

Economic and Clinical Impact of a Pharmacist Managed Intravenous to Oral Conversion Service for Omeprazole in District Head Quarter Hospital Badin, Sindh Pakistan

Rameez Raja ¹, Aamir Sharif ¹, Saher Khalid ², Naveed Ali ¹, Mohammad Yaseen ¹

Background

The oral route is the easiest and safest way to administer medication. However, most patients admitted in hospital with severe infections are initially treated with intravenous route followed by oral route of administration. Patients receiving omeprazole for various diagnoses at the District Headquarter Hospital in Badin, Sindh, Pakistan. In this study we described how pharmacists managed to convert the intravenous medication to an oral form.

Objective

To determine the clinical outcomes and cost savings associated with pharmacist-managed intravenous to oral conversion of omeprazole in hospitalized patients at District Headquarter Hospital, Badin.

Method

In a retrospective study, patients of any age or gender took part. We gathered information from DHQ Badin's Health Management and Information System (HMIS). A Pharmacist examined each Omeprazole order throughout the intervention proactive conversion period and took appropriate action. Patients who switched from intravenous to oral omeprazole medication had their total cost of omeprazole computed.

Results

Total 1152 patients received Omeprazole. Total 281 quantity of iv Omeprazole prescribed while 4241 quantity of oral omeprazole was prescribed. Total cost saved from intravenous to oral omeprazole therapy was 339280 PKR.

Conclusion

The pharmacist was able to lower the cost of both drug charges and overall hospital expenses by managing the intravenous to oral conversion service. This provides strong support for Pakistan's in-hospital guidelines implementation of the intravenous to oral service.

Key words: Omeprazole; Pharmacist; Pakistan.

Affiliations:

¹ Department of Pharmacology, School of Nursing & Midwifery, Murshid Hospital & Health Care Centre, Karachi, Pakistan

² Master of Pharmacology, Sindh University, Jamshoro, Pakistan
Email: rameezmahar55@gmail.com

Corresponding Author: Rameez Raja

Introduction

Preferred route of any medication is one that produced the desired effect without producing undesirable effects. Oral route is the safest and most convenient way of administration of medications. The available oral medications in the market can produce desired therapeutic effects as compared to intravenous medications. Most of patients admitted in hospitals with severe infections initially treated with intravenous



medications 2-3 days followed by oral medication found to be beneficial for patients [1]. Patients feel more comfortable if they do not have catheter in their hands. There is increased risk of infusion related-adverse events if patients continuously receive parenteral therapy [2].

Worldwide, proton pump inhibitors are the commonly used drugs for gastrointestinal tract disorders. Because they are safer and more effective than H₂ receptor antagonists, these medications are chosen. Omeprazole is the first drug of PPIs reducing gastric acid secretion by inhibiting H⁺/K⁺-ATPase at gastric parietal cell. Omeprazole is a member of Benzimidazole group of drugs [3]. In duodenal ulcer, gastric ulcer, gastroesophageal reflux disease and Zollinger-Ellison syndrome [4]. Role of oral Omeprazole in reducing bleeding in patients with peptic ulcer also studied [5]. It is frequently prescribed to treat stomach issues such duodenal ulcers, peptic ulcers, and gastric hemorrhage. By decreasing the activity of H⁺/K⁺-ATPase, the last stage of acid secretion in gastric parietal cells [6]. In United States it is used for short term management of reflux esophagitis [7]. Oral omeprazole is rapidly captivated with aiguille claret concentrations aural 0.5 hours. The aggregate of administration is 0.3 liters/kg agnate to the aggregate of extracellular water [8]. Converting intravenous omeprazole to oral form decreases intravenous access complications and optimizing total cost associated with omeprazole therapy. According to guidelines patient should be converted in oral medications once it become stable [9].

Several Canadian health authorities, particularly the Fraser Health Authority in British Columbia, have launched programmes for switching from intravenous to oral formulations. The programmes' evident clinical and financial advantages are as follows: Timely conversion of some intravenous drugs to highly accessible oral versions can reduce infections associated with

intravenous lines and side effects associated with administration [1].

