

# **A Drug Utilization Study: Use of Sedative Hypnotic Drugs in Acute Care, Hospital In-patients**

By  
Kunal Mohindra  
B00521481  
[kunal.mohindra@dal.ca](mailto:kunal.mohindra@dal.ca)

Performed at  
Capital Health  
Pharmacy Department, Room 2047 Victoria  
1276, South Park Street  
Halifax, NS B3H 2Y9

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Kunal Mohindra  
BSc. Pharmacy, MHI (Cand.)

## **2. EXECUTIVE SUMMARY**

This report summarizes the internship work of Kunal Mohindra, a Master in Health Informatics candidate (2009-2011) for the period: May 3, 2010 – August 31, 2010. The internship was completed as a part of the HINF 7000: Internship course with Dalhousie University, Halifax, NS.

The project undertaken during the internship period was a drug utilization study on sedative hypnotic drugs. It was conducted at the Victoria General site of the Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia.

The main objective of the study was to examine the use of sedative hypnotic drugs, for acute care in-patients over a period of 6 years (2004-2010). This retrospective study utilized the drug use prescription data from the Pharmacy database, Centricity at the Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia. Descriptive statistics were used to examine the use of sedative hypnotic drugs by each service, both annually and quarterly.

The experience of working in a 'real world' setting throughout the summer of 2010 has enabled the author to find some areas where Health Informatics solutions can be applied to improve health outcomes.

### Recommendations:

1. Nova Scotia should have a common drug formulary that can be followed by all the 35 acute care facilities in Nova Scotia. This would help in preventing medication errors, when a patient is shifted from one health institution to the other, within Nova Scotia.
2. At Capital Health, the preprinted physician orders that have sedative hypnotic drugs on them should include some information on improving sleep hygiene. This might help reduce the use of sedative hypnotic drugs.
3. General education on the harmful effects of sedative hypnotic drugs should be provided to physicians and other health care providers. Also, education on the other non - pharmacological alternatives for sleep should be provided and their use should be encouraged.
4. Work on the implementation of a computerized physician order entry system should be initiated at Capital Health. Once the system is operational, it can be programmed to generate alerts as soon as a physician orders sedative hypnotic drugs. The alerts can include information on the adverse effects of these drugs and links to information on improving sleep hygiene.

### 3. Introduction

Sedatives lower anxiety and calm an awake patient, hypnotics produce drowsiness and promote sleep. They are categorized into a single class because of their common ability to induce sedation and sleep. These drugs have therapeutic indications but have adverse effects during long term use. The common drugs used for anxiety and sedation at Capital Health are: benzodiazepines, trazodone, zopiclone and chloral hydrate. Studies have shown that all the sedative hypnotic drugs have one or more adverse effects associated with them. A brief description follows and some more information has been included in Appendix A.

Benzodiazepines: The adverse effects associated with the use of benzodiazepines include frequent memory disorders, daytime sleepiness, fractures, blunted reflexes, cognitive decline, self care limitations, motor vehicle crashes and increased risk of falls.<sup>[1]</sup>

Trazodone: Some of the common side effects observed with trazodone use are drowsiness, dizziness, dry mouth, nausea/vomiting, constipation, headache, hypotension, blurred vision and cardiovascular adverse effects like hypotension.<sup>[2]</sup>

Zopiclone: It is structurally unrelated to benzodiazepines but causes similar effects when used for insomnia.<sup>[3]</sup> These include traffic related impairment, longer sleep latencies, and reduced sleep efficiency compared with good sleepers.<sup>[4,5]</sup>

Chloral Hydrate: The problems associated with chloral hydrate are its potential to cause gastrointestinal irritation, development of tolerance and physical dependence with prolonged use (> 2 weeks), involvement in multiple drug-drug interactions, and central nervous system depressant effects (light-headedness, nightmares, drowsiness, confusion).<sup>[6-8]</sup>

A study was conducted on hospital patient data at the Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia (QEII HSC) during June 2003 - May 2004. It examined the association between potentially inappropriate prescribing of benzodiazepines and the risk of having a fall during acute in-patient care in elderly patients (at least 65 years of age).<sup>[9]</sup> Some findings of the study indicated that:

1. Fifty eight percent (58.1%) of the 10,044 hospital patient discharges in a year, had received a prescription for at least one benzodiazepine during the hospital stay;<sup>[9]</sup>
2. The rate of falls in elderly patients was 0.57 per 1000 patients and 39% of these falls resulted in injuries.<sup>[9]</sup>

Although the study did not find a significant association with potentially inappropriate benzodiazepine prescriptions and falls in the hospital setting, the high prescription rate of benzodiazepines suggested a follow-up study to further explore the factors that are associated with the use of sedative hypnotic drugs at the QEII HSC.

In view of the evidence regarding the adverse effects of sedative hypnotic drugs and also the recommendation from the previous study carried out at the QEII HSC, a research

project on the utilization of sedative hypnotic drugs was initiated on the pharmacy prescription data of the QEII HSC, for the period April 1, 2004 – March 31, 2010.

The author was the Principal Investigator and the co-investigators of the study were:

- Dr Ingrid Sketris (Chair in Health Services Research, Professor and Director of the Drug Use Management and Policy Residency Program, College of Pharmacy, Dalhousie University);
- Ms. Heather Lummis (Drug Utilization Pharmacist & Pharmacy Research Coordinator, Capital Health);
- Dr. Susan Bowles (Pharmacy Clinical Coordinator, Geriatric Medicine and Mental Health, Capital Health); and
- Dr. Vlado Keselj (Associate Professor & Director of Electronic Commerce, Faculty of Computer Science, Dalhousie; University).

The study received approval from the Capital District Health Authority, Research Ethics Board, Halifax, Nova Scotia on August 12, 2010. Thus, the study is in the midst of analysis and the results shall be available sometime in the month of January, 2011.

It is anticipated that the study shall create awareness about the risks of sedative hypnotic drugs and also shed some light on the increased use of these drugs in a hospital setting. The results of this study will also enable comparison of drug use among males, females and different age groups.

From the study, the investigators expect to know some factors that contribute to the increased use of these drugs. Thus, they may be able to provide recommendations for drug policy changes at Capital Health.

## **4. Capital Health**

Capital Health is Nova Scotia's largest provider of health services, which operates hospitals, health centres and community-based programs throughout the Halifax Regional Municipality and the western part of Hants County.<sup>[10]</sup> The district health authority has a total of 11,000 employees, physicians, learners, and volunteers providing medical and surgical care, mental health care, community health programs, addiction prevention and treatment, and environmental health services.<sup>[10]</sup>

Capital Health serves the 400,000 residents of the district and provides specialist services to the rest of Nova Scotia and Atlantic Canada, with an operating budget of approximately \$800 million.<sup>[10]</sup>

According to the Capital Health website, Capital Health is on a journey to become a leader in people centered health, healing and learning.<sup>[11]</sup> In order to move towards this target, milestones to be achieved by 2013 have been defined. A poster that lists these milestones has been put up at different locations in the hospital. All the milestones have been directed towards Patient-Centered Health Care.

The Pharmacy services at Capital Health have a mission to serve the Capital District Health Authority community by improving health through safe and effective medication use, clinical care, education, and research.<sup>[12]</sup> They also have a vision of becoming a national leader in academic programs, clinical care and research; where every patient in their care interacts with a pharmacy team member and every staff member is valued. Some strategic directions have been defined to move towards this vision.<sup>[12-13]</sup>

## **5. Job Description**

The author was a resident in the Drug Use Management and Policy Residency Program, College of Pharmacy, Dalhousie University. The residency program is funded by the Canadian Health Services Research (CHSRF)/ Canadian Institute of Health Research (CIHR), co-sponsored by the Nova Scotia Research Foundation (NSHRF).

