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PREVENTION OF INCIDENCE OF DRUG NUTRIENT INTERACTION IN HOSPITALIZED PATIENTS

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Abstract - This single-centre, cross-sectional prospective study aims to reduce Drug-Nutrient Interactions (DNI) by educating patients on food-drug interactions and adjusting diets accordingly. Registered Dietitians (RDs) develop tailored dietary guidelines, while the Health Information Management System (HIMS) enables real-time diet adjustments during hospitalization. Clinical Pharmacists and RDs collaborate to provide integrated educational materials at discharge, following CDSCO and ICMR standards. Counseling is delivered efficiently during the hospital stay and upon discharge. The patient-to-staff ratio is 20:1 for RDs and 30:1 for clinical pharmacists. This study underscores the importance of DNI counseling and highlights how automation enhances personalized nutrition management and improves drug and nutrient efficacy.

Keywords **-** Drug-nutrient interactions (DNI), Health Information Management System (HIMS), Central Drugs Standard Control Organization (CDSCO standards). ICMR (Indian Council of Medical Research), Registered Dietitian (RD), Patient Education.

I. INTRODUCTION

Drug-nutrient interactions (DNI) pose a serious risk to patient safety, especially with rising polypharmacy in aging and chronically ill populations. These interactions can reduce drug efficacy, impair nutritional status, and lead to adverse outcomes. Many patients unknowingly consume foods or supplements that interfere with their medications. This research addresses the issue using a multidisciplinary strategy that integrates patient education by dietitians, clinical pharmacist input to identify drug-related interactions, physician oversight, and automated clinical systems to detect and manage DNI risks in real time. Technology-enabled alerts and tailored dietary guidelines streamline workflows, allowing clinical pharmacists and dietitians to efficiently reach more patients. By improving awareness, reducing adverse interactions, and optimizing therapeutic outcomes, this model supports better health, enhances patient safety, and aligns with accreditation standards. It emphasizes the critical role of clinical collaboration and automation in modern, patient-centered care.

II. OBJECTIVES

a. To evaluate the proportion of high-risk patients (e.g., ICU, geriatrics, paediatrics, oncology, pregnant women, cardiology) who undergo DNI screening, reflecting the effectiveness of the surveillance system[1-2].

b. To measure the time interval between DNI alert and clinical intervention, indicating the clinical team's responsiveness and impact on patient safety [3-4]

c. Track the number of interventions made by clinical pharmacists and dietitians, showcasing interdisciplinary collaboration and preventive care efforts [5].

d. Analyze modifications in prescriptions or nutritional plans following DNI identification to assess clinical impact and adaptability [6-7].

III. LITERATURE REVIEW

a. Drug-nutrient interactions, such as grapefruit juice inhibiting cytochrome P450 enzymes, can increase drug toxicity, while older adults are at greater risk due to polypharmacy and nutrient deficiencies like B12, calcium, and iron (Bailey et al., 2013; MDPI, 2023).
b. Clinical studies show that vitamin K-rich foods can interfere with anticoagulants like warfarin in cardiovascular and diabetic patients, making consistent dietary guidance crucial to prevent clotting complications (Booth et al., 1995).
c. Technology integration, including advanced data tracking and systems like HIMS, aids in monitoring dietary patterns and delivering personalized dietary guidelines, reducing DNI risks and adverse drug reactions (Alhur et al., 2024).
d. Emerging research in pharmacogenomics highlights the importance of genetic screening to optimize drug-nutrient interactions and drug efficacy, particularly in personalized medicine for cardiovascular health (Tsioufis et al., 2022).
e. DNIs can impact pharmacokinetics, including absorption and bioavailability of medications like thyroid drugs and antibiotics, requiring careful timing of food and drug intake for optimal effects (Dahan & Altman, 2004).
f. High-protein diets can affect drug pharmacokinetics by altering urinary pH and renal function, influencing excretion of acidic drugs and efficacy, especially for pH-dependent medications (Greenblatt et al., 2003; Jusko & Shyu, 1979).
g. Herbal supplements, like St.John's Wort, can induce enzymes that reduce the effectiveness of drugs such as warfarin, highlighting the importance of patient awareness regarding herb-drug interactions (Bailey et al., 2013).
h. Long-term medication use can lead to nutrient deficiencies—such as reduced magnesium and B12 from antacids or potassium loss from diuretics—requiring dietary adjustments or supplementation (Alhur et al., 2024).