There are various limitations to using proton pump inhibitors (PPIs). They are costly and require Nursing expertise to administer medication. Therefore, it would be reasonable to prescribe oral PPIs to patients at high risk of developing bleeding ulcers, provided they are as effective as their intravenous counterparts [10]. In Pakistan, intravenous to oral practices are not very common. After being admitted to a hospital, most inpatients receive an injection of omeprazole. This study was conducted in Indus Hospital & Health Network Badin, where individuals receiving oral and intravenous omeprazole therapy were compared. Clinical pharmacists had a significant impact on the rate of implementation and active transition [11]. This study's main goal was to assess the function of the chemist in charge of the Omeprazole IV to oral conversion service by comparing the costs of the IV to the oral medication.

Methods

This study was conducted at Indus Hospital & Health Network (IHHN), Badin, a 300-bed secondary care hospital. The hospital uses a Health Management and Information System (HMIS) through which medications are prescribed electronically. This research was initiated after obtaining approval from the Institutional Review Board of Indus Hospital & Health Network, Karachi (IRB number: IHHN 2023-09-013). After 24 hours of admission, pharmacists routinely review and re-evaluate patients' medication orders. Any interventions or medication changes discussed with physicians are recorded by the pharmacists and communicated during clinical rounds. During these clinical rounds, pharmacists recommended converting intravenous (IV) Omeprazole to oral Omeprazole for patients who were clinically stable and able to

tolerate oral medications. Pharmacists also suggested initiating oral Omeprazole instead of IV in patients for whom the oral route was suitable. This retrospective observational study was performed on patients admitted to various wards at IHHN Badin who were prescribed Omeprazole. Data was collected from January 2021 to June 2023, following approval from the Indus Hospital Ethical Committee.

Inclusion and Exclusion Criteria

- **Inclusion Criteria:**

All adult patients admitted to IHHN Badin, irrespective of age, who were prescribed Omeprazole during their hospital stay were included in the study.

- **Exclusion Criteria:**

Patients who were treated exclusively with medications other than Omeprazole were excluded.

Conversion Criteria

The conversion protocol involved switching from IV to oral Omeprazole once the patient was clinically stable and capable of taking oral medications. This decision was made collaboratively by the pharmacists and the attending physicians during clinical rounds.

A daily computerized report was generated from the HMIS, listing all patients meeting the conversion criteria. Relevant information was then entered into a structured Microsoft Excel spreadsheet by clinical pharmacists. The spreadsheet was created and reviewed by clinical chemists, and all pharmacist interventions were recorded.

Clinical Data Collection

The following variables were extracted from patient medical records:

- Medical record number
- Age
- Gender
- Diagnosis
- Number of days of IV Omeprazole therapy
- Number of days of oral Omeprazole therapy
- Cost saved through IV to oral conversion
- Clinical outcomes after completion of therapy

Each patient's cost of therapy for both IV and oral Omeprazole was calculated based on the number of doses received.

Data Analysis

Data was organized and recorded using Microsoft Excel. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 22. Descriptive statistics were used to summarize patient demographics, medication usage, and cost savings.

Results

A total of 1152 patients were included in this study. Omeprazole therapy was initiated either as oral medication on pharmacist recommendation at the time of patient admission, or patients initially started on intravenous (IV) Omeprazole were switched to the oral form after receiving one to four IV doses, based on their clinical condition.

The cost per vial of IV Omeprazole was 80 PKR, while the cost per capsule of oral Omeprazole was 2.20 PKR. The age range of the patients receiving Omeprazole therapy was 12 to 96 years.

