Insulin Prescribing Practices in Saudi Arabia

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Introduction and Significance

Diabetes is an illness, which occurs as a result of problems with the production and supply of insulin in the body (1). Diabetes has become one of the major causes of premature illness and death in most countries, mainly through the increased risk of cardiovascular disease. It is also a leading cause of blindness, amputation, and kidney failure. It has been estimated that more than 135 million people worldwide have diabetes mellitus and their number expected to reach approximately 300 million people by 2025, 10% of them having type 1 diabetes. Furthermore, 3.2 million deaths are attributable to diabetes every year (2). In countries with high diabetes prevalence, such as those in the Pacific and the Middle East, as many as one in four deaths in adults aged between 35 and 64 years is due to diabetes. Recent studies from Saudi Arabia, Bahrain and Oman showed that diabetes prevalence ranges between 15- 25%. Therefore, the scale of the problem that diabetes poses to the regional health cannot be over emphasized (3, 4). The global increase in diabetes is because of population ageing and growth, and because of increasing trends towards obesity, unhealthy diets, and sedentary lifestyles.

Because of its chronic nature, the severity of its complications and the means required to control them, diabetes is a costly disease, not only for the affected individual and for his /her family, but also for the health authorities. The costs for diabetic patients care account for 11.9% of total US health care expenditures. Approximately half of the expenditures for medical care for diabetes are for treatment of the metabolic condition and half for the treatment of chronic complications. Direct costs to individuals and their families include medical care, drugs, insulin, and other supplies (5).

The discovery of insulin has literally revolutionized the treatment of diabetes. Historically insulin has been used since 1922 as a monotherapy in patient with type 1 diabetes and since the late 1950s in combination or monotherapy with type 2 diabetes. Insulin may be categorized in the following groups based on the time activity profile: *ultra short acting* that includes Humolag (insulin lispro), NovoLog (insulin aspart); *short acting* that includes Humulin regular, Novolin R, and Velosulin BR; *intermediate-acting* that includes Humulin L (lent), Humulin N (NPH), Novolin L (Lent), and Novolin N (NPH); *long acting* Ultralent (Humulin U), Insulin Glargine (Lantus); insulin combinations (NPH/Regular 70/30) (Humulin 70/30 and Novolin 70/30), Insulin aspart protamin/insulin aspart mixture 70/30 (Novolog mix 70/30), insulin NPH/insulin Lispro mixture 75/25 (Humulog mix 75/25), and NPH/regular mixture 50/50 (Humulin 50/50) (6, 7).

Because of multitude of companies which supply the insulin products and many types of formulation (Regular, NPH, Lente, 30/70 combinations) and analogue and their combinations with several trade names, this increases the confusion and adds to the complexities in prescribing insulin in addition to the unavailability of guidelines for prescribing which will lead to these errors. These errors may include eligibility handwriting such as confusing U or IU for 0 or 1 (i.e., 4 units can be misread as 40 or 41 units). Furthermore, several prescribers relate to regular insulin as "clear insulin" for the sake of convenience, and this could mean regular insulin, Lispro, Aspart or Glargine. Patients on Lispro (or Aspart) with Glargine combinations will be using two types of clear insulin. In addition, some physicians prescribe "Insulin L" which could mean either Lente (an intermediate acting insulin) or Lantus (Glargine, a long acting analogue). Another source of confusion is the use of combination-premixed insulin, Patients who remember their insulin as 30/70 may be using either a premixed combination of human insulin (e.g. Huminsulin 30/70) or a premixed analog (e.g. Novomix 30/70). Also Common errors the insulin ratio may not be specified; for example, 'Humulin' or 'Mixtard' may be written in place of 'Humulin M3™' or 'Mixtard 30™', respectively and seems to have been given these uncompleted wrote names as a default of names, which is considered potentially dangerous (8).