IV. METHODOLOGY

This prospective, cross-sectional single-center study was conducted among high-risk patient groups, including ICU, geriatric, oncology, pediatric, cardiac and pregnant populations. An interdisciplinary team comprising clinical pharmacists, dietitians, and physicians conducted daily clinical rounds. Potential drug-nutrient interactions (DNIs) were identified using a real-time electronic alert system integrated with the hospital's health information platform. Upon detection, clinical pharmacists communicated the DNI details to dietitians through a secure electronic channel. Dietitians then modified dietary plans based on the drug dosing schedule (e.g., OD, BD, HS) and updated diet order sheets before each meal. The Food & Nutrition Services (FNB) team implemented these revised orders accordingly. Additionally, patients discharged with medications known to cause DNIs received individualized dietary counseling from dietitians, ensuring continuity of care post-hospitalization.

Study Date – October 2023 to March 2024

V. DRUG NUTRIENT INTERACTIONS

Table - 1

DRUG (TABLETS)	MECHANISIM	FOOD TO BE AVOIDED	DOSE TIMINGS	USEFUL
Digoxin	High fiber binds to the drug and decreases drug bioavailability	Avoid high pectin fruits, legumes, millets or high fiber foods[8].	BD	CAD
Levodopa/ Syndopa Plus	Drug competes with amino acids for absorption transport	Avoid high protein diet, high fat, high fiber, large qty of dairy products[9].	BD	PARKINSONS
Nicoumalone/ Warfarin/ Dalteparin/ Tirofabin	Vitamin K promotes clotting factorsynthesis reducing the drug's anticoagulant effect.	Avoid cabbage, green leafy veggies, soya bean, cauliflower, berries, ayurvedic medicines, organ meats[10].	OD	CABG, MVR, CAD
Azithromycin/ Clarithromycin	Citrus fruits, especially grapefruit, inhibit CYP3A4, increasing blood levels and toxicity risk of azithromycin and clarithromycin.	Avoid citrus foods, juices & carbonated drinks[11].	OD/ BD	ANTIBIOTIC
Doxycycline	Doxycycline binds to calcium, iron, or magnesium in milk, supplements, or papaya, forming non-absorbable chelates that reduce its absorption.	Avoid milk, Ca, Iron Supplements or Papaya[12].	BD	ANTIBIOTIC
Alprazolam (Restyl)/ Diazepam/ Clonazepam 0.25 mg	If given with caffeine causes excitement, nervousness & hyperactivity and lessen the anti-anxiety effects & drug	Avoid coffee, cola, alcohol[13].	HS – 9/10 pm	ANTIDIPPRESENTS

Lorazepam/ Ativan	If given with caffeine causes excitement, nervousness & hyperactivity and lessen the anti-anxiety effects & drug	Avoid caffeine and cola[14].	HS	SEDATIVE
Dytor/Torsemide/ Furosemide (Lasix)	As these drug increase potassium levelsin body, k+ rich food may cause electrolyte imbalance	Avoid potassium rich foods[15].	BD (2nd dose timings 4/6 pm)	DIURETIC
Dytor Plus (Torsemide + Spironolatone)	As these drugs increase potassium levelsin body, k+ rich food may cause electrolyte imbalance	Avoid high fiber and potassium rich foods[16].	BD	DIURETIC
Zolfresh/ Zolpidem	If given with caffeine causes excitement, nervousness & hyperactivity and lessen the anti-anxiety effects & drug	Avoid high fat foods and caffeine.	HS	SEDATIVE
Akurit	Drug efficacy decreases	Avoid high tyramine foods- cheese, yogurt, avocados, bananas, dried raisins, prunes and soya beans[17].	OD	ANTI - TB
Voriconazole 200 mg	Drug absorption decreases	Avoid high fatty meal and dairy products[18].	BD	ANTIFUNGAL