Considering the set of health informatics skills and pharmacy background of the author, this drug utilization study was appropriate. Being the Principal Investigator of the study it was his primary responsibility to define objectives of the study, conduct a literature review, attend various meetings, seek ethics approval, carry out the analysis and report the results with coordinated efforts from the other team members.

The author was allotted an office space at the Pharmacy Department of QEII HSC. He completed his internship under the supervision of Ms. Heather Lummis.

## **6. Activities Performed**

### ***6.1 Defining Objectives of the study***

Although the main goal of the study was clear, the objectives had to be specified. The author held meetings with the co-investigators to come up with clearly defined project objectives.

### ***6.2 Creating Awareness and Seeking Recommendations***

The author prepared a briefing note, which was circulated to some of the Capital Health employees to create awareness about the project and to seek their recommendations on the project objectives, if any.

### ***6.3 Seminars and Meetings***

The author learned about many new and interesting drug related projects being carried out at different locations around the world, through the attendance at the Canadian Agency for Drugs and Technologies in Health (CADTH) Symposium 2010. The author also acted as a recorder at one of the symposium workshops.

Training sessions attended during the first week of the internship focused on the following:

- Searching the literature – Useful tricks to search the electronic databases like Medline, Cochrane Library, Embase;



- Searching the grey literature – Tips to find articles that are not indexed in databases like Medline, etc.
- Using Refworks – Introduction to a useful tool that provides easy management of references.
- Writing briefing notes – Tips for writing briefing notes to ensure effective communication.
- Media training – Key points that should be kept in mind while dealing with the media.

To gain a better understanding of the legislative process at Nova Scotia, the author attended various seminars organized by the Drug Use Management and Policy Residency Program. Also attendance at the Drug Evaluation Alliance of Nova Scotia (DEANS) meeting increased his knowledge in this area.

To gain knowledge about the organization's policies, procedures and role of key players, the author attended a number of meetings at Capital Health. These included:

- Meeting with the Director of Pharmacy - Ms. Anne Hiltz discussed the drug review process at national level and at Capital Health. She also gave insight to the organizational hierarchy.
- Meeting with the Vice President of Patient Centered Health - Mr. Ken Baird described his role in the organization, which is to make sure that all interventions are directed towards patient care.
- Meeting with the Chair of the Falls Prevention Committee - Ms. Margaret Merlin explained that the committee implements evidence based interventions to reduce falls in the hospital. The author shared the project objectives with Ms. Merlin and invited her suggestions. Since the prime goal of this committee is to reduce falls, and the inappropriate use of medications contributes to falls, Ms. Merlin was really interested in this study.
- Attendance at the District Drugs and Therapeutics Committee (DD&T) meeting – The DD&T committee, Capital Health is the one that approves all the drug related policies and preprinted physician orders at Capital Health. Since one of the recommendations of this study may be a policy change, it was useful for the author to know how drug policy changes take place in the organization.

## **6.4 Literature Review**

Once the objectives were defined, the author conducted a literature review to identify the adverse effects of sedative hypnotic drugs. He found some Canadian studies on the use of sedative hypnotic drugs in the real world setting. He also searched the literature for information on non - pharmacological alternatives of sedative hypnotic drugs and the advantages, disadvantages of using preprinted orders. Initially 85 articles were found and after going through each of them only 38 were considered to be relevant. Medline, Embase and the Cochrane Library electronic databases were used to find these articles. (See Appendix A)

### ***6.5 Preparing the Ethics package***

Since the study was being carried out at Capital Health on the prescription data, it required ethics approval from the Capital District Health Authority Research Ethics Board. The author, along with input from the co-investigators, prepared the ethics package which was first submitted on July 9, 2010. The ethics board reviewed the package and requested some additions and clarifications in a letter dated August 9, 2010. The package was resubmitted with the revisions on August 11, 2010. The ethics board finally approved the study on August 12, 2010.

### ***6.6 Provincial Hospital Survey on the Formulary status***

While waiting for a response from the ethics board, the author contacted Pharmacy Directors at other health institutions in Nova Scotia. They were requested to provide information on the formulary status and restrictions on the use of the sedative hypnotic drugs at their institutions. This was done to compare the formulary status of these drugs across different institutions and find out the restrictions that exist on their use. It is anticipated that this information will help in making a policy recommendation. (See Appendix B)

### ***6.7 Collecting information on Preprinted orders***

The Institute of Medicine, USA has estimated that approximately 44,000–98,000 deaths may be caused annually by medical errors in hospitals with many of these errors occurring during the ordering, transcribing, dispensing, and administering of medications.<sup>[14]</sup> These errors are caused by factors such as illegible handwriting, misuse of common abbreviations, and confusion between look-alike or sound-alike drugs.<sup>[14]</sup> In order to avoid medical errors due to these factors, physicians at Capital Health frequently use preprinted orders for prescribing. Preprinted orders consist of a list of drugs, investigations, dietary plans, etc. for the physicians to choose. The results of a study carried out to measure the effectiveness of preprinted orders suggests that the physician's orders are more complete when they use a preprinted order than when they use traditional orders.<sup>[15]</sup>

Historically, sedative hypnotic drugs appeared on some preprinted orders being used at Capital Health, which might be a contributory factor to the increased use of these drugs for anxiety and bedtime sedation. Recent revisions made to the preprinted orders may have made an impact on the use of these drugs.

The author contacted some service managers at the hospital and requested copies of old preprinted orders that had sedative hypnotic drugs on them. Unfortunately, as a practice none of the managers maintain old copies of the preprinted orders. However, a few of them had some information in this context. For the other services, the information on the revision of preprinted orders will be obtained from the institution's Horizon Patient Folder (HPF), the electronic patient chart (as suggested by a co-investigator). (See Appendix C)

## ***6.8 Cleaning the data***

After ethics approval was received, the author was allowed access to the data. The data was extracted from the Pharmacy computer system, Centricity for a 6 year period i.e. April, 2004 - March 31, 2010. It was in the form of Microsoft Excel sheets and each Excel document had prescription data for one year. Some of the columns were not needed so they were removed from the data. In 2005, two services moved from one nursing unit to another within the hospital. Therefore, the prescription data for 2004 – 2005, needed additional work before it could be analyzed.

## ***6.9 Analyzing the Data***

Since ethics approval was received on August 12, 2010, the time remaining for the 4 month internship was not sufficient to carry out all the statistical analysis. However, a part of the last objective has been completed i.e. analysis for one year (2005 - 2006). The author will continue to work on this project on a part time basis, during fall of 2010.

## ***6.10 Presenting and Reporting***

The author presented the project to a group of decision makers close to the end of the internship. The audience included the co-investigators of the study and individuals from the Department of Health, Nova Scotia and the Canadian Agency for Drugs and Technologies in Health. (See Appendix D)

This was a challenging exposure, since the author had to ensure maximum clarity possible and back up statements with evidence. After finishing the internship, the author believes that every researcher should try to convey his findings in the simplest way possible. This will ensure, the message being understood by a majority of the audience. Also, if the results are written in lay language, material can be effectively communicated to any person, even though he/she lacks relevant background knowledge.