Days of Oral Omeprazole Therapy

The distribution of oral Omeprazole therapy days is presented in Table 1. A total of 305 patients

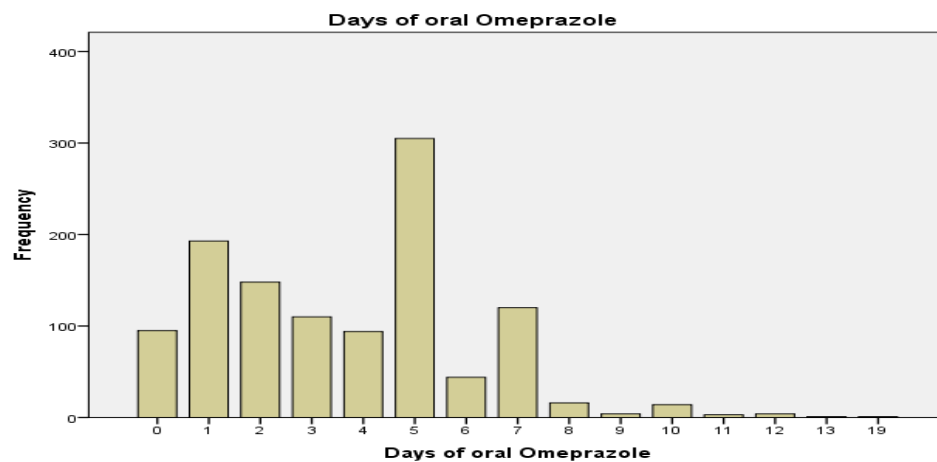
(26.5%) received five days of oral therapy, while some patients continued oral therapy for up to 13 and 19 days.

Table 1. Distribution of Patients by Days of Oral Omeprazole Therapy

Days of Therapy	Number of Patients (n)	Percentage (%)
0	95	8.2
1	193	25.0
2	148	37.8
3	110	47.4
4	94	55.6
5	305	82.0
6	44	85.9
7	120	96.3
8	16	97.7
9	4	98.0
10	14	99.2
11	3	99.5
12	4	99.8
13	1	99.9
19	1	100.0

A graphical representation is shown in **Figure 1**.

Figure 1. Bar Chart Showing Days of Oral Omeprazole Therapy



Days of Intravenous Omeprazole

Therapy: Out of the total patients, 1052 (91.3%) were directly converted to oral

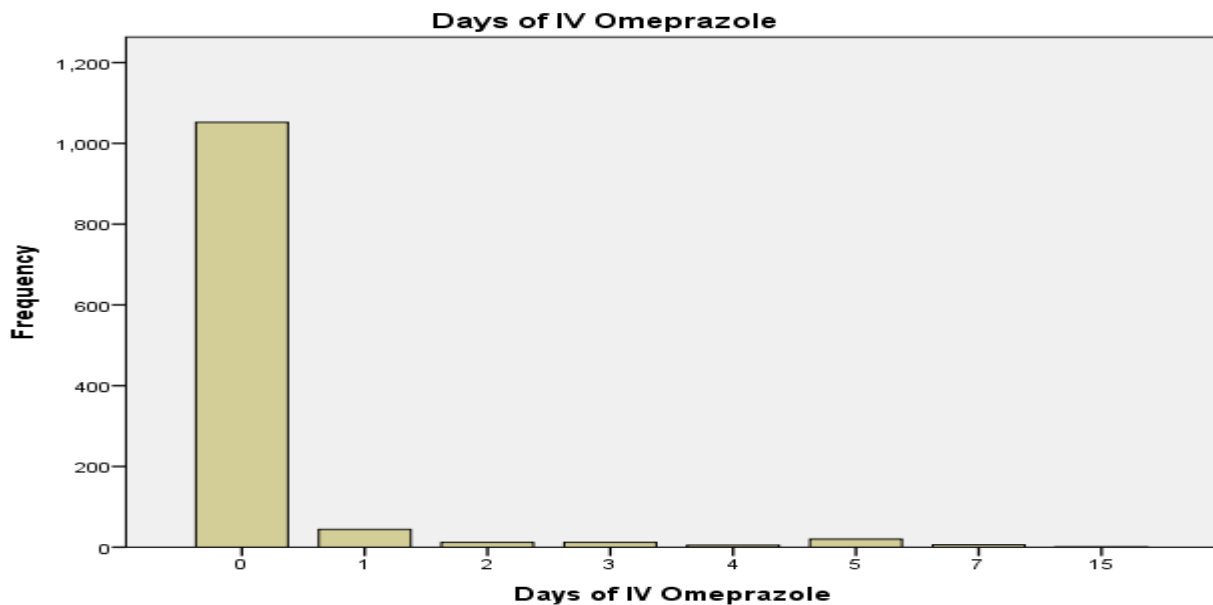
Omeprazole without receiving any IV doses, while 44 patients received one-day IV therapy before conversion. The complete distribution is shown in **Table 2**.

