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PRESCRIPTION ANALYSIS AND COST MINIMIZATION STRATEGIES IN HOSPITALIZED DIABETES PATIENTS

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ABSTRACT

Diabetes mellitus (DM) is among the most common metabolic diseases in the world that is typified by chronic hyperglycemia caused by the malfunctioning of insulin secretion, insulin constraints or a combination of both. Patients with diabetes often need to be hospitalized because of acute complications, comorbidity, or in case of intensive glycemic control, the global burden of DM has also been increasing. The patients who are hospitalized with diabetes are often faced with complicated treatments that involve combination of pharmacologic treatments based on oral hypoglycemic drugs, insulin, and other adjunctive pharmacologic treatments like dietary and physical activities and education to the patients. This medication difficulty exposes patients to the danger of polypharmacy, drug-drug interactions, medication mistakes, and huge healthcare expenses. Prescription analysis has become a tool that is vital in the management of hospitalized diabetic patients. It allows clinicians and pharmacists to detect irrational drug use, maximize pharmacotherapy, and improve clinical outcomes and minimize unnecessary costs. Through the systematic review of the patterns of prescription, healthcare professionals may evaluate the appropriateness, safety, and cost-effectiveness of the used medications. Another area of value is cost-minimization, such as rational prescribing, generic substitution, and the implementation of fixed-dose combinations, which will help to restrict the economic burden, although patient care should not be affected. Also,

the interventions led by pharmacists, including medication therapy management and clinical auditing, have been reported to enhance adherence, avoid adverse drug events, and aid in making evidence-based decisions. The combination of technology, such as computerized prescription auditing and the system of decision support systems powered by AI, presents additional ways of maximizing drug use and minimizing expense. Pharmacoeconomic analyses in practice, multicenter cost-effectiveness trials, and care models can be used to provide strong evidence to support policy and clinical practice. The purpose of the review is to critically discuss prescription pattern analysis and cost-minimization of hospitalized patients with diabetes and to provide emphasis on the rational use of drugs, generic prescription use, pharmacoeconomic assessment of the selected problem, and the important role of clinical pharmacists in the provision of safe, effective, and cost-conscious care.

KEYWORDS: Diabetes mellitus, Prescription analysis, Pharmacoeconomics, Rational drug use, Cost-minimization, Hospitalized patients.

INTRODUCTION

Diabetes mellitus is a progressive and chronic disease that is a major health and economic burden in the entire world. As the International Diabetes Federation (IDF) 2023 report suggested, there are about 537 million adults with diabetes, which will increase to 643 million by 2030.[1] It is called the diabetes capital of the world because India is estimated to have a population of 77 million with the disease.[2] Lifestyle, obesity, and aging of the population are additional causes of burden to the condition.[3]

Comorbid conditions, acute complications, and tight glycemic control make the management of diabetes more complicated in a hospitalized care setup.[4] The common dose will consist of insulin, oral hypoglycemic agents (OHAs), antihypertensives, statins, and antibiotics.[5] This type of polypharmacy increases the chance of negative effects, drug interactions, and unreasonable prescribing.[6] The cost of managing diabetes is therefore huge to the economy, particularly in the low and middle income countries.[7]

Prescription analysis is defined as the methodical assessment of the prescribing patterns to guarantee reasonable drug utilization and determine economical treatment options.[8] It is associated with the evaluation of drug suitability, dose precision, the period of treatment, and the compliance with evidence-based instructions.[9] Together with economical principles of the economy like cost-minimization, cost-effectiveness, and cost-utility evaluation, it

constitutes the foundation of economically viable healthcare in chronic illnesses such as diabetes.[10]

Prescription Analysis Concept

Prescription analysis is the instrument which can influence rational medicine prescribing through detection of inappropriate or non-evidence-based prescribing trends.[11] The World Health Organization (WHO) defines rational use of medicines as implying that patients should be given a medication that suits their clinical needs, dose that is suitable to their needs, duration that is sufficient, and at the minimum cost to the patient and their community.[12]

Prescription data analysis enables clinicians to determine the patterns of drug use, unreasonable interactions, and theoretical treatments.[13] Some of the parameters that are typically evaluated are the average number of drugs per prescription, percent of drugs prescribed using a generic name, use of antibiotics and the rate of hospital formulary use.[14]

The presence of comorbidities like hypertension, dyslipidemia and neuropathic pain commonly results in high level of polypharmacy in prescriptions in patients with diabetes.[15] Research carried out in a tertiary hospital in North India found an average rate of 7.8 drugs per prescription in diabetic inpatients, which describes the level of polypharmacy.[16] These trends require a routine audit to safeguard therapeutic rationality and cost-efficiency.

