a PDA style interface

## History

- Founded by Jason and Charlotte Maude in 1999 in response to the near fatal misdiagnosis of their three year old daughter Isabel Maude
- System was created by physician in 2001

## Technical details

- Isabel uses statistical natural language processing (SNLP) software which makes entry/extraction of data efficient
- Using pattern matching software, Isabel allows professionals in a hospital or group of hospitals to view clinical queries entered into an EMR system (NextGen, PatientKeeper, A4 Health system in USA)
- Results are arranged by body system
- Database is merely a collection of textual disease descriptions found in established medical textbooks
- Taxonomy of over 11000 diagnostic categories
- Causative Drugs 4000 (Martindale's data)

## Subscription

- Individual (\$500 USD/per year)
- Subscription component of ISABEL can be classified into three categories:
  - 1) Pediatric
  - 2) Adult
  - 3) Both
- Institutional (hospital) or group (\$186 USD/per bed year)  
Group wise or hospital based Isabel includes ICAM (clinical alert and monitoring system)

## Component of ISABEL

- Isabel Diagnosis Reminder System (IDRS)
  - Provides clinicians a checklist of likely diagnoses and causative drugs for given symptoms and signs
  - Also suggest Related Diagnoses
  - Designed by clinicians to be used by clinicians
  - Isabel resolves (pattern matching) patient data sets with data sets described in medical literature (textbooks and journals)
  - IDRS is not intended to be used as an oracle to solve medical problems (This is not an electronic medical record)

## Components of Isabel (cont.)

- Isabel Knowledge Mobilizing System (IKMS)
  - Isabel has over 11,000 diagnostic categories
  - Does not generate but mobilizes knowledge using its unique tutored taxonomy
  - Isabel diagnostic categories have the client option of tagging (e.g. SnomedCT) which can be used to recover knowledge from the clinician's workflow
  - Isabel starts at the same point clinicians and patients frequently begin (i.e. with clinical features followed by the construction of a differential diagnosis)
  - Each diagnostic category possesses a kernel of knowledge which uses concept search (not key word search)
  - Institutional subscribed online resource can also be linked in this search of knowledge

## Knowledge

- CME capture
  - all your queries and searches, results generated and knowledge pages you visit will be automatically captured
  - you can add comments and document how the knowledge you were provided with, applied to your clinical practice
- Isabel allows physicians to gather knowledge at point of need
- Isabel inspires physician's tacit knowledge to be useful at point of care

"Lack of knowledge was not an important factor in diagnosis error..." Arch Intern Med. 2005; 165:1493-1499

## ISABEL contribution

- Covers all ages,
- Considers many regions of the world
- Provides likely diagnosis instantly
- Helps develop physicians knowledge base
- Point of care help
- Point of need help
- Established medical text book terminology are used

## Isabel in Action

<http://www.isabelhealthcare.com>

## Validation

- It has been checked for accuracy in the pediatric and ER patients and has been found to be 95% accurate in making the correct diagnosis
- In a Recent study in adult emergency displayed >90% discharge diagnosis
- Isabel has had an impact on decision making, in a clinical study junior clinicians used Isabel in their decision making
- In simulated cases Isabel reminded users to keep in mind an additional important diagnosis in 1/8 episodes and prompted the user to order a clinically important test in 1/10 cases
- All Clinically significant diagnosis were considered in the consultation processes
- Isabel has demonstrated to help junior physicians make comprehensive assessments and avoid incomplete workups. Approximately 45% of incomplete workups occurred when not using Isabel by juniors
- It helps physician to get their tacit knowledge out at point of care and avoided incomplete workups

## Outstanding points

- On average the data entry time for Isabel on a stand alone basis (as opposed to extraction from EMR) is less than a minute
- Isabel is the only diagnosis decision support system to be interfaced with EMR (currently in USA )
- Pre-assigned fields (age, gender, chief complaints, positive findings) in the EMR are defined, and data from these pre-assigned fields are submitted to Isabel (single click on an **Isabel** button in the EMR)

# Try It Out in Computer Lab

Please complete an evaluation  
form, or send your feedback  
comments to  
[grace.paterson@dal.ca](mailto:grace.paterson@dal.ca)





# ISABEL

## DIAGNOSIS REMINDER AND KNOWLEDGE MOBILIZING SYSTEM-ISABEL

**Technology Assessment Report**  
**By: Rashoo Brar and Badal Dhar**  
**Date June4, 2008**

### Introduction

A Physician's important job, at the point of care, is to understand the patient's physical situation and make a correct diagnosis. A proper diagnosis helps a patient in obtaining a quick remedy, reduces the number of encounters, and reduces cost. Physicians learn in their training to try to synthesize correlate signs and symptoms and come to a conclusive diagnosis. If required then the physician may need to do some investigations to help come to a conclusion. Only with a correct diagnosis can a physician implement appropriate medical management.

Physicians work in stressful situations and often work with limited resources and time. These factors can lead to misdiagnosis. Study finds that lack of knowledge is not the important factor in diagnosis error [1]. So, it is important that there is a system which reminds physicians to consider all possible diagnosis.

There are times when physician has to work under time constraint, there are symptoms related to a drug, and there are emerging new complexities related to bio terrorism.

Considering these entire factors there is a need by the physician to be reminded that all possible diagnosis has been considered or accounted for.

Moreover based on symptoms and complaints, a detail understanding and recent finding is also important to the physician at the point of need. There are many resources, knowledge and information in many places but filtering them according to the need and extracting them for use is important too.

### **What is ISABEL?**

Isabel is a clinical decision support and knowledge mobilizing system. Isabel delivers as a web-based standalone system and has been interfaced with electronic patient/medical record. Isabel diagnostic advice is derived from searching unformatted medical textual content. This powerful approach permits users to search by concept matching as well as word matching, and is significantly different from previous diagnostic expert systems. The clinical features input into the Isabel system are also in unstructured free text language, in order to facilitate ease of use by clinicians in busy environments.