The author had also prepared a final report in the Canadian Health Services Research 1-3-25 format.<sup>[16]</sup> However, the results section in the report did not have any content, since the results are still pending.

# **7. Project Description**

## ***7.1 Research Questions***

1. Does the use and type of sedative hypnotic drugs used change over the years i.e. 2004 – 2010?
2. Does the use of sedative hypnotic drugs at the QEII HSC vary by service i.e. cardiology, orthopaedic surgery, psychiatry, etc.?
3. Does the use vary by age group, gender, and PRN (means “take as needed”) dosing status of the patient (2004-2010)?

## **7.2 Policy Question**

Sedative hypnotic drugs appear on preprinted orders of some services of Capital Health. Does the appearance of sedative hypnotic drugs on preprinted orders increase their use? If yes, then how?

## **7.3 Objectives of the Study**

The main objectives of the study were:

1. To describe utilization of sedative hypnotic drugs for the entire hospital and by service using aggregate data. The services being studied will be grouped into medicine (e.g. neurology, cardiology, etc.), surgery (orthopaedic, vascular, etc.), psychiatry and long term care at the QEII HSC. Long term care only comprises of one unit, Alternate Level Care unit.
2. To describe and compare the utilization of sedative hypnotic drugs in terms of days of therapy by patients according to gender, age group, and PRN vs. scheduled doses. PRN dosing is defined as at least one prescription written for the patient with directions that contain “PRN” or “take as needed”. The Pharmacy computer system has information on the doses delivered, if the doses are not used and returned, they are credited back. This information is available even if the prescription was issued on a PRN basis. A day of therapy (DOT) is counted if the patient was issued one or more doses of a specific drug on any day as determined by prescriptions entered in the pharmacy computer system. The age categories will be determined by the distribution of the data but are expected to be grouped as follows: 17-50 years, 51-64, 65-74, 75-84, and 85 years and older.
3. To describe and compare how changes in preprinted orders have impacted the utilization of sedative hypnotic drugs by quarter and by year. Specific services that are believed to have had changes to the list of sedative hypnotic drugs on their preprinted orders are Orthopaedic Surgery and General Medicine (Medicine Teaching Unit and Community Health Unit). These two services will be compared to a control group believed not to have preprinted orders with sedative hypnotic drugs on it. Orthopaedic Surgery will be compared to General Surgery and General Medicine will be compared with Cardiology. Dates and details of changes in the preprinted orders, eg. when and if sedative hypnotic drugs were added, removed or changed, will be determined for each service.  
(See Appendix A for more information.)

# **8. How the work relates to Health Informatics**

## **8.1 Project Objectives**

Before work on any project can be started, a set of clearly defined objectives need to be drafted. The objectives should consider the:

- Interests of all the investigators;

- Interest of the head of the department where the study is being conducted;
- Available time frame;
- Availability of resources; and
- Previous studies in that area.

While defining the objectives of this study the author considered all these factors. He also acquired skills that enabled him to find a common path between varied interests of the investigators.

## ***8.2 Literature Review***

Every new project builds on the work previously done by other investigators, in some part of the world. We need to search the published literature, in order to learn about studies done in the area of our interest. Searching the literature needs careful attention to obtain all necessary information.

Although the author had some experience in searching the literature for school work. He enhanced his skills through the training sessions and also through the experience of conducting a literature review. The author also learned about Refworks through the training session and used this tool while drafting various documents, during the course of this internship. (See Appendix A)

## ***8.3 Ethics Approval***

All research projects involving patients, staff, resources or data from external sources or from within an organization are to be reviewed by a Research Ethics Board (REB) before the research begins.<sup>[17]</sup> Capital Health has its own Research Ethics Board.

The Research Ethics Board at Capital Health evaluates the protocols with reference to scientific validity, informed consent, harm/benefit ratios, subject selection procedures, and adherence to the Tri-Council Policy Statement and the REB Procedures regarding protocols and consent forms.<sup>[17]</sup> For a study to be approved, the protocol must be scientifically valid and ethically acceptable.<sup>[17]</sup>

While preparing the ethics package, a researcher must:

- Ensure maximum clarity possible;
- Consider the fact that reviewer's might not have adequate or up to date knowledge in the researcher's study area; and
- Ensure that he/she has completed and attached all the necessary forms.

The author did not have any past experience of applying for an ethics approval. With continued support and guidance from the co-investigator, the author tried his best to abide by the above mentioned factors. But still the author experienced a small setback, as the ethics board after reviewing the package requested some clarifications and additions. This is not uncommon for new and experienced researchers. Through this experience, the author developed skills to ensure clarity in his text and thereby eliminating misunderstandings by reviewers.

## **8.4 Communication Skills**

All investigators are required to have effective communication skills, to be able to convey the right message. Effective communication skills are helpful while:

- Presenting for a study grant /funding approval or writing a grant proposal;
- Presenting the findings of a study or writing a final project report;
- Presenting to create general awareness;
- Writing a publication.

An investigator is not always aware of the background knowledge or other factors related to the audience. For example, the target audience may have limited time to read prepared materials or attend presentations. Thus, the investigator must ensure that messages are presented using plain language conveyed in a precise format.

The author enhanced his communication skills through the following:

- He prepared a briefing note which was circulated to a number of Capital Health employees to create awareness about the project and to seek their recommendations on the project objectives, if any. Since the author was not aware of the background of the readers, he had to ensure that the briefing note was written in simple language and precise format.
- The author presented to a group of decision makers close to the end of the internship. The audience included representatives both from the Department of Health, Nova Scotia and the Canadian Agency for Drugs and Technologies in Health.
- The author had also prepared a report in the Canadian Health Services Research 1-3-25 format.<sup>[16]</sup> The experience was valuable since the author will be working on a publication in the near future.

## **9. Critical Analysis of a Problem**

### **9.1 Problems associated with use of Preprinted Orders**

As mentioned earlier, in order to reduce medical errors physicians at Capital Health frequently use preprinted orders when prescribing. Several authors have reported that preprinted orders serve to decrease medication errors, promote adherence to institutional policies, and can also contribute to 80% reduction in the number of incomplete prescriptions.<sup>[14, 18-22]</sup>

Although preprinted orders have several advantages they do not have a significant effect on the potential adverse drug events (ADEs).<sup>[23]</sup> Approximately, 6.5 ADEs occur per 100 admissions a large hospital setting.<sup>[24]</sup> 28% of these ADEs are preventable, and 56% of preventable ADEs occur during prescribing.<sup>[24]</sup>

A case report was published describing a situation where the dose of magnesium sulfate was printed as 16g (130mEq) instead of 16mEq (2g). Since it was typed on a preprinted order, the pharmacist dispensed the dose and the patient became hypotensive after

administration.<sup>[25]</sup> Even if the preprinted order has been reviewed and approved, errors can still appear after printing.<sup>[25]</sup>

Another study found that the preprinted orders are likely to increase the use of controlled substances i.e. opioids and benzodiazepines, in the emergency department. A total of 26,638 charts were reviewed and it was found that the opioid orders increased from 2.1 % to 13.6 % of the total number of prescriptions, post implementation of preprinted orders. However, the benzodiazepine orders increased from 1.4% to 3.9% of the total number of prescriptions.<sup>[26]</sup>

Similarly, the preprinted orders with sedative hypnotic drugs on them might impact the use of these drugs at Capital Health. This was the main motivation for the author's study.