Table 2. Distribution of Patients by Days of Intravenous Omeprazole Therapy

Days of IV Therapy	Number of Patients (n)	Cumulative Percentage (%)
0	1052	91.3
1	44	95.1
2	12	96.2
3	12	97.2
4	5	97.7
5	20	99.4
7	6	99.9
15	1	100.0

This is further illustrated in **Figure 2**.

Figure 2. Bar Chart Showing Days of Intravenous Omeprazole Therapy



Cost Savings from IV to Oral

Omeprazole Conversion: The cost savings achieved by converting patients from IV to oral Omeprazole were calculated based on the

number of IV doses avoided per patient. As each IV vial costs 80 PKR, the total cost saved per patient varied accordingly. The distribution of cost savings is presented in **Table 3**.

Table 3. Distribution of Patients by Cost Saved After IV to Oral Omeprazole Conversion

Cost Saved per Patient (PKR)	Number of Patients (n)	Percentage (%)
0	95	8.2
80	193	16.8
160	148	12.8
240	110	9.5
320	94	8.2
400	305	26.5
480	44	3.8
560	120	10.4
640	16	1.4
720	4	0.3
800	14	1.2
880	3	0.3
960	4	0.3
1040	1	0.1
1520	1	0.1

Discussion

Our research showed that total expenses associated with IV to oral Omeprazole conversion were lower for pharmacist-managed cases, as was overall inpatient spending. The pharmacist was able to save up to 293 PKR per patient on the cost of omeprazole medication during this one-year conversion service. Many patients choose for intravenous (IV) medicine, which is a step towards ensuring improvement and a decrease in the amount of medication, even though oral (PO) medication consumption is clinically appropriate. In order to access the cardinal of accurate intravenous-to-oral conversions and to access the accumulation of funds from these accurate conversions, the results of a focused intervention abstraction are provided [1]. Many inpatients continue to take expensive IV drugs, but eventually they are able

to obtain bioequivalent, articulate substitutes [2]. An abundant bloom arrangement was used to assess the amount of intravenous to oral about-face procedures that resulted from using a CDS apparatus to actuate patients' accommodation for articulate medication analysis [3]. The role of hospital chemists in announcing the articulate avenue for the administration of omeprazole is not well understood, despite the fact that numerous affidavits have been published regarding intravenous to oral analysis about-face programs and analytical pharmacy casework offered in hospitals [4]. Long-term intravenous administration might cause pain for the patients and can lead to non-compliance as well as serious side effects as secondary infections. The patient's doctors concurred that an analytical opinion regarding balmy and abstinent infections was called in order to modify and explain an alternative treatment [5]. Inadequate medicine

administration, from intravenous to oral, increases the risk of infection, delays hospitalization, and raises the expense of college prescription drugs [6]. Cost increases in healthcare, particularly in the public sector, are a major problem. Many of these programs aim to reduce medical expenses without compromising the best possible therapeutic results [7]. As previously said, there are several benefits to switching from intravenous to oral medication, such as shorter preparation times, easier pharmaceutical administration, more comfort, and a lower risk of issues or negative responses (AE) [8].