### **History of the Development of ISABEL**

Isabel Maude, three-year daughter of Jason and Charlotte Maude, was fatally misdiagnosed by health care professionals. In response to that event Jason and Charlotte Maude founded Isabel Healthcare in July 1999. Joseph Britto MD the Attending Physician of St Mary's Hospital in Paddington, London was also involved in the development of Isabel. They developed the system so that physicians could be reminded of all the possible related diagnosis. In June, 2002 the pediatric version of the Isabel diagnostic tool was launched.

## Components of ISABEL

### Isabel Diagnosis Reminder System (IDRS)

- Following on from history taking and clinical examination Isabel assists the learned intermediary by reconciling patient data sets with data sets as described in medical literature.
- The **IDRS** is intended to be used as a near-patient decision support tool. It is designed to be used by clinicians to provide a checklist of likely diagnoses and drugs for a patient's clinical features to reduce diagnostic errors and improve patient care.
- Isabel taxonomy contains over 11,000 diagnosis and 4000 causative drugs. This taxonomy is updated every day to a small extent but they go through major update every 3-6 months.

### Isabel Knowledge Mobilizing System (IKMS)

- The IKMS goes one step further: it harnesses diverse medical knowledge related to each of the diagnostic suggestions and drugs. It also searches an extensive knowledge base to find specific answers to clinical questions arising in the workflow.
- Isabel does not generate but mobilizes disparate knowledge/content using its unique tutored taxonomy and delivers this into the clinician's workflow.
- Isabel's diagnostic categories have the client option of tagging (e.g. SnomedCT). Clients could use Isabel's tutored taxonomy and/or SnomedCT tagging to retrieve knowledge into

the clinician's workflow IKMS can be used either in a clinical setting to quickly Read up a Textbook.

### **Read up text books.**

According to the parameters provided this features allows physician to go to different books related to that topic.

### **Lessons learned**

This feature searches all the published journal and finds out what are the pitfalls and complexities related to given query and physician can read all the materials according to his choice. The physician also has the option to narrow down this search by entering additional search criteria.

### **What's new?**

This feature also searches the entire published journal but finds out what are current development in diagnosis and new ideas related to a given query. The physicians can read all the materials according to his choice. Option for narrowing down his searched paper is also available here. Physicians have options to narrow down, as well as ordering the papers, the findings of search by entering additional search criteria.

### **Annotated images**

This feature allows physician to look into images that are related to parameters, symptoms, signs and diagnosis being entertained by the physicians. Thus one can have a visual understanding of that disease and symptoms.

### **CME**

This component is basically for the physicians who like to have CME accreditation. Before starting the search or suggestion for diagnosis, one can click on the CME button. This starts capturing all the query the physician provides to Isabel. There is an end button that ends the session. All the activity during this session is recorded and can be emailed to somewhere also can be stored as excel file. Apart from CME accreditation it may be helpful to the physician to look into his/her activity store them for future analysis.

### **Distribution**

Isabel is web-based system so one needs to have a user ID and password to connect to Isabel's web site and get the benefit of the system. It does not require to any download component (client) to any local computer. One can subscribe for pediatric component, or adult component or component that covers both.

There could be independent license or can be grouped or hospital license.

There are some extra components that can be incorporated in ISABEL. These are integration with EMR (electronic medical records). These features are currently available with some EMR systems

in USA. These are NextGen, PatientKeeper, and A4 Health system. Isabel is also working to provide connectivity with other EMR system too.

Isabel can be connected from PDA too. As the system does not require any downloading to the local machine or PDA, PDA requires to be connecting to a separate web-address which provides PDA style interface.

### **Other facility provided in Hospital or group based ISABEL**

Clinical Alert System and Diagnosis monitoring system are two features available with ISABEL hospital or group subscribed system

Clinical Alert System captures similar queries provided by the physician to Isabel that helps physicians to identify if there are any special complexities that are prevailing in the hospital or group of physicians.

Diagnosis monitoring system also captures the diagnosis and query provided by the physician. This component uses pattern recognition and cluster analysis software. This may help physicians if there is are any specific diseases spreading in a community or if there is a possibility of any kind of pandemic situation that persists.

### **Technology used**

**Isabel** differs from rules based DDSS like QMR, Iliad, Dxplain, DiagnosisPro, PKC in that it uses statistical natural language processing [SNLP] software and is thus able to handle unstructured

data. Entry and extraction of data is therefore very quick. It uses pattern matching software in a hospital or group of hospitals to view clinical queries entered into an EMR system. It also uses pattern recognition and cluster analysis software in its diagnosis monitoring system and clinical alert system in hospital or group system of Isabel. Isabel searches the natural language of established textbooks. On an average the data entry time for Isabel on a stand alone basis has been shown in studies to be less than a minute-basically the time its takes to type 3-4 clinical features.

### **Validation**

Isabel has been checked for accuracy in the pediatric and ER patients and has been found to be 95% accurate in making the correct diagnosis. In a Recent study in adult emergency displayed >90% discharge diagnosis. In simulated cases Isabel reminded users to keep in mind an additional important diagnosis in 1/8 episodes and prompted the user to order a clinically important test in 1/10 cases. All clinically significant diagnosis was considered in the consultation processes. Isabel has also demonstrated to help junior physicians make comprehensive assessments and avoid incomplete workups. Approximately 45% of incomplete workups occurred when not using Isabel by juniors

Thus Isabel helps physician to get their tacit knowledge out at point of care and avoided incomplete workups.

## **Discussion**

This tool is not an expert system; it is a clinical decision support system that helps physicians to improve the quality of a diagnosis. It does not take a long time to have the suggestions provided by the Isabel. It does not even guide physicians to take a decision rather it suggests physician whether the physician has considered all the possible related diagnoses.

Based on the feature and specification it provides a big list of possible diagnoses, with a further subclass of diagnosis with one class, that might sometime seems complex. But physicians are well aware of their activity and their knowledge. This system respects the notion that physicians have the knowledge, but it is not possible for all human to consider all possible related diagnosis and that is why it provides all possible diagnoses consideration.

However, the knowledge component helps physicians to be updated with current knowledge and also to revise anything at point of need. As knowledge is dynamic, and recent findings are being accumulated everyday and keeping track of those recent finding is not always possible by physicians. Isabel helps in this respect by providing related topic easily according to the need of the physician.

