

## Evaluation of the development, implementation and the cost assessment of Intravenous to Oral Therapy conversion

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### ABSTRACT

This study reports the results of a prospective observational study of Intravenous to oral conversion based on the duration of hospital stay, and cost assessments (in terms of patient benefit or savings, from the study). A total of 101 patients including both the genders were suffering with different diseases were enrolled in a prospective observational study for a period of 6 months in the primary care hospital. The subjects had been considered into study based on the source of data, inclusion & exclusion criteria. All 101 (100%) patients experienced a significant better difference in their medication therapy or treatment therapy and their duration of hospital stay and cost of illness was reduced. The duration of hospital stay was decreased from 6 days to 2 days and the cost savings were observed i.e., about 90-100% of cost saving was done to the higher number of the patient. Our prospective observational study, using a standard protocol and guidelines were decreases the cost of the therapy and duration of hospital stay to the patient. The numbers of conversions were more after the study performed.

### INTRODUCTION

When a patient becomes ill, he or she goes to the hospital for a check-up or consultation with a doctor or physician. The doctor determines a provisional diagnosis based on the patient's signs and symptoms and writes him with the required medical assessment or tests to undergo. After test results are received the doctor then makes a final diagnosis, based on which the patient takes the prescribed medication. The doctor determines whether the patient has an acute illness or disease or a chronic condition or disease, which determines the severity of the patient's disease condition and the duration of the disease treatment. The doctor then makes a final judgment based on this. If the disease or severity is found to be more severe, then the patient needs to stay in the hospital. The physician/doctor needs to select the route of drug and the selection of route of administration of any drug depends on certain factors like patient severity of the disease and compliance, safety, efficacy, quality and bioavailability of a drug. The intravenous route of drugs obeys all the factors. So, in severe cases the initial

treatment is started with the intravenous drugs (for ex: intravenous antibiotics, gastrointestinal agents, cardiovascular drugs etc.) and the treatment should be then converted to the oral medication therapy based on the reduction and improving patient health status based on different conversion factors. The conversion of the drugs or treatment therapy must and should be based on standard guidelines.

### Irrational use of drug a major problem:

The maximum time required for a treatment therapy conversion from intravenous to oral route is after 2 to 3 days of administration of intravenous medication (IV), but there are many barriers which prevent this conversion and lead to improper drug use or irrational use of medicine, which is a major global problem worldwide. According to WHO, more than half of the medication are prescribed, delivered, or marketed incorrectly, and half of all patients do not take them correctly or otherwise the medical staff in the hospital are not giving the proper attention during the intake of medication by patient. Medicine overuse,

underuse, or misuse wastes valuable resources and poses extensive health risks. Examples of illogical medicine usage include: using too many drugs per patient ("polypharmacy"); and incorrect use of antimicrobials, which is common and often in inadequate dosage, for non-bacterial infections; over-use of injections when oral formulations would be more appropriate; failure to prescribe in accordance with clinical guidelines; inappropriate self-medication, often of prescription-only medicines; non-adherence to dosing regimes.

We predicted that in our hospital, IV therapy was overused where PO was appropriate, and that implementing the evaluation of early conversion from IV-PO therapy and may result in a patient's budget friendly practice. As a result, we sought to examine the efficacy of the health care system innovations and instructional sessions for a multidisciplinary team in a primary care hospital in inducing early IV to PO drug conversion. We also looked forward how IV drug intake shows impact on total pharmaceutical expenses, and patient safety.

## MATERIALS AND METHOD

A prospective observational study was conducted for a period of 6 months in a primary care hospital. The study included all the patients visiting the hospital above the age of 18 and above patients who agreed to participate in the study, willing to cooperate during study and meet the inclusion criteria's received iv therapy  $\geq 48$  h, tolerate oral intake, able to sufficiently absorb oral medications via oral, nasogastric or feeding tube, patient improving clinically negative blood culture for  $\geq 48$  h, a febrile temperature  $< 38^\circ\text{C}$  for at least 24 hours were included. Patient below the age of 18 and who are unable to participate in the study due to their medical condition or any other reasons like difficulty in swallowing, malabsorption syndrome (obstruction, ileus, persistent nausea, vomiting or diarrhoea, short bowel syndrome, motility disorder), continuous feed tube (note: tube feed are not absolute) contraindication, use syrup, crushed tablets or slurry tablet formulation, patient refuse to take oral medication and unconsciousness were excluded from the study.