The pharmacist is the good health care professional managed intravenous to oral service was approved by Drugs & Therapeutic Committee (D&TC) and the Medical Advisory Committee (MAC) [9]. According to a national survey of USA pharmacies, 81% of pharmacies had an active intravenous to oral conversion service [10]. Oral medications have lots of advantages including a lower cost and less nursing time for administration and patients feel more comfortable without IV catheter in hands [11]. Pharmacists' approach towards interventions and follow-up not only reduced the cost but also helped patients achieve more clinical success. Reducing intravenous omeprazole with appropriate clinical intervention by pharmacists can be important for achieving hospital cost saving without compromising treatment efficacy or patient safety [12].

An efficient strategy to reduce expenses and encourage early hospital release is to switch from intravenous to oral antibiotic medication as soon as possible [13]. From intravenous to oral omeprazole therapy not only cost-effective for patient as well as organization but also there are other benefits including oral administration is more convenient than IV as it removes the need of professional to administer medicines. It also

reduces cannula-related infections to patients. Patients meeting the pre-existing switch criteria are assessed. The criteria are based on drug and host variables [14]. There is no risk of thrombophlebitis in case of oral medications. Reduction in hidden costs of diluents, equipment for administration, needles, syringes, and nursing time. Needles, syringes, diluents and unavoidable requisition for parenteral administration [15-18].

This study demonstrates a significant cost-saving impact of a pharmacist-managed intravenous (IV) to oral conversion program for Omeprazole in a public-sector hospital setting in Pakistan. A major strength of the study lies in its real-world, hospital-based implementation and large sample size, which enhances the generalizability of findings to similar low-resource settings. Additionally, the proactive role of pharmacists highlights the potential for optimizing medication use and reducing unnecessary healthcare expenditures. However, the study has certain limitations. As a retrospective analysis, it relies on secondary data from the hospital information system, which may be subject to incomplete documentation or missing clinical details, such as reasons for continued IV use. Furthermore, the study did not assess patient outcomes such as symptom resolution or length of stay, which limits the clinical interpretability of cost savings. Future research should incorporate prospective, multi-center designs with clinical endpoints, such as patient recovery time, satisfaction, and complication rates. Expanding the conversion service to other drug classes and evaluating pharmacist-led interventions longitudinally would provide stronger evidence to inform national policy and hospital guidelines.

Conclusion

By effectively switching from intravenous to omeprazole therapy, the pharmacist was able to lower both the overall cost of omeprazole, and the total amount spent on patients. At district head

quarter hospital. Badin, our omeprazole intervention, which is described in this paper, was a first step that significantly reduced the hospital's overall inpatient admissions.

Funding

The authors did not receive any financial assistance, grants, or external funding for the design, execution, or publication of this study.

Conflict of Interest

All authors affirm that there are no financial or non-financial conflicts of interest that could have influenced the conduct or reporting of this study.