Insulin prescribing tops the list of drugs involved in medication errors in the UK and in the USA (9, 10). Indeed, insulin is classified as "high-alert medication" that associated with significant morbidity and mortality when ordered and/or administered incorrectly. Insulin was involved in 9% of the error that resulted in patient harm, which include serious potentially life-threatening complications (e.g., sever hypoglycemia) (11). There have been several reports of insulin-related medication errors involving confusion between Lantus and lent insulin (12, 13). An alert from the Institute for Safe Medication Practices has drawn attention to the name similarity between Lantus and Lente (an intermediate-acting insulin preparation) as a potential source of error during the filling of oral or written orders for Lantus (14). This may be further complicated by illegible prescriptions or unclear oral orders and the fact that some prescribers designate the type of insulin by using the one-letter abbreviation on the commercial vial, in this case, the letter L for both Lantus and Lente. Therefore, the pharmacist, patient, and health care worker must have a thorough understanding of the differences between these medications, Lantus, Lente or Lispro (Humalog), to avoid confusion that may compromise a patient's safety and overall clinical status (15).

Mathew (16) has studied the insulin prescription error in India. He stated that there are at least seven different companies supplying insulin in various forms, and described several categories of error that can be involved in the multifactorial of insulin forms, in timing of insulin doses, and illegible handwriting (confusing IU or U for 0, etc). Another source of confusion is the use of

combination-premixed insulin (premixed combination of human insulin such as Huminsulin 30/70 or a premixed analog Novomix 30/70. In addition, the physicians often not mentioning the species of insulin is another error. He give his advise that all the physicians should write the prescription in full form mentioning the trade name, generic name as well as the species and also expect the manufacturers to agree upon a common formula to designate insulin and analogs depending upon the species, type of insulin and combinations involved.

Novo Nordisk Inc has release an alert regarding tow of its products (NovoLog® Mix 70/30-premixed insulin-, and NovoLog®-rapid-acting insulin analog-) in August 26, 2005 for clarifications and differentiation of both products. The manufacturer has recommended "all pharmacists carefully distinguish insulin formulations by name and NDC number when dispensing. Patients receiving the incorrect insulin could be subject to the risk of adverse events, such as hyperglycemia or hypoglycemia. The use of color branded labeling will aid in facilitating dispensing of the correct product" (17).

According to ASHP medication errors (ME) are defined as deviating from intended directions as specified by the prescriber, and it is of different type and lie within these main categories: prescribing errors, dispensing errors, medication administration errors, and patient compliance errors (18). Mediation errors compromise patient confidence in the health care system and increase health care costs. The problems and sources of mediation errors are multidisciplinary and multifactorial, which may occur from lack of knowledge, substandard performance, and mental lapses, or defects or failures in system (19, 20). Medication errors occur in all 4 phases of drug delivery process: ordering (49%), transcribing (11%), dispensing (14%), and drug administration (26%). The prescribing errors have been defined in terms of errors in decision making (prescription inappropriate for the patient concerned) and errors in prescription writing: (1) failure to communicate essential information which may include the followings: prescribing a drug, dose or route that is not that intended, writing illegibly, writing a drug's name using abbreviations or other non-standard nomenclature, writing an ambiguous medication order, prescribing "one tablet" of a drug that is available in more than one strength of tablet, omission of the route of administration for a drug that can be given by more than one route, prescribing a drug to be given by intermittent intravenous infusion without specifying the duration over which it is to be infused, omission of the prescriber's signature; (2) transcription errors (e.g., unintentionally not prescribing a drug that the patient was taking prior to their admission, continuing a prescribing error when writing a patient's drug chart on admission to hospital, transcribing a medication order incorrectly when rewriting a patient's drug chart; writing "milligrams" when "micrograms" was intended, writing a prescription

for discharge medications that unintentionally deviates from the medication prescribed on the inpatient drug chart).

It has been estimated that 44,000–98,000 people die each year in hospitals in the US as a result of medical errors, exceeding the number attributable to the 8th leading cause of death. Most of these medical errors, probably between 10% and 20%, are due to medication errors (21, 22), and are estimated to account for more than 7000 deaths, either in or out of hospital, in the US annually. The cost per year of medication errors in the US have been estimated to be $US 2.8 million for a 700-bed teaching hospital, while the cost to the National Health System in the UK in additional days in hospital was estimated at £500 million (23). Moreover, estimates in Australia indicate that 80,000 people are admitted to hospitals with medication errors, at a cost of $A 350 million per year (23).