The system was first launched in 2001 with only pediatric component and later it included all age of people and different geographical area. It also incorporated EMR integration into its system. Many countries are using this system in their hospitals. Many physicians have found Isabel to be a valuable tool in their clinical practice.



## References:

1. Diagnostic error in Internal medicine'. Mark Graber MD, Department of Veterans Affairs Medical Center, Northport, NY. Arch Intern Med. 2005; 165:1493-1499
2. <http://www.isabelhealthcare.com/home/default>

## Appendix A: ISABEL

Username and password for ISABEL tool:

Username	Password
<a href="mailto:dal1@dal.ca">dal1@dal.ca</a>	healthinformatics
<a href="mailto:dal2@dal.ca">dal2@dal.ca</a>	healthinformatics
<a href="mailto:dal3@dal.ca">dal3@dal.ca</a>	healthinformatics
<a href="mailto:dal4@dal.ca">dal4@dal.ca</a>	healthinformatics
<a href="mailto:dal5@dal.ca">dal5@dal.ca</a>	healthinformatics
<a href="mailto:dal6@dal.ca">dal6@dal.ca</a>	healthinformatics
<a href="mailto:dal7@dal.ca">dal7@dal.ca</a>	healthinformatics
<a href="mailto:dal8@dal.ca">dal8@dal.ca</a>	healthinformatics
<a href="mailto:dal9@dal.ca">dal9@dal.ca</a>	healthinformatics

## Appendix A:

### VISUAL Dx:

#### **Objective**

Understanding how a Clinical Decision Support Tool can facilitate a deeper understanding of a case workup, and the terminology required for the referral and triage. Entering Patient Findings into Visual Dx for Differential Diagnosis

#### **Key Findings**

##### **Presentation**

Mr. Andrew Smith is a 59-year farmer presented to the Family Doctors with chief complaints of skin rash with no fever... He has noticed that his rash has increased since last year. Initially he noticed his rash were only on his forehead, face, and hands. But with the course of time it has progressed to his anterior lower legs, forearms, frontal scalp, back of neck and chest. He also mentions that his skin is dry and he finds his rash is scattered all over his body.

#### **Guiding Questions**

1. What further history is required?
2. What specific features of the physical exam may be important?

Mr. Smith mentioned that he use to get Severe Sunburns and also mentions that his dad had similar kind of rash and was on some medication. Mr. Smith has been taking no medication (prescriptions, herbal, or over the counter).

Physical examination reveals wrinkled wizened, leathery,” prematurely aged,” skin with hyperkeratotic Subtle, barely elevated rough papules with color variation from whites to yellows scale, and were difficult to remove and caused some distress to the patient . On further findings Lesion were reddish brown in color with a white scale on top measuring in size between 3-4 millimeters in diameter. Lesions felt like sand paper, and were scattered.

### **Guiding Questions for Group Discussion**

1. Formulate a differential and working diagnosis.
2. What is the course and prognosis of the disease?
3. What laboratory investigations should be ordered ( if needed)?
4. Given the laboratory results, what are the risks to the patient?
5. What are the therapeutic options?
6. How do you convey the patient’s findings for a dermatology referral?

# VisualDx

## Clinical Decision Support System

8th Annual  
Summer Institute  
*Division of Medical Education*  
Wednesday, June 4, 2008  
to  
Friday, June 6, 2008  
Prepared by: Dr. Grace Paterson/Dr. Rashoo Brar

## Agenda

- Introduce the Clinical Decision Support Software VisualDx.
- Demonstrate VisualDx functionality and capabilities.
- Discussion

## VisualDx Background

- VisualDx is a Visual Clinical Decision Support tool that guides Primary Care Clinicians, Emergency Care clinicians, and Public Health personnel in the diagnosis, treatment, and management of dermatologic disorders.
- VisualDx allows Clinicians to develop differential diagnoses by entering lesion morphologies and patient findings. It employs graphical search tools, a computerized knowledge base of relationships between findings and diagnoses, and thousands of images to present the clinician with a list of diseases that most closely match the criteria entered.

## VisualDx Background Cont'd

- VisualDx was initially designed for Primary Care and Emergency Clinicians. Its use has now expanded to areas such as Public Health, the Military, Medical Education, Dental Clinics, Rural Health and Correctional Health.
- VisualDx was first released in 2001. The latest version (5) of VisualDx has 26 different modules, with over 16,000 images represented in almost 900 diagnoses. It has more than 17,000 clinical findings grouped into sixteen different categories.

## VisualDx Background Cont'd

- VisualDx is a Java-based application that can be run on individual desktops, laptops and tablet PCs; or used across networks; or accessed over the Internet on a subscription basis. Pricing is based on the number of users, the number of installations, the combination of modules, and the time period of the license.
- VisualDx was developed by Logical Images Inc. – the world's leading provider of image-based medical diagnostic and educational software, based in Rochester, NY.
- <http://www.logicalimages.com>

## Demonstration

[www.visualdx.com/visualdx/visualdx5/launch.jsp](http://www.visualdx.com/visualdx/visualdx5/launch.jsp)

We acknowledge Art Papier, MD, for providing VisualDx licenses for the Summer Institute  
Free Demo available from <http://www.logicalimages.com/>



## Appendix A:

### Descriptive analysis: National Health and Nutrition Examination Survey (NHANES)

#### Step# 1

First log on to <http://www.cdc.gov/nchs/nhanes.htm>

This is webpage for **National Health and Nutrition Examination Survey** done in United States.

#### Step2

Go to NHANES on the left side of the home page. Then click 2005-2006 section. Go over the documentation/information provided on this page.