A total of 101 patients were screened for enrollment. Of which, all the patients met inclusion criteria and the same were included into the study following obtaining informed consent form. The study protocol was approved by the institutional Ethics Committee of the university, which waived the patient's consent requirement.

## COLLECTION OF DATA:

Project team approached the project site and met the participants and explained about the study purpose and a written consent was taken from the participants. Patient data collection form, interview with patient and their representative and patient investigation reports.

## PROTOCOL PREPARATION:

The hospital protocol for switch from IV-PO therapy was designed and approved by the institutional ethical Committee and was discussed at the nursing-pharmacy committee. Prior to the current study, there was no related protocol in the hospital. A MEMO was distributed to the departments involved. The Stanford Health Care protocol (Mui, 2013) was used for inclusion and exclusion criteria, with minor adaptations. A total of targeted IV medicines with comparable bioavailability (Fischer et al., 2003) and hospital formulary availability were considered (Fig. 1). Antimicrobial agents were composed of ten of the targeted

drugs. A comparable selection of specific medications.

## RESULTS:

### Socio-demographic details:

The collected data showed that almost among total of 101 patients were enrolled in the present study and among the 101 patients, 49 (48.51%) participants were males and 52 (51.48%) participants were females. Here Female predominance over Males was observed as shown in table 1 and figure 2. And majority of the subjects belongs to the age group of 41 to 50 years (22.77%). On contrast, least number of subjects was observed between the ranges of 71 to 80 years (6.93%).

Figure 3 shows, among 101 subjects 23 (22.77%) of RTI (Respiratory tract infection) 21 (20.79%) of UTI (Urinary tract infection) 05 (4.95%) of CVS (Cardiovascular diseases) 09 (8.91%) of CNS (central nervous system diseases) 04 (3.9%) of Hepatic 05 (4.9%) of GIT (Gastrointestinal diseases) 06 (5.94%) of DM (Diabetes mellitus) 03 (2.97%) of septicemia 02 (1.98%) vertigo 03 (2.97%) of seizures 02 (1.98%) thyroid diseases 18 (17.82%) were others (viral fevers) were enrolled in the study where all the patients are converted from intravenous to oral route of administration.

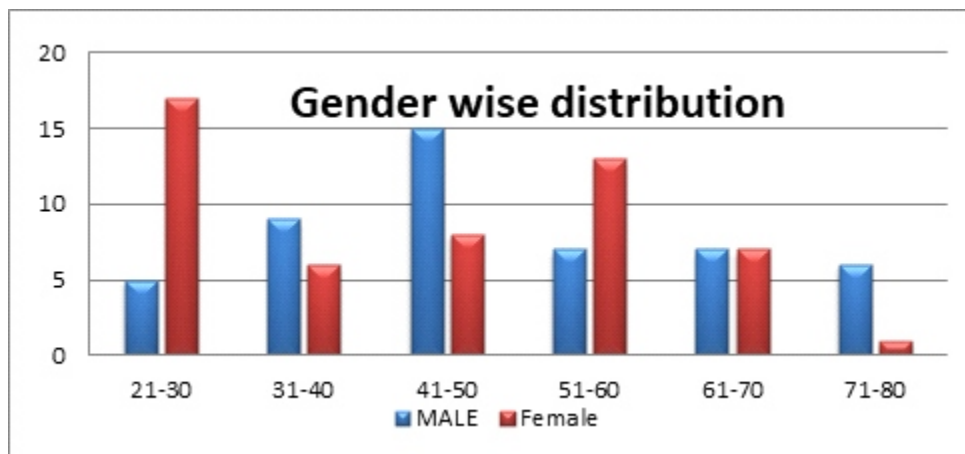
Figure 4 shows, among 101 subjects 23 (22.77%) of RTI (Respiratory tract infection) 21 (20.79%) of UTI (Urinary tract infection) 05 (4.95%) of CVS (Cardiovascular diseases) 09 (8.91%) of CNS (central nervous system diseases) 04 (3.9%) of Hepatic 05 (4.9%) of GIT (Gastrointestinal diseases) 06 (5.94%) of DM (Diabetes mellitus) 03 (2.97%) of septicemia 02 (1.98%) vertigo 03 (2.97%) of seizures 02 (1.98%) thyroid diseases 18 (17.82%) were others (viral fevers) were enrolled in the study where all the patients are converted from intravenous to oral route of administration.