## **9.2 A Health Informatics Solution**

A Health Informatics solution that overcomes the disadvantages associated with the use of preprinted orders is a Computerized Physician Order Entry System (CPOE). CPOE systems are computer applications that allow electronic entry of orders for medications, laboratory and radiology investigations. CPOE systems for ordering medications are also called electronic prescribing systems.<sup>[27]</sup>

The Institute of Medicine, USA has urged the adoption of electronic prescribing systems in all health care organizations by 2010.<sup>[28]</sup> A number of studies have evaluated implementation of CPOE systems in different health care settings and a majority of them report benefits of the system.

A study on ADEs at six community hospitals in Massachusetts, USA found that 75% of the ADEs were preventable. Also, 81.5% of the preventable ADEs were found to be potentially preventable by a CPOE.<sup>[24]</sup>

A CPOE, capable of generating alerts/warnings when implemented at a medical centre can help in reducing orders of medications that are not recommended for older adults (>65 years old).<sup>[29]</sup> The rate of orders having inappropriate medications dropped from 11.56 to 9.94 orders per day, for hospitalized adults (>65 years), post implementation.<sup>[29]</sup>

The results of a postal survey of 950 US prescribers' suggest that the prescribers' knowledge on the drug-drug interactions is generally poor. Thus there is a need for systems that alert prescribers about potential interactions.<sup>[30]</sup>

CPOE systems have also been found to be associated with:

1. A 23-minute (clinically significant) decrease in length of stay among patients who were discharged from the emergency department; and
2. A 20% decrease in the mortality rate, in a children's hospital.<sup>[31-32]</sup>

However, there have also been many instances where the implementation of CPOE has facilitated medication errors. The results of a study that evaluated a CPOE system

(implemented in a tertiary care teaching hospital) reveal that the CPOE facilitated 22 types of medication errors. The examples include: fragmented CPOE displays that prevent a rational view of patients' medications, closely arranged selection options that facilitated double dosing and incompatible orders, inflexible ordering formats that do not allow the user to correct the errors and thus generating wrong orders.<sup>[65]</sup> These errors as well as some more have also been documented in a systematic literature review that focused on the impact of CPOE systems.<sup>[66]</sup>

Other studies on CPOE systems have found that physicians are reluctant to use the CPOE systems, due to increase in ordering time, decrease in interaction with patients, and the lack of integration with workflow and thus affecting the ultimate success of a CPOE.<sup>[67]</sup>

The interface design of the CPOE contributes to a majority of the problems mentioned above. Interface designs that do not conform to the prescriber's task behavior and decision making processes may lead to inefficient workflow and user frustrations. Moreover, a poor CPOE interface design facilitates medical errors.<sup>[67]</sup>

A recent literature review attempted to explore the changes that need to be made to the design of the CPOE interface in order to improve the usability, prescriber's workflow and medication order process. Based on the review of problems associated CPOE systems, some recommendations have been made:<sup>[67]</sup>

1. The presentation of the data on different screen section should follow the prescribers' normal flow of actions. (similar to the flow of actions he had, while using the preprinted orders)
2. Deep navigation structures should be avoided i.e. the prescriber should not be forced to navigate through a number of screens to find information in a particular context.
3. The system should be flexible i.e. in case of an error, the prescriber should be allowed to edit or cancel the particular field or action, rather than being forced to cancel the whole order.
4. There should be enough space for text fields to accommodate all the anticipated physician entries. This will prevent the users from using other data entry fields to enter the text.
5. Entry fields and read only fields should be differentiated by appropriate color, label and shape format to attract the prescriber's attention.
6. The screen elements should be separated by space, so as to ensure that a wrong option is not clicked by mistake.
7. For automated system calculations, the underlying arithmetic basis should be made available. So that the prescriber can easily validate the calculations.
8. Intelligent error detection should be implemented and the prescriber should be provided with justifications and relevant links to the evidence, if desired.
9. Log-in and log-out procedures should be as fast as possible, to save time of the prescriber and to prevent him/her from using log-in session of another prescriber, leading to an entry for a wrong patient.
10. Repetitive alerts and high number of alerts can lead to physicians becoming insensitive to the alerts. A study has found that drug safety alerts are overridden by



clinicians in 49% to 96% of cases.<sup>[68]</sup> Thus, the alerts should be based on a smart algorithm that generates alerts tailored to the specific patient conditions.

11. The recommended options in the lists can be highlighted. As found in a study, highlighting medication dosages on the screen can positively influence prescriber's to pick the recommended option.
12. Long lists should be presented in a logical order (e.g alphabetical, numeric) and the user should have an option to search through the lists.
13. Use of terms should be consistent throughout the system.
14. Information on the optimal method for ordering should be made explicit to the prescriber, which can be included within the interface.
15. The presentation of information should reflect user needs rather than the computer process.
16. Prescribers should be provided with an option to view and select available order sets.

High prescription rate of benzodiazepines, a class of sedative hypnotic drugs was found by a study done on the hospital discharge data of QE II HSC, Capital Health (2003-2004).<sup>[9]</sup> This was despite the fact that there was sufficient evidence on the adverse effects of benzodiazepines. Thus, we can say that evidence existed but has not affected practice. This can be termed as a knowledge gap and in order to bridge this gap, we need to create more awareness and also implement policies that restrict the use of these drugs.

A CPOE coupled with a decision support system can be implemented to create more awareness as well as aid in monitoring the use of these drugs. The CPOE system can be programmed to generate alerts to the prescribers' ordering sedative hypnotic drugs. The alerts can include information on the adverse effects of these drugs and links to information on improving sleep hygiene or non pharmacological alternatives of sedative hypnotic drugs. These alerts will create awareness among prescribers.

In services where these drugs are frequently prescribed, the system can be programmed to accumulate the drug use per patient on a daily basis. And if the drug use exceeds the limit specified in the best evidence, an alert can be sent to the health service manager or pharmacist on that unit. If he/she thinks that the prescribing trend is inappropriate the prescriber can be notified or a restriction can be applied, based on institution policy.

The system can also be programmed to restrict some of the services from using these drugs and then automatically provide the prescriber with information on improving sleep hygiene. The prescriber can thus share this information with the patient or the nurse in charge.

Implementing such a system should help in decreasing the use of drugs that are inappropriately prescribed and have serious adverse effects, e.g. sedative hypnotic drugs.

## **10. Conclusions**

The adverse effects of sedative hypnotic drugs have been proven by numerous studies but still their utilization rates have not changed much, over the years. The author anticipates

that the study will create awareness about the risks of these drugs among prescribers and other health care providers.

Also, from the results of this study the investigators will be able to provide recommendations for drug policy changes at Capital Health. The policy changes and awareness among the health care providers will hopefully lead to a change in the prescribing practices of these drugs.

Benefits of Computerized Physician Order Entry Systems have been proven by several authors. If the interface design of the system is based on sufficient background research, its implementation shall definitely help in preventing adverse drug events and also reducing medical errors.

It is the author's belief that this internship was a terrific opportunity to gain valuable experience. The support and guidance from the co-investigators shall enable the author to take this project to a next level.