Frequent Drug Classes Among Hospitalized Diabetic Patients

3.1. Oral Hypoglycemic Agents (OHAs)

Metformin is the preferred first-line medication in the treatment of type 2 diabetes mellitus because it is effective, safe, inexpensive, and affordable.[17] The sulfonylureas (glimepiride and gliclazide) are often used as additions in the case of monotherapy failure.[18] Newer OHAs such as dipeptidyl peptidase-4 (DPP-4) inhibitors, sodium-glucose cotransporter-2 (SGLT2) inhibitors and thiazolidinediones are also being administered at increasing costs.[19] The comparison of cost-minimization between metformin-sulfonylurea and metformin-DPP-4 inhibitors combination reveals that the former reduces the costs by 35-50 percent without reducing the glycemic control.[20]

3.2. Insulin Therapy

Acute glycemic control is often used by hospitalized patients using insulin particularly in surgical or critically ill care.[21] In most cases, human insulin preparations (regular and NPH)

are cheaper and as effective as insulin analogues.[22] Still, doctors tend to prefer analogs due to their predictable pharmacokinetic characteristics and subsequent high cost.[23] Cost-reduction literature suggests that replacement cost of analogues with conventional human insulin has the potential to save the therapy cost by 40-60 percent in resource-constrained circumstances.[24]

3.3. Adjuvant Medications

The mainstay of the cardiovascular risk reduction in diabetics is comprised of antihypertensives (ACE inhibitors, ARBs, calcium channel blockers), as well as statins.[25] Rational prescribing involves finding appropriate drug choices to comorbidity e.g. administration of ACE inhibitors in nephropathy or ARBs in microalbuminuria.[26]

4. Significance of Cost-Minimization Analysis (CMA)

CMA is a pharmacoeconomic method applied when there is equal clinical outcome between two or more interventions but there are differences in costs.[27] It is especially applicable to diabetes where various treatment alternatives have comparable effectiveness. In particular, the combination therapy using metformin-glimepiride is clinically equal to that using metformin-teneligliptin but much less expensive.[28] Equally, an insulin glargine dose replacement of NPH insulin has similar glycemic control with reduced cost.[29]

Several perspectives can be used to conduct CMA; these may be patient, hospital, or healthcare system.[30] On hospital level, CMA assists development of cost-effective drugs formulary committees without reducing effectiveness.[31] At the patient level, the out-of-pocket spending reduction has the potential of enhancing medication adherence.[32] Economic analysis therefore becomes a part of providing fair healthcare delivery.[33]

5. Cost Minimization Strategies with Hospitalized Diabetes Patients

5.1. General Promotion of the use of Generic Prescriptions

Generic prescribing is much cheaper, and therapeutically equivalent.[34] WHO urges nations to embrace generic policies so as to enhance affordability.[35] India has the Jan Aushadhi scheme which provides quality-assured generics at up to 50-90 percent reduced prices.[36] The research has shown that branded metformin and glimepiride with generic alternatives may save INR 300-500 per month per patient.[37]

5.2. Rational use of Fixed-Dose Combinations (FDCs)

FDCs enhance compliance and convenience but need to be applied wisely.[38] Metformin with glimepiride or empagliflozin is used as rational FDCs, which can provide synergistic effect.[39] Nevertheless, unreasonable combinations (e.g. glibenclamide + metformin and pioglitazone in unselected patients) can worsen the risk of adverse events.[40] The rational use of FDC is checked periodically by the Drug and Therapeutics Committee (DTC).[41]