**Table 1 : SOCIO-DEMOGRAPHIC CATEGORIZATION**

AGE	MALE	FEMALE
21-30	05	17
31-40	09	06
41-50	15	08
51-60	07	13
61-70	07	07
71-80	06	01

IV MEDICATION	DOSE	COST (RS)	ORAL MEDICATION	DOSE	COST (RS)	ORAL BIOAVAILABILITY	IV:PO EQUIVALENCE
<b>Antimicrobials</b>							
Pippericilline and Tazobactam	4.5 mg	272.10	Amoxicillin and clavulanic acid	875 mg +125 mg	90/10=9	27% amoxicillin 50% clavulanic acid	1:1
Azithromycin	500 mg	215.0	Azithromycin	250 mg	70/3=23.3	38%	1:1
Linezolid	2mg/ml	505.0	Linezolid	600 mg	340/10=34	100%	1:1
Ciprofloxacin	200 mg	11.25	Ciprofloxacin	250-500mg	41/10=4.1	60-80%	1:1.25
Metronidazole	500mg/100 ml	15.00	Metronidazole	500 mg	12.76/15=1	80%	1:1
Cefuroxime	750mg	199.0	cefuroxime	250-500 mg	69.25/8=9	52%	1:1
Meropenam	2mg/ml (1gm )	749.0	Meropenam	1 to 3 g	412/6=68	91%	1:1
Ceftriaxone	1-2g/d	67.04	Amoxicillin and clavulanic acid	875 mg +125 mg	90/10=9	27% amoxicillin 50% clavulanic acid	1:1
Amoxicillin and clavulanic acid	1-2g/d	140.93	Amoxicillin and clavulanic acid	875 mg +125 mg	90/10=9	27% amoxicillin 50% clavulanic acid	1:1
amoxicillin	500mg-1g	95.00	amoxicillin	500mg-1g	70/10=7	97%	1:1
<b>Non –antimicrobial Drugs</b>							
ondansetron	2 mg/ml	14.3	ondansetron	4or 8 mg	109/10=11	50-70%	1:1
<b>Antihistamine</b>							
Promethazine	25mg/ml	11.00	Promethazine	25 mg	45.5/10=4	25%	
Hydrocortisone	100mg Q24h	63.13	Hydrocortisone	50 mg Q8h	68/10=7	100%	
<b>Gastrointestinal agents</b>							
Pantoprazole	40 mg	55.36	Pantoprazol	40 mg	169/10=16.9	80%	1:1
			Rabeprazole	20 mg	148/10=14		
Ranitidine	500mg/2ml	13.00	Ranitidine	150 mg	6.30/10=1	50%	1:1
<b>Miscellaneous</b>							
Acetaminophen	1000mg/10 0ml	4.00	Acetaminophen	500mg - 650mg	7.49/10=1	85-98%	1:1
Levicetrium	500mg-1500mg	30.00	Levicetrium	500mg-1500mg	110/10=11	100%	1:1

Fig 1 : Hospital protocol for switching from IV-PO



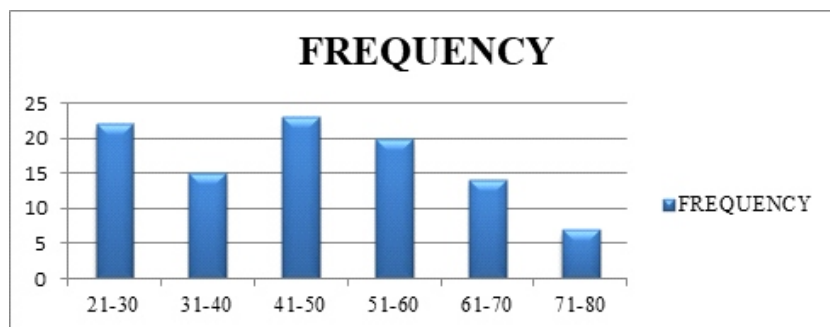
**Figure 2 :** Socio-demographic charetersticks of participants. (x-axis : AGE ) (y-axis: NUMBER OF PATIENT)

**Table 2 : AGE WISE DISTRIBUTION**

AGE	FREQUENCY
21-30	22
31-40	15
41-50	23
51-60	20
61-70	14
71-80	07

**Table 3 : DISEASE WISE DISTRIBUTION**

DISEASES	TOTAL SUBJECTS	MALE	FEMALE
RTI	23	15	8
UTI	21	11	10
CVS	05	03	02
CNS	09	03	04
HEPATIC	04	03	01
GIT	05	04	01
DM	06	01	05
SEPTICEMIA	03	01	02
VERTIGO	02	01	01
SEIZURES	03	01	02
THYROID	02	01	01
OTHERS	18	07	11