VI. DATA COLLECTION

Flow Chart - 1

1. Patient Demographics and risk category

Age/ Gender/ Department/ clinical Diagnosis/ length of stay

⇩

2. DNI Screening Status

Screened for DNI (Yes/ No)/ Total High-risk patients per department/ % Screened per Department

⇩

3. Response Time Metrics

DNI Alert Timestamp (Clinical Pharmacist)/ Dietician Intervention Timestamp/ Time from Alert to Action (Minutes/ Hours)

⇩

4. Interdisciplinary Interventions

Number of Interventions(Pharmacist + Dietician) (Daily Meetings EOD)/ Frequency per patient 1 or 2

⇩

5. Therapeutic Plan Adjustments

Prescription or Nutrition Plan Change? / Nature of change: Drug Time Adjustment, Food Timing Separation, Nutrient Restriction

⇩

6. Discharge Counseling Records

Counseling provided at Discharge? / Summary of Dietary Instructionsto patient / care giver

VII. COMBINED RESULTS & IMPLICATIONS

Here's the 6-month summary based on a consistent occupancy of 60 patients per month (360 patients total), with 90 patients per department.

Table - 2

Department	**n**	**% Screened & Compliance**	**($\chi^2 = 18.75$, df = 3, $p < 0.001$) P vs Oncology**	**% Screened & Compliance**	**Mean ± SD (hrs)**	**ANOVA Post-hoc (vs. Oncology)**
Critical Care ICU	90	86.7%`↑	P < 0.001	86.7%`↑	3.0 ± 1.0	p < 0.001
Surgical	90	66.7%	P = 0.032	66.7%	4.5 ± 1.2	p = 0.004
Oncology	90	60.0% ↓	Reference	60.0% ↓	5.8 ± 1.4	Reference
Cardiology	90	80.0% ↑	P = 0.003	80.0% ↑	4.0 ± 1.1	p < 0.001

a. **Screening**: Fig.1 DNI screening compliance varied significantly across departments ($\chi^2 = 18.75$, df = 3, $p < 0.001$), with Oncology (60.0%) significantly lower than ICU (86.7%) and Cardiology (80.0%). These findings identify Oncology as a key target for improvement.

b. **Response Time**: Mean time to intervention differed significantly across departments ($F(3,356) = 42.9$, $p < 0.001$), with Oncology showing the longest delays per Tukey's HSD. ICU had the shortest times, indicating more efficient response processes.

c. **Intervention Type**: Dieticians had more interventions than clinical pharmacists (2.00/day vs.

1.33/day; $p < 0.001$), driven by broader DNI reviews, unlike clinical pharmacists who see only new patients.

d. **Post DNI Modifications**: Modification types post-DNI differed significantly ($\chi^2 = 12.27$, df =2, $p = 0.002$), with nutrition changes (41.7%) most frequent. This highlights the nutrition-centric impact of DNI alerts.

Fig. 1. Fig. 2.