## **11. Recommendations**

1. There are 35 acute care facilities in Nova Scotia and they all have different drug formularies;<sup>[33]</sup> the formulary status of sedative hypnotic drugs even differs from the Nova Scotia Pharmacare formulary (See Appendix B). Alberta has recently formulated a common hospital formulary, which is a list of medications approved for use in acute care facilities.<sup>[34]</sup> The formulary will ensure consistent provision of safe and cost effective medications across the province.<sup>[34]</sup> All the drugs in the formulary have been selected from the Health Canada's list of approved drugs.<sup>[34]</sup> Thus, it will save time of doctors as they don't need to search for the best medications.<sup>[34]</sup> It took them nine months to compile the formulary.<sup>[34]</sup> They have a total of 102 hospitals that provide acute care services.<sup>[35]</sup> Thus, this should be implemented in Nova Scotia, which is a comparatively smaller province, with a smaller number of acute care facilities.
2. Preprinted physician orders at Capital Health containing the sedative hypnotic drugs should include some information on sleep hygiene that might help in reducing the use to some extent. Since the preprinted orders have a space constraint, a small note at the bottom of the preprinted orders can be printed and the sleep hygiene information can be printed at the back of the page. A pilot study can be conducted to find out its impact.
3. General education should be provided to the physicians and other health care providers on the side effects that sedative hypnotic drugs can cause. Also, education on other non - pharmacological alternatives for sleep should be provided. The use of these alternatives should be encouraged across the hospital, by using various methods i.e. seminars, posters, etc.
4. Work on the implementation of a computerized physician order entry system should be initiated. Once the system is operational, it can be programmed to generate alerts,

as soon as a physician orders sedative hypnotic drugs. The alerts can include information on the adverse effects of these drugs and links to information on improving sleep hygiene.

# **Appendix A**

## **Background Information and Methodology**

## ***Adverse effects of Sedative Hypnotic Drugs***

Benzodiazepines: A Canadian study suggests that almost one third of all the people above 65 years of age fall each year. Half of these falls result in minor injuries and up to 25% result in a more serious injury.<sup>[36]</sup> The use of medications has been found to be an important and potentially modifiable risk factor for falls in older adults. Although various classes of medications have been associated with falls, the weight of the evidence suggests that benzodiazepines are most commonly associated with falls.<sup>[9]</sup>

An Ontario based study examined the contribution of benzodiazepine exposure to driver error in fatal crashes in all US from 1993 to 2006. The results suggest that drivers between the ages of 25 to 55 taking intermediate to long half life benzodiazepines have increased odds of driving in an unsafe manner compared to those not taking benzodiazepines.<sup>[37]</sup>

Benzodiazepines are also well known to produce dependence and the majority of the patients who take these drugs at recommended doses for more than one or two months are likely to become dependent.<sup>[38]</sup>

Trazodone: When the risk-benefit ratio of trazodone was assessed, its side effects were found to be significantly substantial as compared to other non-benzodiazepine hypnotics.<sup>[39]</sup> Some studies also suggest that use of trazodone can cause sexual adverse effects in males like ejaculatory inhibition and erectile dysfunction.<sup>[39-40]</sup> Thus, the use of trazodone as a sedative hypnotic drug should be carefully considered.

Zopiclone: A Norwegian based study compared the sleep of adult and elderly users of zopiclone with drug free insomnia patients and found that the sleep of chronic users of zopiclone is not much better than that of drug-free patients with insomnia.<sup>[5]</sup>

A study based in the Netherlands suggests a 7.5 mg evening dose of zopiclone can produce residual sedation and moderately impair driving for approximately 11 hours in elderly patients.<sup>[41]</sup> This study was carried out on a group of healthy drivers between the ages of 55-75 years. Canadian prescribing guidelines recommend a starting dose of 3.75 mg for the elderly patients.<sup>[3]</sup>

Zopiclone has the potential for being an agent of abuse and addiction. While many have suggested that the addictive potential for this and other “Z” drugs (zolpidem, zaleplon) is less than for most benzodiazepines, caution should be taken when prescribing this agent for insomnia.<sup>[42]</sup>

Chloral Hydrate: Chloral hydrate has been in use as a sedative hypnotic drug since 1869<sup>[6]</sup> and is one of the oldest drugs with sedative properties.<sup>[43]</sup> It has a narrow therapeutic range and use has declined since the introduction of benzodiazepines.<sup>[43]</sup> The use of chloral hydrate has been found to have weak association with increased risk of cancer in animal studies.<sup>[6-8]</sup> There are safer alternatives now available for clinicians to prescribe.<sup>[6-8]</sup>

## ***Non Pharmacological alternatives of Sedative Hypnotic Drugs***

Some alternatives to sedative hypnotic drugs are non-pharmacologic approaches such as:

1. **Sleep hygiene education**: This seeks to optimize sleep quality by teaching patients about good sleep habits. Some of the recommendations include avoid heavy meals, avoid taking caffeine in the later hours of the day, exercise regularly, avoid taking naps, go to sleep and wake up at the same time each day.<sup>[44]</sup>
2. **Cognitive behavior therapy for insomnia (CBTi)**: There is strong empirical evidence on effectiveness.<sup>[45]</sup> Studies have also shown that the CBTi has comparable efficacy and more durable long-term gains after treatment discontinuation, when compared to sleep medication.<sup>[45]</sup> A comparison of CBTi with sleep hygiene in a sample of 81 subjects suggests that CBTi produces greater decrease in wakefulness after sleep onset than standard sleep hygiene education.<sup>[45]</sup> A randomized control trial also suggests that cognitive behavior therapy and gradually reducing the benzodiazepine hypnotic dose can help in benzodiazepines withdrawal.<sup>[46]</sup>
3. **Stimulus control**: Another effective non-pharmacological therapy for insomnia is stimulus control, where patients are taught to eliminate distractions and associate the bedroom only with sleep. All other activities like reading and television, etc. should occur in a room other than the bedroom.<sup>[44]</sup>
4. **Paradoxical intention**: Another effective therapy asks the patient to stay awake as long as possible, thereby removing the fear of not being able to sleep.<sup>[44]</sup>
5. **Sleep restriction**: In this therapy, the patients are asked to monitor their sleeping hours by using sleep diaries and they are advised to keep their sleeping hours close to an average estimated sleep time and it should be at least 5 hours. However, sleep restriction therapy may increase daytime sleepiness and thus make activities such as driving unsafe.<sup>[44]</sup>

## ***Use of Sedative Hypnotic drugs in Canada***

There have been very few Canadian studies on the use of sedative hypnotic drugs in the real world setting. The studies that do exist largely examine benzodiazepines rather than the newer agents such as zopiclone and trazodone. Despite the fact that evidence on benefit is limited to specific indications of short duration and there is clear evidence of harm, 10 - 20% of adults in Western societies regularly take benzodiazepines.<sup>[47]</sup>

### **Quebec**

A study carried out on elderly Quebec residents using provincial administrative data of 6 years (1989-1994) suggested that benzodiazepines are commonly used in elderly patients. Of the 252,811 elderly persons reviewed, 31% had filled at least one benzodiazepine prescription, during this period.<sup>[48]</sup> This study also noted that the people who have a

greater risk for injuries from falls, due to other pre-existing conditions, were more likely to become new users of benzodiazepines.<sup>[48]</sup>

### **British Columbia**

A recent study on the utilization of benzodiazepines conducted on the British Columbia, administrative database suggests that 8.4% of the British Columbians use benzodiazepines and approximately 3.5% use them for long term. They also concluded that despite the increased awareness of the risks associated with the use of benzodiazepines, the use has not changed much in the past decade.<sup>[49]</sup>