The screenshot shows a web browser window displaying the National Center for Health Statistics (NCHS) website for the National Health and Nutrition Examination Survey (NHANES) 2005-2006. The browser's address bar shows the URL: [http://www.cdc.gov/nchs/about/major/nhanes/nhanes2005-2006/nhanes05\\_06.htm](http://www.cdc.gov/nchs/about/major/nhanes/nhanes2005-2006/nhanes05_06.htm). The page features a blue header with the CDC logo and navigation links. A left sidebar contains a menu with categories such as 'About NCHS', 'Surveys and Data Collection Systems', 'Initiatives', 'Research and Development', 'Press Room', 'Publications and Information Products', 'Listservs', and 'Other Sites'. The main content area is titled 'NHANES 2005-2006' and includes sections for 'Contents in Detail', 'Using the Data', and 'Data, Documentation, Codebooks, SAS Code'. The 'Contents in Detail' section lists links for 'Survey Questionnaires, Examination Components and Laboratory Components', 'Survey Operations Manuals, Consent Documents, Brochures', 'Demographics', 'Examination', 'Laboratory', and 'Questionnaire'. The 'Using the Data' section lists links for 'Analytic Guidelines', 'Response Rates and CPS Totals', 'NHANES Web Tutorial', 'General Data Release Documentation', and 'Release Notes'. The 'Data, Documentation, Codebooks, SAS Code' section lists links for 'Demographics', 'Examination', 'Laboratory', and 'Questionnaire'. The page footer indicates it was last reviewed on December 28, 2007. The Windows taskbar at the bottom shows the 'start' button, open windows for 'NHANES - National...' and 'Descriptive analysis...', and the system tray with the time 1:33 PM.



## How is NHANES Data Collected?

1. Direct Interview: directly interviewing the survey participant and those within their household about their health.
2. Direct Examination: conducting clinical tests, **anthropometric, biochemical**, and radiological measurements, and physical examinations..
3. Physician Inquiry/Medical Records: reviewing participant's medical record.

In current practice, however, NHANES data are derived primarily from the first two sources; that is, via direct interview and direct clinical examination

### Step 3

Go over the following :

#### ■ [Demographics](#)

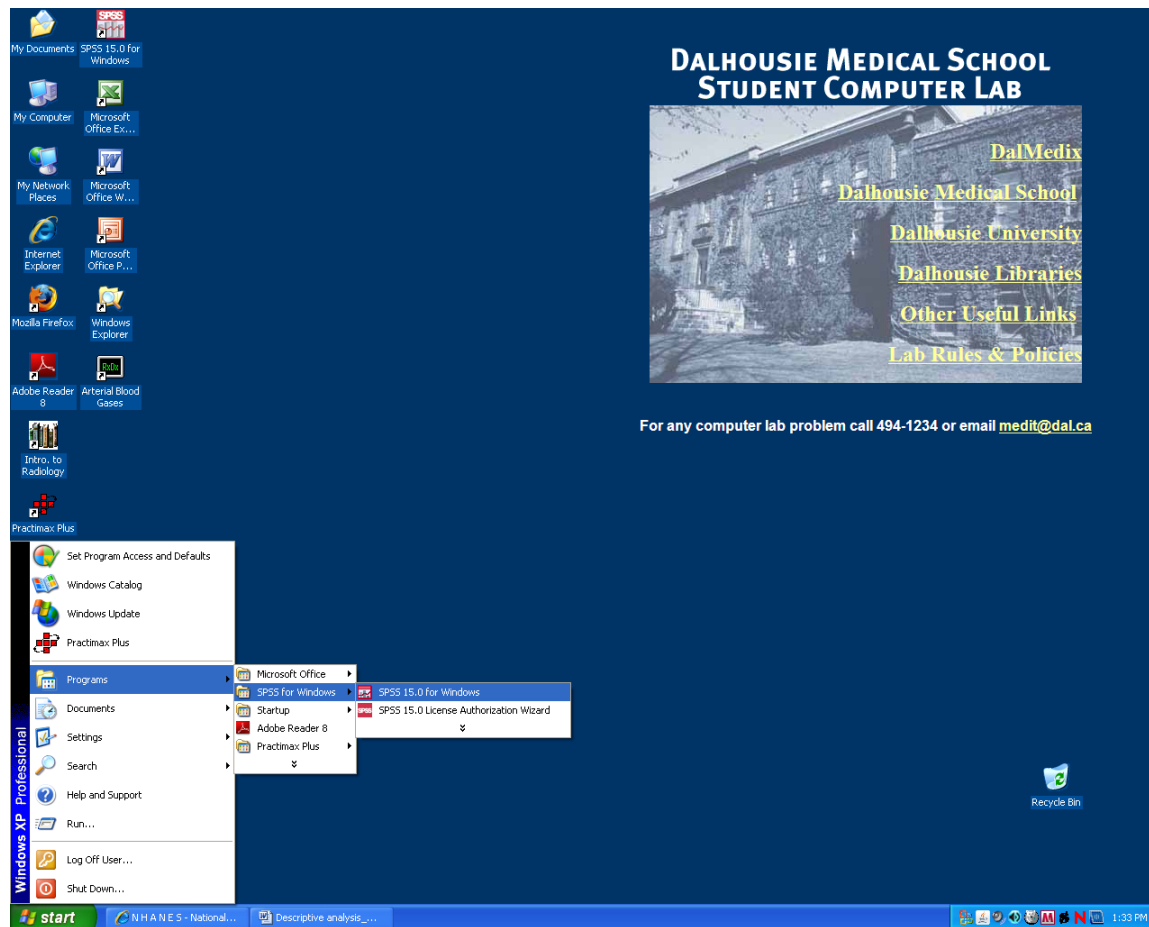
#### ■ [Examination](#)

- [Laboratory](#) : For further analysis go to any dataset, right click on the dataset and save at save the target as..... Where ever you want to save it for your analysis.