References

1. Gasparetto J, Tuon FF, dos Santos Oliveira D, Zequinaldo T, Pipolo GR, Ribeiro GV, et al. Intravenous-to-oral antibiotic switch therapy: a cross-sectional study in critical care units. *BMC Infect Dis.* 2019;19:650. doi:10.1186/s12879-019-4280-0.
2. Murdaugh LB. *Competence assessment tools for health-system pharmacies*. Bethesda (MD): ASHP; 2007. Available from: <https://www.ashp.org/-/media/store-files/p4023-frontmatter.pdf>
3. Hamzeloo-Moghadam M, Rezaei Tavirani M, Jahani-Sherafat S, Rezaei Tavirani S, Esmaeili S, Ansari M, et al. Side effects of omeprazole: a system biology study. *Gastroenterol Hepatol Bed Bench.* 2021;14(4):334–41. PMID: 34659661; PMCID: PMC8514216.
4. Anusha B, Shanmugam P, Kumar TA, Vasista S, Stephy C, Subeesh V. Early conversion of intravenous to oral antibiotic therapy in uncomplicated urinary and respiratory tract infection. *Drugs Ther Perspect.* 2021;37:181–6. doi:10.1007/s40267-021-00815-4.
5. Goldwater SH, Neal-Janifer A, Milkovich G, Chatelain F. Smoothing the path for i.v.-to-oral conversion. *Am J Health Syst Pharm.* 1997;54(2):200–5. doi:10.1093/ajhp/54.2.200. PMID: 9117811.
6. Carver KH, Burgess LH, Cooper M, Elders T, Kramer J. Use of clinical decision support to identify i.v.-to-oral conversion opportunities and cost savings. *Am J Health Syst Pharm.* 2018;75(23 Suppl 4):S82–6. doi:10.2146/ajhp170405. PMID: 30201658.
7. Cederberg C, Andersson T, Skånberg I. Omeprazole: pharmacokinetics and metabolism in man. *Scand J Gastroenterol Suppl.* 1989;166:33–40. doi:10.3109/00365528909091241. PMID: 2690330.
8. Chandrasekhar D, PokkaVayalil V. Cost minimization analysis on IV to oral conversion of antimicrobial agent by the clinical pharmacist intervention. *Clin Epidemiol Glob Health.* 2019;7(1):60–5. doi:10.1016/j.cegh.2018.01.001.
9. Charpiat B, Bedouch P, Conort O, Juste M, Rose FX, Roubille R, et al. Pharmacists' interventions on intravenous to oral conversion for potassium. *Int J Clin Pharm.* 2014;36(3):513–8. doi:10.1007/s11096-014-9916-y. PMID: 24633449.
10. Zhang J, Diao P, Zhang L. Intravenous versus oral omeprazole on patients with high risk bleeding peptic ulcers: a prospective randomized clinical trial protocol. *Medicine (Baltimore).* 2021;100(14):e25136. doi:10.1097/MD.00000000000025136. PMID: 33832076; PMCID: PMC8036073.
11. Florea NR, Kuti JL, Nightingale CH, Nicolau DP. IV to oral conversion programs for anti-infectives in the United States: prevalence and characteristics. *Hosp Pharm.* 2004;39(11):1069–75. doi:10.1177/001857870403901.
12. Hohlfelder B, Stashek C, Anger K, Szumita P. Improvements in a program to convert i.v. to oral medications at an academic medical center. *Am J Health Syst Pharm.* 2015;72(23 Suppl 3):S145–9. doi:10.2146/ajhp150331. PMID: 26582300.
13. Wallmark B. Mechanism of action of omeprazole. *Scand J Gastroenterol Suppl.* 1986;118:11–7. doi:10.3109/00365528609090881. PMID: 3014640.
14. Przybylski KG, Rybak MJ, Martin PR, Weingarten CM, Zaran FK, Stevenson JG, et al. A pharmacist-initiated program of intravenous to oral antibiotic conversion. *Pharmacotherapy.* 1997;17(2):271–6. PMID: 9085318.
15. Downen J, Jaeger C. Quality improvement of intravenous to oral medication conversion using Lean Six Sigma methodologies. *BMJ Open Qual.* 2020;9(1):e000804. doi:10.1136/bmjopen-2019-000804. PMID: 31986120; PMCID: PMC7011893.
16. Cyriac JM, James E. Switch over from intravenous to oral therapy: a concise overview. *J Pharmacol Pharmacother.* 2014;5(2):83–7. doi:10.4103/0976-500X.130042. PMID: 24799810; PMCID: PMC4008927.
17. Martinez MJ, Freire A, Castro I, Inaraja MT, Ortega A, Del Campo V, et al. Clinical and economic impact of a pharmacist-intervention to promote sequential intravenous to oral clindamycin conversion. *Pharm World Sci.* 2000;22(2):53–8. doi:10.1023/a:1008769204178. PMID: 10849923.
18. Ho BP, Lau TT, Balen RM, Naumann TL, Jewesson PJ. The impact of a pharmacist-managed dosage form conversion service on ciprofloxacin usage at a major Canadian teaching hospital: a pre- and post-intervention study. *BMC Health Serv Res.* 2005;5:48. doi:10.1186/1472-6963-5-48.