### **Alberta**

A telephone survey in Alberta indicated that 3.3% people out of the 3345 people surveyed use benzodiazepines and zopiclone. Among these users, zopiclone was found to be most prevalent (approximately 40%), followed by lorazepam (33.8%) and the rest of the population took other benzodiazepines like clonazepam, temazepam, triazolam, diazepam, etc.<sup>[50]</sup>

### **Atlantic Canada**

A two year retrospective study (April 2002 - March 2004) suggests that approximately 11% of the First Nations populations in the Atlantic provinces through the Non-Insured Health Benefits program had filled at least one benzodiazepine prescription.<sup>[51]</sup>

### **Nova Scotia**

A study compared the use of benzodiazepines and other sedative hypnotic drugs in Nova Scotia and Australia. The results suggest that use had increased at a steady rate in both areas but the use of benzodiazepines in Nova Scotia was found to be more than double that in Australia, from 2000 to 2003, after adjusting for population size. The study also suggests that the higher use of benzodiazepines in Nova Scotia may be due to the fact that the Canadian province has 12 more benzodiazepines and related compounds available than Australia.<sup>[52]</sup>

## ***Methodology of the Study***

### **Design, Patients and Setting**

This retrospective study included drug use data of all the patients who were prescribed sedative hypnotic drugs from April 1, 2004 – March 31, 2010 at the QEII HSC. However, drug use data of patients admitted to the Camp Hill Veterans' Memorial Building or the Nova Scotia Rehabilitation Centre, was excluded. These locations are chronic care facilities (long term care and rehabilitation) and do not represent acute care treatment. QEII HSC is located in Halifax, Nova Scotia and is the largest adult academic health sciences centre in Atlantic Canada. In addition to providing primary healthcare to tens of thousands of Atlantic Canadians, it is also a centre for excellence in health research.<sup>[53]</sup>

## **Data Sources**

Aggregate prescription data was obtained from the pharmacy computer system, Centricity. The data on preprinted orders was obtained from Health Service Managers of each of the units (i.e. Cardiology, Orthopedics, Medicine Teaching Unit and Community Health Unit).

## **Data Analysis**

Drug utilization data will be reported using the World Health Organization's (WHO) Anatomical Therapeutic Chemical (ATC)/Defined Daily Dose classification (DDD) system.<sup>[54]</sup> This is an internationally accepted method of reporting drug utilization consumption. The DDD is defined as "the assumed average maintenance dose per day for a drug used for its main indication in adults".<sup>[54]</sup> It overcomes difficulties in comparing prescriptions of different price, pack size, duration, and dose by relating all drug use to a standardized unit.<sup>[52]</sup> The number of DDDs shall be divided by 100 patient days to standardize for the number of occupied beds in the different time periods.

### **Objective 1**

Descriptive statistics will be used to report the rates of DDD per 100 patient days per year and quarterly for the entire hospital and by service (medicine, surgery, psychiatry and long term care). Long term care comprises only one unit i.e. Alternate Level Care unit. The entire sedative hypnotic drugs class will be reported as well as a breakdown by drug class (benzodiazepines, chloral hydrate, zopiclone, and trazodone) and by formulary status (eg. whether the drug is on the Capital Health formulary or not). The benzodiazepine class will be further subdivided into short, intermediate, and long acting drugs<sup>[55]</sup>. Results will be graphed as DDD/100 patient days over time.

### **Objective 2**

Descriptive statistics will be used to report days of therapy per patient. As well, days of therapy will be categorized depending on the distribution of the data but are expected to be grouped as follows:  $\leq 2$ , 3 – 9, and  $\geq 10$  days. Mean  $\pm$  standard deviation DOT will be described by year, by gender and by age category. The percentage of patients who receive PRN dosing, compared to the total number of patients, will be calculated among the gender and age categories.

### **Objective 3**

Descriptive statistics will be used to report the rates of DDD/100 patient days per year and quarterly for the following targeted services: Orthopaedic Surgery, General surgery, General medicine, and Cardiology.

Orthopaedic Surgery and General Medicine (Medicine Teaching Unit and Community Health Unit) are believed to have had changes to the list of sedative hypnotic drugs on their preprinted orders. These two services will be compared to a control group believed not to have preprinted orders with sedative hypnotic drugs on it. Orthopaedic Surgery will be compared to General Surgery and General Medicine will be compared with Cardiology. The entire sedative hypnotic drugs class will be reported as well as a



breakdown by drug class (benzodiazepines, chloral hydrate, zopiclone, and trazodone). Results will be graphed as DDD/100 patient days over time. Data analysis will be performed using the statistical tool - SAS version 9.2 (Cary, North Carolina).

### **Limitations**

The Pharmacy system was used to collect the data on the sedative hypnotic drugs delivered to the unit. However, a chart review of the nursing administration records to find out whether the drug was actually administered to the patient or not, will not be possible.

## **Appendix B**

# **Survey on the Formulary Status of Sedative Hypnotic Drugs in Nova Scotia Health Districts**

**Survey on the Formulary Status of Sedative Hypnotic Drugs in Nova Scotia Health Districts**  
(As of August, 2010)

Drug (Generic Name)	Formulary Status (F = Formulary, NF = Non formulary)									Restrictions on Use (if any)
	Pharma- care, Govt. of NS	QE II, Halifax	CRH CC	Cape Breton Health Auth.	SWN DHA	PCHA	AVH, Kentville	SSDHA (all sites)	CEHHA	
Oxazepam	Benefit	F	F	F	F	F	F	F	F	-
Lorazepam	Benefit	F	F	F	F	F	F	F	F	-
Alprazolam	Benefit	F	F	F	F	F	NF	NF	F	SSDHA - Auto prescribe to Lorazepam
Diazepam	Benefit	F	F	F	F	F	F	F	F	-
Zopiclone	Benefit	F	F	F	F	F	F	F	F	-
Trazodone	Benefit	F	F	F	F	F	F	F	F	-
Chloral hydrate	Benefit	F	F	F	F	F	F	F	F	-
Temazepam	Benefit	NF	F	F	NF	F	NF	NF	F	SSDHA - Auto prescribe to Lorazepam CEHHA – Psychiatrist only
Flurazepam	Non- Benefit	NF	F	F	NF	F	NF	NF	NF	-
Chlordiaze- poxide	Benefit	NF	F	F	F	F	F	F	F	SSDHA- Limited to the Detox centre
Triazolam	Benefit	NF	F	F	NF	F	NF	NF	NF	-
Clorazepate Dispotassium	Benefit	NF	NF	F	NF	F	NF	NF	NF	-
Nitrazepam	Non- Benefit	NF	F	F	NF	F	NF	NF	NF	-

**Key:**

QE II- Queen Elizabeth II Health Sciences Centre, Halifax<sup>[56]</sup>

AVH- Annapolis Valley Health Valley Regional Hospital, Kentville<sup>[57]</sup>

SSDHA- South Shore Health, Bridgewater NS<sup>[58]</sup>

CEHHA- Colchester East Hants Health Authority, Truro, NS<sup>[59]</sup>

PCHA- Pictou County Health Authority, New Glasgow, NS<sup>[60]</sup>

SWNDHA- South West Nova District Health Authority<sup>[61]</sup>

CRHCC- Cumberland Regional Health Care Centre<sup>[62]</sup>

Pharmacare- Department of Health, Nova Scotia<sup>[63]</sup>

## **Appendix C**

# **Information on the Preprinted Orders Having Sedative Hypnotic Drugs, Capital Health**

**Selected Preprinted Orders having Sedative Hypnotic drugs, Capital Health**

(As of August, 2010)