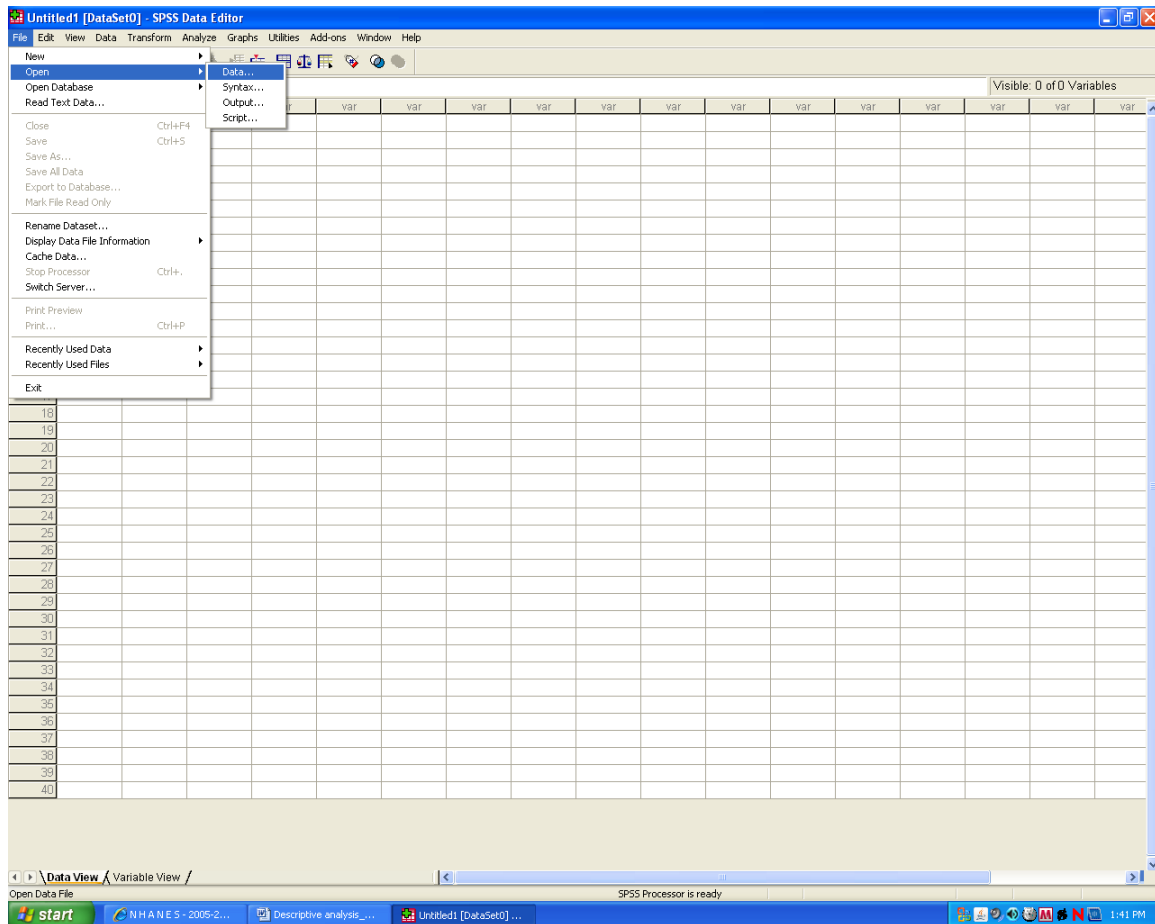
The screenshot shows a web browser window displaying the NHANES 2005-2006 Laboratory Files page. The page title is "2005-2006 Laboratory Files" and it lists various laboratory datasets. A context menu is open over the link "Glycohemoglobin [Data, Docs] (January, 2008)", showing options like "Open", "Open in New Tab", "Open in New Window", "Save Target As...", "Print Target", "Cut", "Copy", "Copy Shortcut", "Paste", "Add to Favorites...", "Properties", and "Print". The browser's address bar shows the URL "http://www.cdc.gov/nchs/about/major/nhanes/nhanes2005-2006/lab05\_06.htm". The taskbar at the bottom shows the Start button and several open applications, including "NHANES - 2005-2..." and "Descriptive analysis...".

## Step 4

For this particular analysis we will open SPSS



In SPSS we will go to file and open data (where you saved it) with **xpt** file type.  
Save the current data file and order the file according to the primary key (e.g. Sequence number, ID, etc)