In Saudi Arabia medication errors problem was highlighted by many investigators. Al Nasser studied the pattern of drug prescribing in primary care centers in Al-Baha region of Saudi Arabia. The study showed the inadequacy of documentation of prescribing information; 53.7% of medications were prescribed without a specific duration and almost 97% did not identify the strength (24), Felimaban studied the prescribing habits of physicians in primary healthcare centers to assess the content of prescriptions and the extent to which attempts were made to educate the patient about the prescribing drugs. The study carried on three primary healthcare centers in Riyadh city; Felimaban found that the prescription content score was generally unsatisfactory (25). Bawazir has also investigated the drug-prescribing pattern of ambulatory care physicians in the ministry of health hospitals. The study involves 22 general hospitals covering the various health regions within Saudi Arabia. Auditing prescription information revealed that documentation was not generally complete. Information relating the patient age and diagnosis was missing in 18.6% and 9.8% of the prescriptions, respectively (26). Khoja and coworkers studied the medication error problem in the primary care center in Riyadh, and they found that of all prescriptions collected in the study, 11.6% were found to have at least one error (27). Mahfouz has studied prescribing pattern in 23 primary health care centers in the Asir region, and they found that the leading missing items in the studies prescription were the duration should medication be taken (32.9%), patient's name (15.8%), and patient’s health record number (6.5%). In addition, prescribing drugs by generic names among physicians was about 29% (28).

Study Objectives

The primary objectives of the current study are as follows:

1. To evaluate insulin prescribing practices at selected hospitals in Saudi Arabia.
2. To describe the pattern and magnitude of prescription errors associated with insulin therapy.
3. To determine associated risk to patients from such errors.
4. To propose writing tips to improve insulin-prescribing practices by clinicians.

The secondary objectives include the following:

1. To describe other types of medications prescribed to diabetics in the study population.
2. To estimate the overall cost of drug therapy in patients who are on insulin therapy.

Research Methodology

A retrospective study that will be conducted over a period of 3 months at three different hospitals (MOH, military, and teaching) in Riyadh city. The aim is to collect at least 1500-3000 prescriptions that include insulin as a prescribed medicine from the outpatient pharmacy. A data-collecting sheet (Appendix I) designed to tabulate the Patient's demographics and define prescriber/setting characteristics will be used to collect pertinent information. Four categories in the prescription will specifically be investigated: 1) completeness of the patient's data that includes hospital name, patient name, MRN, date of birth, and diagnosis, 2) insulin prescription content including writing illegibly, insulin name/type, non-standard nomenclature, dosage and direction, quantity to dispense, and an ambiguous medication order, 3) prescription appropriateness when applicable, and 4) other medications that the prescription may contain.

Data Analysis

Descriptive statistics of patients' demographics, prescriber and setting will be obtained. Analyzing and comparing types and frequencies of types of insulin prescription errors such as dosage and timing appropriateness will also be conducted. Types of other medications (class and specific agent) will be tabulated and the average cost per patient/year will be calculated using suitable statistic software.

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Appendix 1. collecting data sheet

Insulin prescribing practice in Saudi Arabia

Patient's demographics			
Name: _____	MRN: _____	Diagnosis: _____	
Age (year): _____	Sex: _____	Weight (Kg): _____	
Insulin prescription			
Handwriting	☐ Good	☐ Fair	☐ Bad
Insulin name	☐ Full	☐ Partial	☐ N/A
	☐ Generic	☐ Trade	☐ Both
Specific insulin type	☐ yes	☐ No	_____
Insulin type (tick all applicable)	☐ Regular	☐ NPH	☐ Lent
	☐ 30/70	☐ 50/50	☐ Lispro
	☐ Aspart	☐ Glargine	☐ others
Insulin dose	☐ full	☐ U	☐ IU
Type of device to be used	☐ vial	☐ pen	☐ N/A
Route of administration (s.c.)	☐ yes	☐ No	_____
Time of administration	☐ yes	☐ No	_____
Prescribing practice			
Insulin appropriateness	☐ yes	☐ No	☐ N/A
Dosage appropriateness	☐ yes	☐ No	☐ N/A
Frequency/ time appropriateness	☐ yes	☐ No	_____
Setting and prescriber			
Setting	☐ GP Clinic	☐ DM Clinic	☐ Ward
Prescriber	☐ Intern	☐ resident	☐ specialist/consultant

Other drugs		
Drug name	Dose	Frequency

Comment: _____

For the Patient's demographics, any field not filled it means this variable is not mentioned