**Figure 3 :** AGE WISE DISTRIBUTION. (x-axis : FREQUENCY) (y-axis: AGE)

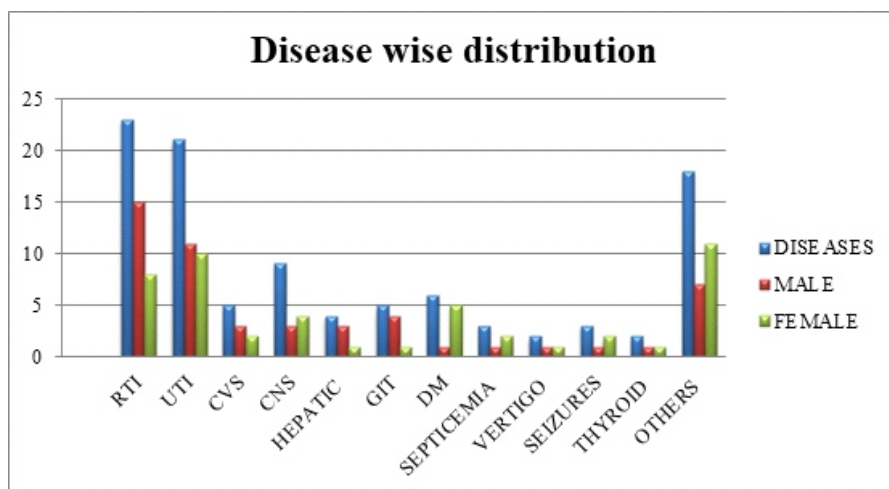


Figure 4 : Disease wise distribution. (X-AXIS:NUMBER OF SUBJECTS) (Y-AXIS:DISEASE)

Table 4 : Assessment of association between duration of hospital stay and state of conversion form IV to PO therapy

DOHS	MALE	FEMALE	TOTAL	P VALUE
2	08	06	14	0.618836
3	13	24	37	0.061664
4	16	10	26	0.23655
5	11	10	21	0.083437
6	03	00	03	0.086348
Total	52	49	101	

Table 5 : COST ASSESSMENT

SAVING IN PERCENTAGE	NUMBER OF PATIENTS BENEFITED
1-10%	02
11-20%	01
21-30%	05
31-40%	06
41-50%	09
51-60%	06
61-70%	14
71-80%	17
81-90%	20
91-100%	21

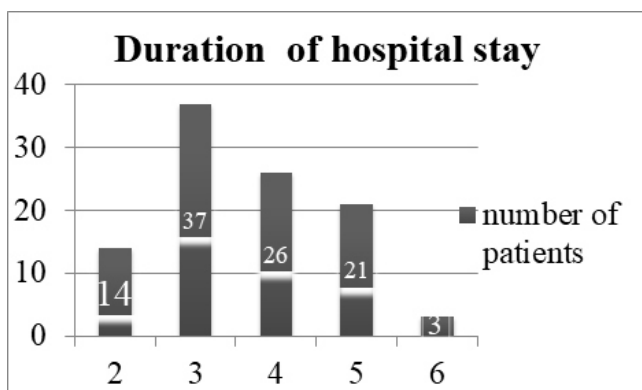
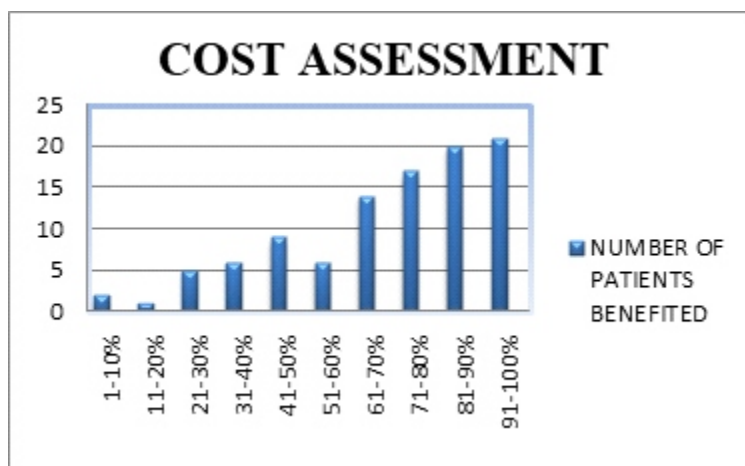