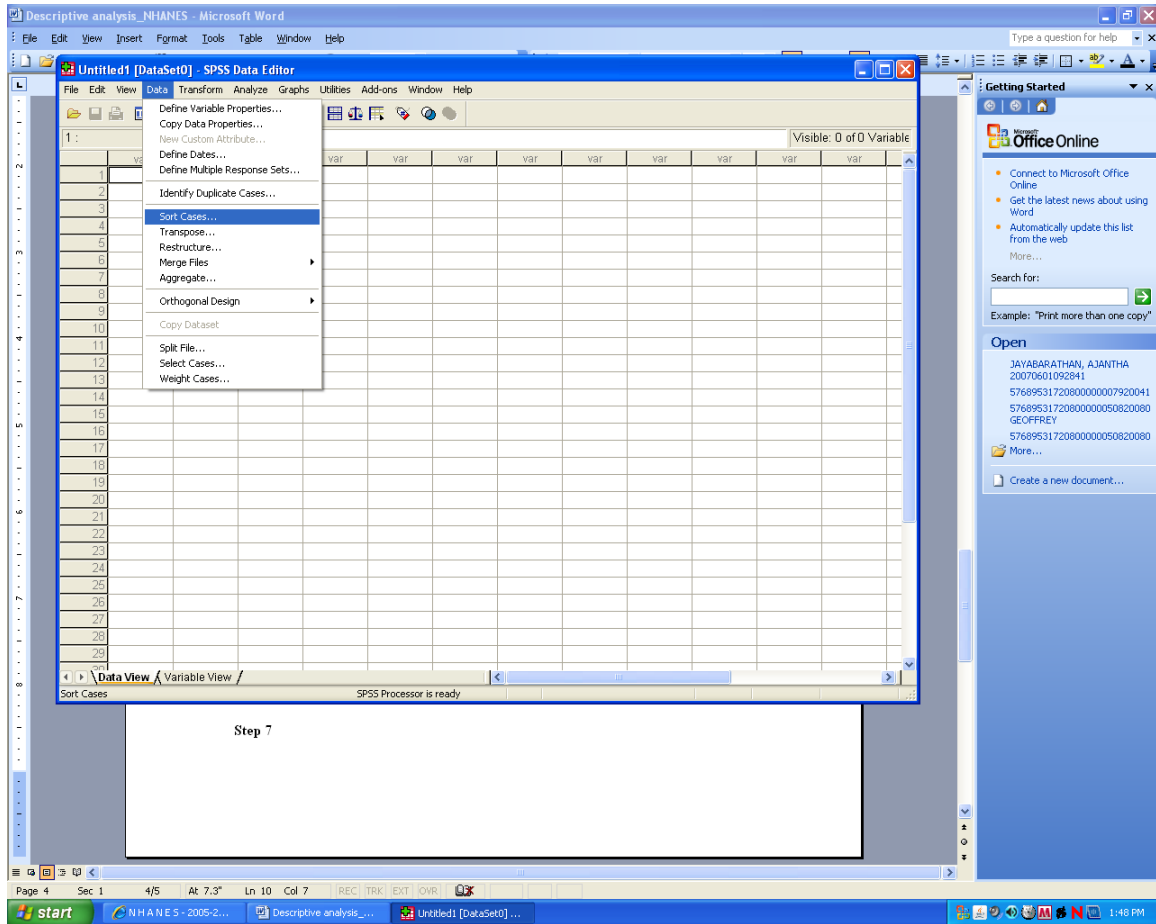


## Step 5

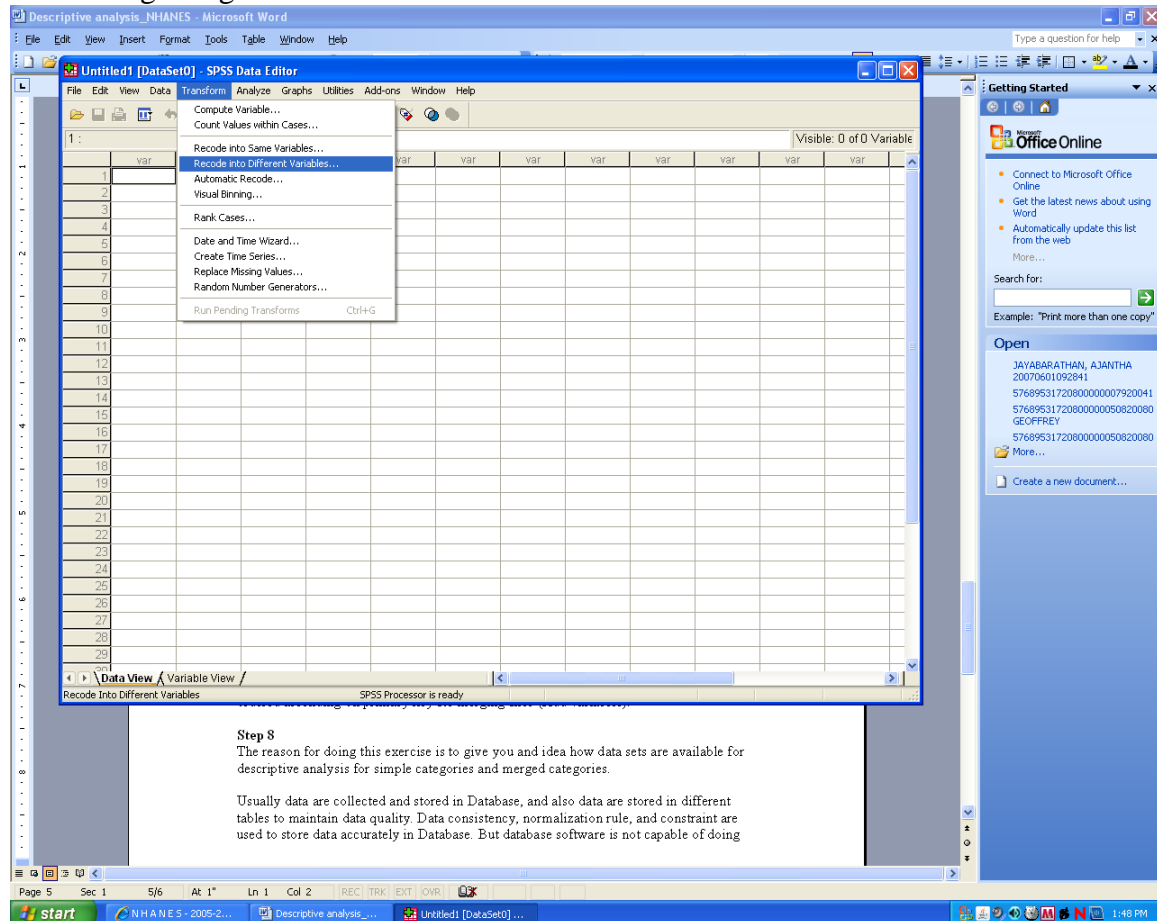
In this step do descriptive analysis like frequency, descriptive would be shown. When doing any activity like frequency there is a way to save the command into syntax using paste and this is done to keep track of the commands. Moreover when there is a complex operation it is better to save them because later one might forget what the steps were.

## Step 6

For this step we will go to data and then click onto sort cases , sort cases is used to sort based on particular field, however many a time according to their primary key, and in the ascending/descending order. After going through this tab we will explore select cases, select case is used to select a special group of data to do analysis (e.g. Analysis of effect of medication only on females, and for this task you will select only females).