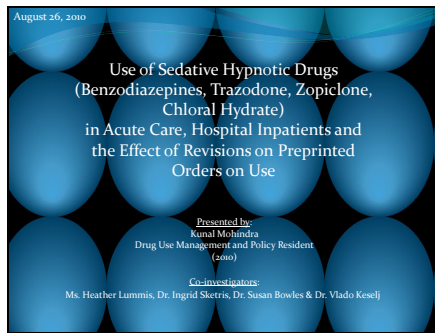
S No.	NAME	UNIT	PPO Number	DATE	SHDs
1.	Routine Admission/ Transfer to CCU/IMCU/General Cardiology	Dept. of Medicine, Division of Cardiology	PPO 0046 MR June 15 2009	June 2009	1. Trazodone 25-50 mg po at bedtime prn 2. Oxazepam 15-30mg po at bedtime prn
2.	Routine Catheterization/ PTCA Admission	Division of Cardiology	CD 0644 MR_03_06	March 2006	1. Chloral Hydrate 500mg po at bedtime prn
3.	Admission orders for General medicine	Dept. of medicine	CD 0854 MR 10/05	October 2005	1. Oxazepam 15-30mg po qhs prn
4.	Admission orders	Dept. of Medicine, Division of Rheumatology	CD 0816 MR 10/05	October 2005	1. Oxazepam 15-30mg if under age 65 po hs prn 2. Chloral Hydrate 500-1000 mg if age 65 or older po hs prn
5.	Post-op-orders (with standard pain medication)	Dept. of Surgery, Orthopaedic Surgery	PPO 0192 MR Nov 3 2008	Nov. 3, 2008	1. Oxazepam (15-30mg if <65) po hs prn 2. Chloral hydrate (500-1000mg if >=65) po nightly prn
6.	Physician's Standing Order	Dept. of Surgery, Orthopaedic Surgery	QE MR 59/94 Revised June 2005	June 2005	1. Oxazepam 15-30mg po nightly prn if under age 65 2. Chloral Hydrate 500-1000mg nightly prn if age 65 or older
7.	At risk of delirium- Orthopaedic post-operative orders	Dept. of Surgery, Orthopaedic Surgery	CD 0654 MR 07/05	July 2005	1. Trazodone 25-50mg 2. If patient already on a sleep pill, continue the same.
8.	ER Admission of Orthopaedic Patients	Dept. of Surgery, Orthopaedic Surgery	CD 0715 MR 08/05	August 2005	1. Oxazepam 15-30mg po nightly prn if under age 65 2. Chloral Hydrate 500-1000mg nightly prn if age 65 or older
9.	Post-op orders	Dept. of Surgery, Orthopaedic Surgery	QE 7827 MR Revised 09/04	September 2004	1. Oxazepam (15-30mg if <65) po nightly prn 2. Chloral hydrate (500-1000mg if >=65) po nightly prn
10.	Post-op orders	Dept. of Surgery, Orthopaedic Surgery	QE 7827 MR 10/98 Rev. 06/99	June 1999	1. Oxazepam (15-30mg if <65) po hs prn 2. Chloral hydrate (500-1000mg if >=65) po hs prn

Sources of Information for Appendix C:

They have been included in the bibliography, which is attached at the end of this report.<sup>[12, 64]</sup>

# **Appendix D**

## **Slides of the Presentation**



## Outline

- Background
  - Benefits of sedative hypnotic drugs (SHDs)
  - Adverse effects of SHDs
  - Use of SHDs in Canada
- Research & Policy Questions
- Project Objectives
- Formulary status of SHDs across different health institutions
- Recommendations

## Background

- Benzodiazepines
  - Improve sleep latency by 14.3 minutes. [1]
  - Increase sleep duration by 48.4 - 61.8 minutes. [1]
  - Occasional short term use can be helpful but not longer than a few weeks. [2]
  - Most frequently prescribed in patients 65 & over. [3]
  - In Canada, use increases with age. [4]

[1] Hobbrook et al, 2001 [2] First et al, 2009 (a Cochrane review)  
[3] Bogunovic et al, 2004 [4] Beck et al, 2005

## Background cont..

- Benzodiazepines
  - Their addictive nature and profound effects have been known for over 40 years. [1]
  - Common adverse effects include:
    - Daytime sleepiness, increased risk of falls, fractures, road accidents. [2]
    - Dependence, if a recommended dose is given to a patient for 2 months. [1]

[1] Manufacturing addictions, 2007 [2] Sleep complaints, 2008

## Background cont..

- Trazodone
  - An anti-depressant, but used in low doses for treatment of insomnia.
  - Marginal improvement in sleep latency, sleep duration and sleep quality. [1]
  - Common side effects include:
    - Drowsiness, headache, constipation, blurred vision, cardiovascular adverse effects like hypotension [1]
    - A few studies suggest that its use can cause sexual adverse effects in males. [2], [3]
    - Risk benefit ratio, side effects were found to be significant. [3]

[1] Mendelson, 2005 [3] James et al, 2004  
[2] Kaufman et al, 2007

## Background cont..

- Zopiclone
  - Structurally unrelated to benzodiazepines. [1]
  - Improves sleep duration, but less than benzodiazepines. [2]
  - Common side effects include:
    - Traffic related impairment, reduced sleep efficiency when compared with good sleepers. [3], [4]
    - A 7.5 mg evening dose can produce residual sedation & moderately impair driving for approx. 11 hrs. (in elderly). [5]

[1] Je-CPS, 2009 [3] Gustavsen et al, 2009 [5] Leulkens et al, 2009  
[2] First et al, 2009 [4] Sivertsen et al, 2009 (a Cochrane review)



### Background cont..

- Chloral hydrate
  - Used as a SHD, since 1869. [1]
  - As a hypnotic, chloral hydrate induces sleep without the disruption of rapid eye movement episodes. [1]
  - Sold as an over-the-counter sleep aid in Australia. [1]
  - Narrow therapeutic range, use has declined since the introduction of benzodiazepines. [2]
  - Common side effects include:
    - Gastrointestinal irritation, development of tolerance, physical dependence, CNS depressant effects like light headedness, drowsiness, confusion. [1], [3], [4]
    - Weak association with increased risk of cancer, as found in animal studies. [1], [3], [4]

[1]Hasselkom et al, 2006 [3]Vincow, 1992  
[2]Ludwigs et al, 1996 [4]Chloral hydrate- CPhA Monograph, 2010

### Use of SHDs in Canada

- Most of the Canadian studies examine benzodiazepines, rather than newer agents like zopiclone and trazodone.
- The evidence suggests: benefit of benzodiazepines is limited to a short duration and there is clear evidence of harm. [1]
- But, 10-20 % of the adults in Western societies, regularly take benzodiazepines. [1]

[1]Norman et al, 1997

### Use of SHDs in Canada

- Quebec: A 6 year study (1989-1994), found that 31 % of 250,000 elderly patients had filled at least one benzodiazepine prescription. [1]
- British Columbia: A recent study, suggests that 8.4 % of British Columbians use benzodiazepines and approx. 3.5 % use them for long term. [2]
- Alberta: In a telephone survey, 3.3 % of the 3345 people surveyed use benzodiazepines and zopiclone. Out of these approx. 40 % use zopiclone. [3]