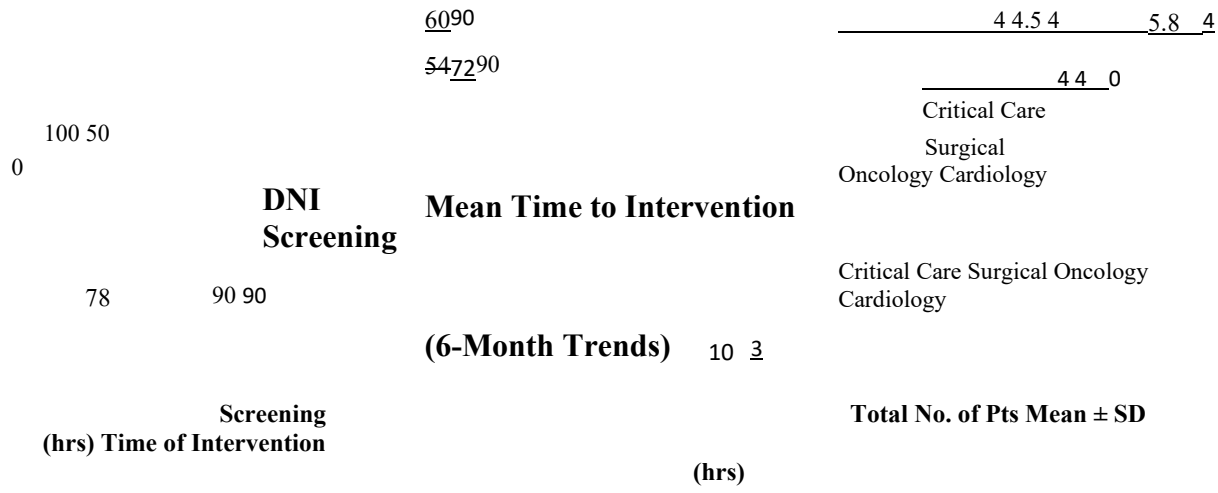

Fig. 1. Screening compliance across different Departments
Fig. 2. Mean time to Intervention for both Dieticians and Clinical Pharmacists

Fig. 3. Fig. 4.

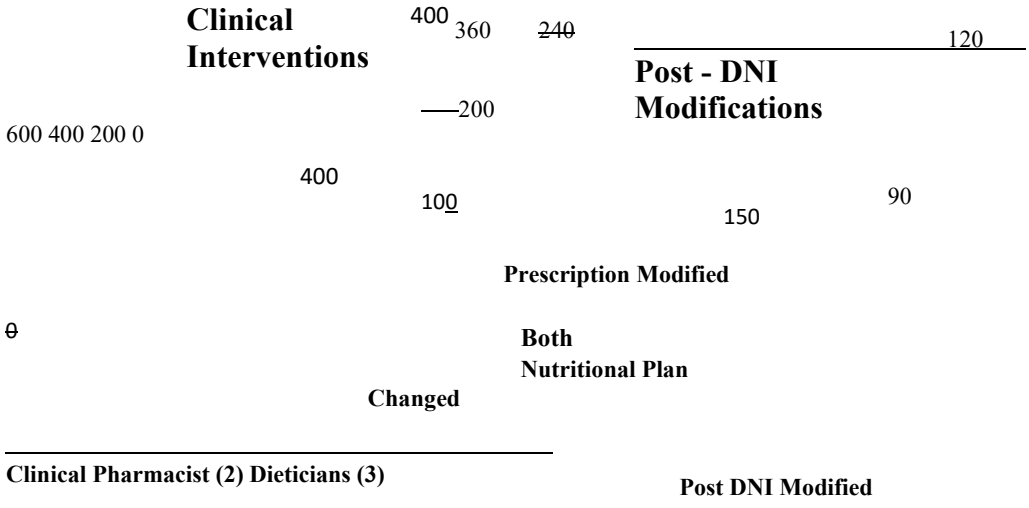

Fig. 3. Staff type Intervention - 2 Clinical Pharmacist and 3 dietician interventions per day on average
Fig. 4. Number and type of prescription or nutritional plan modifications made post-DNI detection

VIII. DISCUSSION

Over 6 months, significant departmental differences were observed in DNI alert handling. ICU had the highest screening compliance (86.7%) and fastest response time (3.0 ± 1.0 hrs), while Oncology lagged with the lowest screening rate (60.0%) and longest response time (5.8 ± 1.4 hrs), both statistically significant ($p < 0.001$). Dieticians led interventions (360 vs. 240 by clinical pharmacists; $p < 0.001$), reflecting broader DNI reviews, unlike clinical pharmacists who see only new patients. Post-DNI, 41.7% of patients had nutritional plans changed, 33.3% had prescriptions modified (time), and 25% received both, with nutrition changes significantly more common ($\chi^2 = 12.27$, $p = 0.002$). These findings highlight the need for targeted improvements, especially in Oncology.

IX. CONCLUSION

Significant interdepartmental variation exists in both screening compliance and response to DNI alerts. Oncology consistently demonstrates the lowest performance, underscoring the need for targeted quality improvement. The data highlight the importance of dietary counseling and adherence in improving drug efficacy and patientsafety, suggesting that educational programs and technology can enhance DNI management. Proactive dietary adjustments and patient education are crucial for improving clinical outcomes, emphasizing the need for structured interventions in managing DNIs**.**

X. LIMITATIONS AND FUTURE DIRECTIONS

The single-center design restricts generalizability, and further research could explore automated DNI alerts in diverse settings.

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