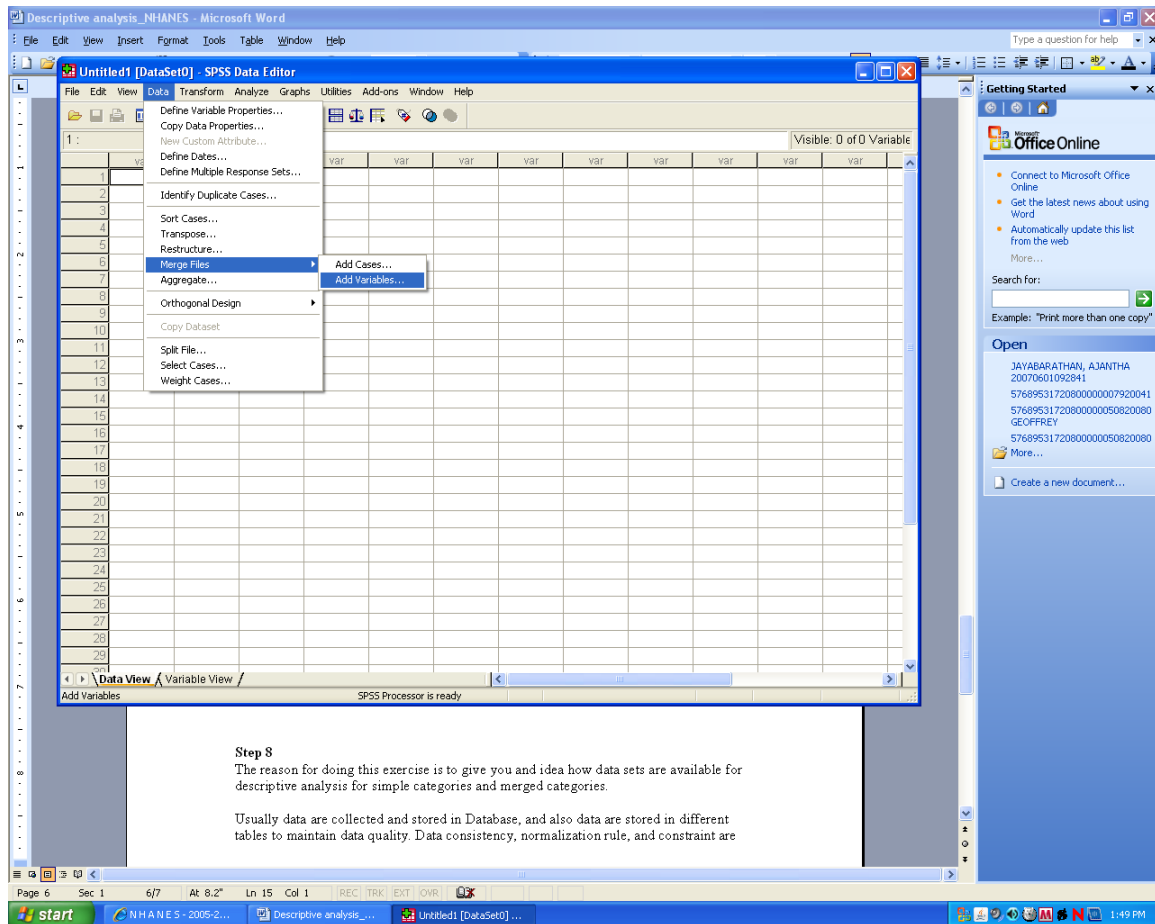


Further in this step you will explore transform tab which will help us in Recoding data. Recode is done to see variations in the levels. For example: grouping of variables into smaller groups like effect of age on glucose or vice versa.



## Step 7

In this section we will try to merge files and this merging can be done in two ways i.e. add cases and add variables. For this particular task we will go to data and then click merge files into different variables. We will not discuss add cases because they are usually done by database personnel and distributed by them. We will see how variables are added. However, for merging of files (add variables) we have to have two files with a common field, which is usually primary key in both the files, both the files should be ordered ascending on primary key for merging files (Add variables).



## Step 8

The reason for doing this exercise is to give you an idea how data sets are available for descriptive analysis for simple categories and merged categories.

Usually data are collected and stored in Database, and also data are stored in different tables to maintain data quality. Data consistency, normalization rule, and constraint are used to store data accurately in Database. But database software is not capable of doing statistical analysis. However, after data is stored in database, then data from different tables are exported to statistical package for analysis. Important part of data analysis is statistical understanding. Statistical analysis is not part of the course, but we will explain how simple descriptive analysis can be done in SPSS, and how data manipulation is performed in SPSS. This will give you a familiarity with SPSS environment. The more you learn statistics you would be able to use SPSS. However, these are basic techniques of SPSS one should be equipped to go with SPSS.

## Descriptive analysis:

**National Health and Nutrition Examination Survey (NHANES)** data set

### Step# 1

First log on to <http://www.cdc.gov/nchs/nhanes.htm>

This is webpage for **National Health and Nutrition Examination Survey** done in United States.

### History of NHANES

The current NHANES was born out of The National Health Survey Act of 1956. This particular piece of legislation provided for the establishment of a continuing National Health Survey to obtain information about the health status of individuals residing in the United States, including the services received for or because of health conditions. The responsibility for survey development and data collection was placed upon the National Center for Health Statistics (NCHS), a research-oriented statistical organization housed within the Health Services and Mental Health Administration (HSMHA) of the Department of Health, Education, and Welfare (now the Department of Health and Human Services). Since its inception in 1959, eight separate Health Examination Surveys have been conducted and over 130,000 people have served as survey participants.

Statistics like these sell newspapers, inspire public-policy initiatives, and provide topics for classroom discussions. But where do these statistics come from? How can scientists determine the

percentage of the *entire* U.S. population that suffers from conditions such as obesity and osteoporosis or engage in unhealthy habits such as smoking?

Statistics such as those listed above, along with a whole host of other health and **nutrition** data, are derived from the National Health and Nutrition Examination Survey, or NHANES. NHANES is arguably the largest and longest-running national source of objectively measured health *and* nutrition data. Through physical examinations, **clinical** and laboratory tests, and personal interviews, NHANES provides a "snapshot" of the health and nutritional status of the U.S. population. Findings from NHANES provide health professionals and policymakers with the statistical data needed to determine rates of major diseases and health conditions (e.g., **cardiovascular** disease, **diabetes**, obesity, **infectious diseases**) as well as identify and monitor trends in medical conditions, risk factors, and emerging public health issues, so that the appropriate public health policies and prevention interventions can be developed.

## **Step2**

Go to NHANES on the left side of the home page. Then click 2005-2006 section. Go over the documentation/information provided on this page.

How is NHANES Data Collected?

4. Direct Interview: directly interviewing the survey participant and those within their household about their health.
5. Direct Examination: conducting clinical tests, **anthropometric**, **biochemical**, and radiological measurements, and physical examinations..
6. Physician Inquiry/Medical Records: reviewing participant's medical record.



In current practice, however, NHANES data are derived primarily from the first two sources; that is, via direct interview and direct clinical examination

### **Step 3**

Go over the following :

- [Demographics](#)
- [Examination](#)
- [Laboratory](#)
- [Questionnaire](#)

### **Step 4**

For this particular analysis we will open SPSS

In SPSS we will go to file and open data (where you saved it) with **xpt** file type.