5.3. Prescription Auditing

Regular prescription auditing recognises unreasonable practice, and then giving feedback to prescribers.[42] Auditing is oriented at such parameters as drug duplication, inappropriate usage of antibiotics or off-label administration.[43] Experience in tertiary care centers has demonstrated that the average cost of drugs per patient dropped by 18-25 percent after regular audits were implemented.[44]

5.4. Hospital Formulary Management

Formularies can direct prescribers to make evidence based and cost-effective drug selections.[45] Formulary management can minimize pharmacy spending by limiting the high-priced analogues and incorporating the established generics.[46] Forms of pharmacy and Therapeutics Periodically, Pharmacy and Therapeutics Committees (PTCs) review the contents of their formularies to confirm their conformity to therapeutic guidelines.[47]

5.5. Pharmacist-Led Interventions

Clinical pharmacists make sure that there is rational selection of drugs, correct dosage and monitoring.[48] Through their interventions, they eliminate medication mistakes, minimize negative incidents, and enhance cost-effectiveness.[49] Research proves that diabetes management initiatives that are led by pharmacists reduce drug cost by 15 percent and hospital readmission rates by 20 percent.[50]

6. Influencing Factors on Prescription Patterns

There are several factors that affect physician prescribing patterns and they include clinical experience, availability of medicine, patient preferences, and pharmaceutical promotions.[51] Prescription trends are also influenced by institutional policies and national guidelines.[52] Considering the use of computerized physician order entry (CPOE) systems, errors in prescriptions are greatly minimized and allow following guidelines.[53] In most developing

countries however, paper based prescriptions prevail thus creating inconsistencies in the use of drugs.[54]

Even economic factors are significant. In those cases where hospitals do not have reimbursement systems, doctors will use low cost but in some cases ineffective drugs unconsciously.[55] On the other hand, branded prescription could be issued by private facilities because of promotion factors.[56] Feedback mechanisms and continuous medical education (CME) can aid the process of standardising prescribing behaviour.[57]

7. Polypharmacy and Its Connotations

Polypharmacy which is the simultaneous use of five or more drugs is prevalent among the hospitalized diabetics because of various conditions.[58] Although this is sometimes required, polypharmacy can pose too many risks to drug interactions, side effects and financial burden.[59] It has been demonstrated that every new drug increases the likelihood of adverse drug event by 7-10 percentage points.[60] Safety may be enhanced and costs may be reduced by rationalizing the therapy of unnecessary medications and deprescribing them.[61]

Measures to take care of polypharmacy are periodically-reconcil medication, pharmacist review as well as patient counselling.[62] The electronic prescription systems with interactivity also assist in reducing errors by incorporating telecommunication alert on the prescription system.[63] The hospitals that have adopted such systems cite that such systems have led to 15-25 percent reduction in the number of preventable adverse events.[64]

8. Clinical guideline role in rational prescribing

Some of the clinical guidelines like the American Diabetes Association (ADA) and National Institute of Health and Care Excellence (NICE) offer consistent guidelines on how diabetes should be managed.[65] These evidence-based guidelines ensure that there is rational prescribing and the best cost-benefit results.[66] As an example, it is recommended that metformin be the first-line therapy, then better agents should be used under particular clinical signs.[67] Nevertheless, research indicates that there is a lack of adherence to these recommendations in most hospitals.[68] The institutional surveillance is critically important.[69]

9. Prescription Analysis Evaluation Tools.

Prescription analysis involves a number of tools and indicators that are utilized to ensure rational use of drugs among hospitalized patients. WHO/INRUD core prescribing indicators are extensively used.[70]

- Mean encounter drugs/encounter.
- Share of prescriptions made using generic name.
- Percentage of exposure to antibiotics.
- Percentage of injections being prescribed**.**

Percentage of drugs of essential medicines list

Moreover, the Drug Utilization Review (DUR) programs are also becoming more commonplace in hospitals.[71] DUR is a method of reviewing past and future prescriptions to find out inappropriate dosages, drug interactions, and unnecessary treatment. Computerized technologies embedded in the hospital information systems also contribute to accuracy and efficiency.[72]