[1]Bartlett et al, 2009 [3]Esposito, 2009  
[2]Cunningham et al, 2000

### Use of SHDs in Atlantic Canada

- A two year retrospective study (April 2002 - March 2004) suggests that 11% of the First Nation population in the Atlantic provinces had filled at least one benzodiazepine prescription through the Non-Insured Health benefits program. (NIHB) [1]
- Nova Scotia: A study on 3 years (2000-2003) of data suggests that the use of benzodiazepines in NS is more than "double" that in Australia. [2]
- Population of NS, 2001 = 900,000 (approx.) & Australia, 2001 = 19 million (approx.) NS has 12 more benzodiazepines & related compounds available than Australia. [3], [3], [4]

[1]MacLachlan et al, 2005 [3]Statistics Canada, 2009  
[2]Smith et al, 2008 [4]Australian Bureau of Statistics, 2009

### Use of SHDs at QE II, CDHA

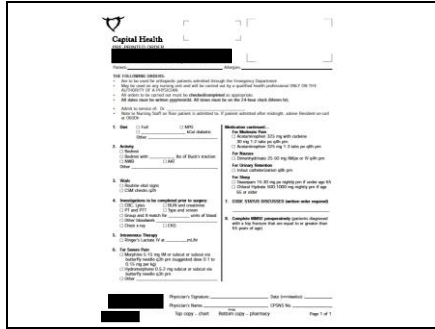
- 58.1 % of the 10,044 discharges in a year, had received a prescription for at least one benzodiazepine. [1]
- The rate of falls in elderly patients was 0.57 per 1000 patients and 39 % of these falls resulted in injuries. [1]
- The high prescription rate of benzodiazepines, suggested a follow up drug utilization study.

[1]Stolarz et al, 2009

### Preprinted orders

- Institute of Medicine, USA estimates that approx. 44,000 - 98,000 deaths each year, are caused by medical errors which include errors in:
  - Ordering, transcribing, dispensing.
    - Caused by - illegible handwriting, misuse of common abbreviations, confusion between sound-alike, look-alike drugs. [1]
- To minimize such errors, preprinted orders are used at Capital Health.
- A study on their effectiveness: Physicians orders are more complete when they use preprinted orders. [2]

[1]Tamer et al, 2006 [2]Olivier et al, 2004



### Research Questions

- Does the use and type change over the years? (2004-2010)
- Does the use of SHDs at the QE II vary by service (cardiology, orthopaedic surgery, psychiatry, etc.)?
  - Services with SHDs on orders eg. Orthopaedic Surgery
  - Services without SHDs on orders eg. General Surgery
- Does the use vary by age group, gender, and PRN (Pro re nata) dosing status of the patient? (2004-2010)

### Policy Question

- SHDs appear on preprinted orders of some services of Capital Health. Does the appearance of SHDs on preprinted orders increase their use? If yes, then how?

### Data

- QE II prescription data from the pharmacy computer system, Centricity.
- For the period of 6 years, April 1, 2004 – March 31, 2010.
- Drug use has been calculated using the World Health Organization Anatomical Therapeutic Chemical (ATC)/Defined Daily Dose classification (DDD) system, 2010.

### Project Objectives

- Describe utilization as defined daily doses (DDD) per 100 patient days for the entire hospital and by service on a quarterly and yearly basis.
- Describe and compare the utilization in terms of days of therapy by patients according to gender, age group, and PRN vs. scheduled doses.

### Project Objectives

- Describe and compare how changes in the preprinted orders have impacted the utilization of SHDs using the DDD per 100 patient days by quarter and by year.
- Services that have SHDs on preprinted orders will be compared with the ones that do not have SHDs on their preprinted orders.
  - Orthopaedic Surgery vs. General Surgery
  - General Medicine (Medical Teaching unit & Community Health Unit) vs. Cardiology

### Accomplished so far...

- July 9, 2010 - Submitted an application for Ethics approval to the Capital Health REB.
- August 9, 2010 - Received a response letter from REB. Clarifications and some additions requested.
- August 11, 2010 - Revisions submitted.
- August 16, 2010 - Got the approval !!

**Formulary Status of Sedative and Hypnotic Drugs in Nova Scotia Health Districts**

Drug (Generic Name)	Formulary (any of NS)	Formulary Status (F - Formulary, NF - Non Formulary)							Restrictions on Use (if any)
		QEII Halifax	CEHHA Colchester East Hants Health Authority	SWNDHA South West Nova District Health Authority	PCHA Pictou County Health Authority	SSDHA South Shore Health, Bridgewater NS	AVH Annapolis Valley Health Valley Regional Hospital, Kentville, NS	CRHCC Cumberland Regional Health Care Centre, Amherst, NS	
Clonazepam	F	F	F	F	F	F	F	F	-
Lorazepam	F	F	F	F	F	F	F	F	-
Alprazolam	F	F	F	F	F	F	F	F	MDA - Non prescribed in Lunenburg
Clonazepam	F	F	F	F	F	F	F	F	-
Lorazepam	F	F	F	F	F	F	F	F	-
Alprazolam	F	F	F	F	F	F	F	F	-
Clonazepam	F	F	F	F	F	F	F	F	-
Lorazepam	F	NF	F	F	NF	F	NF	NF	MDA - Non prescribed in Lunenburg CEHHA - Psychiatric only
Alprazolam	F	NF	F	F	NF	F	NF	NF	-
Clonazepam	F	NF	F	F	NF	F	NF	NF	MDA - Limited Use in Lunenburg
Lorazepam	F	NF	F	F	NF	F	NF	NF	MDA - Limited Use in Lunenburg
Alprazolam	F	NF	F	F	NF	F	NF	NF	-
Clonazepam	NF	NF	NF	F	NF	F	NF	NF	-
Lorazepam	F	NF	F	F	NF	F	NF	NF	-

As of August 2010

### Key-

- QE II- Queen Elizabeth II Health Sciences Centre, Halifax
- AVH- Annapolis Valley Health Valley Regional Hospital, Kentville, NS
- SSDHA- South Shore Health, Bridgewater NS
- CEHHA- Colchester East Hants Health Authority, Truro, NS
- PCHA- Pictou County Health Authority, New Glasgow, NS
- SWNDHA- South West Nova District Health Authority, Yarmouth, NS
- CRHCC- Cumberland Regional Health Care Centre, Amherst, NS
- F- Formulary
- NF- Non Formulary

### Recommendations

- Develop a common drug formulary that can be followed by all 35 Acute care facilities in Nova Scotia. [1] [Alberta has recently formulated one for their 102 facilities, which took 9 months.] [2]
- Include information on evidence-based guidelines and sleep hygiene on the preprinted orders.
- Educate physicians and other health care providers on the harmful effects of the SHDs and also on the non pharmacological alternatives of SHDs.

[1]Health Canada, 2008 [2]Alberta Health Services, 2010

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Co-Investigators:	Others:
<b>Ms. Heather Lummis</b> Drug Utilization Pharmacist & Pharmacy Research Coordinator, Victoria General, Capital Health <b>Dr. Susan Bowles</b> Pharmacy Clinical Coordinator, Geriatric Medicine and Mental Health, Capital Health <b>Dr. Vlado Keselj</b> Associate Professor & Director of Electronic Commerce, Faculty of Computer Science, Dalhousie University	<b>Ms. Ethel Langille Ingram</b> Research Associate, IMPART, College of Pharmacy <b>Ms. Jocelyn LeClerc</b> IMPART, College of Pharmacy <b>Ms. Kathryn Landry</b> Pharmacy Student, Dalhousie University



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