Save the current data file and order the file according to the primary key (e.g. Sequence number, ID, etc)

### **Step 5**

In this step do descriptive analysis like frequency, crosstabs would be shown. Other important activity like adding variable, data types (date, character, string ... You can put anything in string

like numbers and date but you cannot calculate with them) will be described. When doing any activity like frequency there is a way to save the command into syntax using paste and this is done to keep track of the commands. Moreover when there is a complex operation it is better to save them because later one might forget what the steps were.

## **Step 6**

For this step we will go to data and then click onto sort cases , sort cases is used to sort based on particular field, however many a time according to their primary key, and in the ascending/descending order. After going through this tab we will explore select cases, select case is used to select a special group of data to do analysis (e.g. Analysis of effect of medication only on females, and for this task you will select only females).

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### **Step 8**

The reason for doing this exercise is to give you an idea how data sets are available for descriptive analysis for simple categories and merged categories.

Usually data are collected and stored in Database, and also data are stored in different tables to maintain data quality. Data consistency, normalization rule, and constraint are used to store data accurately in Database. But database software is not capable of doing statistical analysis. However, after data is stored in database, then data from different tables are exported to statistical package for analysis. Important part of data analysis is statistical understanding. Statistical analysis is not part of the course, but we will explain how simple descriptive analysis can be done in SPSS, and how data manipulation is performed in SPSS. This will give you have a familiarity with SPSS environment. The more you learn statistics you would be able to use SPSS. However, these are basic technique of SPSS one should be equipped to go with SPSS.

## **Appendix B:**

### **EMR Case Studies**

#### **Guide for Observations**

Researchers will shadow each member of clinic staff for an hour. If the clinic has a large staff then the researcher will shadow one person in each role. When shadowing the physician, the physician will ask the patient if they consent to the researcher being present. Only if consent is given will the researcher remain present in the examination room. No personal health data will be recorded at any time. The researcher will be recording the staff and patient interactions with the EMR only.

**Focus:** Interactions with the EMR. Keep the following questions in mind:

Questions are highlighted in Red and the observation is mentioned highlighted in Green:

1. *Who* is using the EMR?

- **Question:** Do physicians enter data themselves, or does another staff member do this for them?

**Observation:** Physician was entering the data.

- **Question:** Do all staff members use the EMR?

**Observation:** Receptionist, Physician.

- **Question:** Do the patients have any interactions with the EMR? Of what nature?

**Observation:** They were shown their record on the screen.

- **Question:** Do different staff members appear to have more or less skill with the EMR than others?

**Observation:** Not applicable.

## 2. *When* is the EMR used?

- **Question:** During a patient visit?

**Observation:** Yes

**Question:** Only at the end of the visit?

**Observation:** Occasionally

**Question:** At the end of the day?

**Observation:** Not applicable

- **Question:** At different times by different staff?

**Observation:** yes, EMR is used by the receptionist

.

- **Question:** Is it in constant use by office staff for booking appointments?

**Observation:** Yes, there was a constant use for booking appointments.

3. *Question:* What functions of the EMR are being used?

*Observation:* Scheduling appointments, referrals, printing prescription

*Question:* Do physicians and office staff use the same functions?

*Observation:* No

*Question:* Are certain functions used only at certain times?

*Observation:* Not applicable.

4. *Where* is the EMR?

*Question:* Are there desktops in exam rooms?

*Observation:* There were three different examination rooms and all the rooms had desktops with EMR.

*Question:* How does the space accommodate them?

*Observation:* Very well lay out.

*Question:* Do physicians or other staff use laptops or portable devices?

*Observation:* No.

**Question:** Where is the EMR relative to the patient? Is the EMR blocking the field of vision between the patient and physician?

**Observation:** No

**Question:** Do all staff members have their own station to access the EMR, or do they have to share?

**Observation:** There are three different exam rooms and there is a desktop in the reception area too. Both the staff members have their own stations.

5. *How* is the physician interacting with the patient while using the EMR?

**Question:** Non-verbal communication [gestures, head nodding, eye contact, physical orientation (body positioning) relative to the patient]

**Observation:** There was a verbal and non-verbal communication including, head nodding, eye contact and body positioning relative to the patient.

**Question:** Gauge and compare physician's attention to patient vs. physician's attention to the computer

**Observation:** The attention span was generally equally divided between the patient and the computer. However, the emphasis was on the patient interaction and the computer was merely an aid to help the physician in helping him make a clinical decision. It did not appear to impede in the patient interaction overall.

**Question:** Is the physician talking with the patient while interacting with the EMR?

**Observation:** Yes

**Question:** Does the physician ever show the patient what is on the computer screen (i.e., allow patients to view their record), and discuss what is on the screen with the patient?

**Observation:** Occasionally

### *Strengths and weaknesses*

**Question:** What seems to be working really well at this clinic?

**Observation:** According to the observation it seems that paper charts and EMR both were working simultaneously

**Question:** What problems or concerns related to the EMR do you observe?

**Observation:** The only noticeable concern was not proper utilization of EMR.

### **Overall Observation:**

On June 8, 2008 the intern made a visit to a primary care physician's clinic in Monton, New Brunswick. Observation started as soon as the intern walked in the clinic. Intern was able to observe the receptionist during her daily work day. It was observed that receptionist had her own working station with EMR application. She used this application for Scheduling, appointments,



registrations, patient information including; medical summary, patient encounters, messages, medication refills, vaccination and so on.

The receptionist takes out paper charts in the morning and places them on her desk with a list of patients scheduled for that day. As soon as the patient gets registered with the receptionist, their chart is pulled out of the pile from the desk and the patient is taken to the examination rooms with his paper chart.

As the patient sat in the examination room, the doctor comes and asked the patient about his chief complaints. All the mentioned complaints were entered in the EMR during the visit. There were some times when the information was added at the end of the visit. During our observation one of EMR features were not working to it expectations i.e. print prescription. So on that particular day the physician was writing prescriptions on prescription pad.

In summary it seems that paper charts and EMR both were working simultaneously in this particular clinic.