Figure 5 : Assessment of association between duration of hospital stay and state of conversion form IV to PO therapy. (X-Axis : Duration of hospital stay) (Y-Axis : Number of patient)



**Figure 6 :** Cost assessment. (X-Axis : Saving in percent) (Y-Axis : Number of subjects benefited )

Figure 5 shows shows , the length of hospital stay among 101 subjects 14 patients have 2 days of dos, 37 have 3 days of dos, 26 have 4 days of dos 21 have 5 days of dos and 3 patients have 6 days of dos , where the length of hospital stay was decreased from longer 6 days to at least as 2-3 days.

Figure 6 shows shows that in this study 21 number of subjects are experiencing cost saving of 90-100% that occurs during IV to oral conversion which is higher among all the other percentage saving.

## DISCUSSION

Lack of medication conversion from intravenous to oral contributes to increased risk of infection, delayed discharges and higher medication costs because Physicians were probably not aware of the existence of clear guidelines on the adequate timing of the conversion. At our institution, intravenous to oral medication conversion rate was 90-100%. The goal of our project is to reduce the duration of hospital stay and reduce the cost for applicable medications. The method used in this project is focused on eligibility criteria for the conversion. The results shows benefits for the patients in respect to cost, length of hospital stay, improves patient comfort and , reduces the risk of IV infections.

As far as various patterns of IV to oral are concerned, administered Antibiotic courses of treatment that were switched to a suitable oral dosage form were very few and involved antibiotics were piperacillin with tazobactam, Azithromycin ,linezolid, ciprofloxacin, metronidazole, cefuroxime, meropenem, ceftriaxone, Amoxicillin with clavulanic acid, and also other drugs including Anti emetic-Ondansetron, Antihistamines- Promethazine, hydrocortisone , GI agents - Pantoprazole, and miscellaneous -Acetaminophen, levitracetam. These drugs are converted from Iv to PO conversion. Mostly Conversion of drugs is followed by Sequential therapy. Drugs such as ceftriaxone with no PO equivalent its conversion to oral dosage form was done using step-down conversion therapy, which was occasionally performed in this study. These antibiotics were converted in a sequential type to oral formulation. Firstly, these are available in both IV and PO Formulations and secondly, sequential therapy is probably easiest Way to follow and also due to poor awareness of physicians regarding switch therapy and

step-down therapy.

In this study, we attempted to switch the drugs from intravenous to oral route of administration, where a total of 101 patients of various diseases were enrolled in the study over a period of 6 months. Data were collected from patients presenting with different diseases. At beginning of study socio-demographic details were recorded using data collection form. Among them Female predominance over males was observed. Table 6.1 figure 6.2a shows, Patients with age group 21 to 60 years (78.79%) were more admitted in the hospital and less number of patients were admitted in the age group of 61 to 80 years (21.93%). Figure 6.3a shows, patient of RTI 23 (22.77%) were effected more ,where as thyroid 02 (1.98%) subjects of patients were seen less Figure 6.4a explains the length of hospital stay and state of conversion from IV to oral therapy i.e., The duration of hospital stay was decreased from long 6 days to least 2-3 days Figure 6.5a shows percentage of cost saving per number of patient treatment therapy.

## CONCLUSION

From our study we found that IV to PO conversion practice was frequent and the most frequent conversion practice was sequentially followed by switch conversion .Firstly, these are available in both IV and PO formulations and secondly, sequential therapy is probably easiest way to follow and also due to poor awareness of physicians regarding switch therapy and step-down therapy. For instance, drugs such as ceftriaxone with no PO equivalent and hence its conversion to oral dosage form was done using step-down conversion therapy, which was occasionally done in this study.

And the awareness of IV to PO conversion practice and short term training of health care team is vital for better conversion practice and the rational use of antibiotics makes it better for a healthy society and that will influence the outcome of the patient in a fruitful way. During our implementation phase, we identified 101 IV orders that were eligible for switch therapy. Timely and appropriate switching of drugs from IV to PO therapy could reduce the duration of hospitalization of patients. And the practice of IV to oral conversion can shorten the duration of IV therapy and reduces the treatment cost without any negative influence on the outcome of treatment.

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