10. Economic Cost of Diabetes among Hospitalized Patients

Hospitalization due to diabetes is very expensive both in terms of direct costs and indirect costs.[73] Direct costs are medications, lab tests, insulin therapy and patient hospital stay and indirect costs to be incurred are loss of productivity, burden on the caregiver and long term complications.[74] Indian multicenter study found hospitalization costs of USD 400-500 on average per diabetic patient, with the drugs taking up 30-40 percent of the overall amount.[75]

Proper prescription analysis and cost-cutting measures can save a lot of money. An example is that the replacement of exensive branded OHAs with generics or human insulin with analogues led to savings of 25-50 percent without extra cost being incurred in terms of glycemic control.[76]

11. Pharmacist role in cost reduction

Clinical pharmacists are in the center of cost-minimization measures. They are responsible for[77]

- Examining prescriptions based on rationality and guidelines compliance.
- Determining possible drug-drug interactions and contraindications.
- Recommendation of generic substitution and cost-saving substitution.
- Managing medication therapy (MTM) programs.

- Patient counseling to increase adherence.

Research has indicated that pharmacist-led interventions result in an average 15-20% price reduction on drugs, glycemic control, as well as, a lower rate of hospital readmissions.[78] Cooperative care between physicians and pharmacists is a model of care that guarantees clinical and economic sustainability.[79]

12. Obstacles to Cost-Minimization Strategy

Although there are proven advantages, there are numerous obstacles to the adoption of cost-minimization strategies.

- Physician causes: physician-related factors, Lack of awareness, brand-name prescribing habit, and insufficient training in pharmacoeconomics.[80]
- Patient-related factors: Brand preference, poor health literacy and mistrust of generics.[81]
- Systemic causes: Low access to generic drugs in hospitals, absence of computerized prescription, and poor formulary policies.[82]
- Regulatory reasons: The complicated procedures of approving the fixed-dose combinations and the absence of a price regulation of some drugs.[83]

The solutions to these barriers would involve education, policy changes, and interventions at system levels.[84]

13. The Future and Integration of Technology

New technologies can streamline the prescription analysis and cost reduction

Electronic Records of health (EHRs): Can facilitate real-time minute prescriptions auditing and support.[85]

Artificial Intelligence (AI): Recommends cost-efficient options[86] and predicts high-risk patients of polypharmacy.

Telepharmacy: Enhances the accessibility of pharmacist consultation and the compliance in rural and remote settings.[87]

Pharmacogenomics: De-accelerates prescriptions, eliminating trial-and-error prescriptions and the related expenses.[88]

- The recent developments in the health information technology such as electronic health records, clinical decision-support systems, and electronic monitoring tools will be instrumental in supporting glycemic control, improving prescribing habits, and improving care in general in a hospital environment.[89]

14. Policy Implications

National and institutional policy interventions are important in the cost containment

- **Promotion of generic drugs:** The government programs such as Jan Aushadhi in India make cheaper drugs more accessible.[90]
- **Formulary restrictions:** The inclusion of economical drugs in the hospital formularies leds to the decrease in high-cost prescriptions.[91]
- **Insurance coverage:** Extended coverage on generic drugs will increase adherence and reduce out-of-pocket expenses.[92]
- **Compulsory auditing of prescription**: National policies which are urging frequent prescription audits can create consistency in rational drug utilization.[93]

It is demonstrated that significant diminution of the healthcare expenditure on diabetes is attained in countries with powerful generic policies and formulary management.[94]

15. CONCLUSION

The cost-minimization approach with the detailed prescription analysis are crucial in the hospitalized diabetes management. Highlighted strategies are rational prescription, prescription of generic drugs, idea of optimization of fixed dose combinations, pharmacist lead intervention, and systematic prescription auditing in hospitals. The challenges to the execution of these strategies, like prescriber behavior, a lack of awareness, and institutional limitations, can be readily mitigated with the help of specific education, evidence-based policy change, and the incorporation of digital health technologies. These actions do not only enhance better clinical outcomes, but also save money to both patients and healthcare systems. In the future, pharmacoeconomic analyses of real-world research, AI-prescription auditing, and evidence-based cost-effectiveness analyses should be considered to consolidate the evidence-based practice and contribute to the provision of high-quality and sustainable diabetes care.

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