A descriptive outcome based study for treatment strategies of lower respiratory tract infections using medication therapy management

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ABSTRACT

Lower respiratory tract infections (LRTI's) are the fifth leading cause of death due to infections being responsible for 2.74 million deaths worldwide. Antibiotics are used primarily to treat these infections. The aim of this research is to study the medication therapy management of patients with lower respiratory tract infections admitted in ESI hospital, Bangalore and to improve the quality of life of patients. It is a descriptive, observational, and interventional study. The data is collected through suitably designed forms and by direct interaction with the patients as well as their care takers. The study cohort consists of 40 patients, of that males were 24 (60%) and females were 16 (40%). Most of the infected cases were in the age group of 51 to 60 years and minimum infected were of 11 to 20 years and 81 to 90 years. The symptoms like Hyperthermia (30%), Tachycardia and tachypnea (32.5%) were observed. High count of RBS, PPBS, FBS were seen among 25%. Observations including leukocytopenia (7.5%), neutropenia (15%), lymphocytopenia (22.5%), leukocytosis (22.5%), neutrophilia (27.5%), lymphocytosis (35%), eosinophilia (7.5%), monocytosis (2.5%), and all cases have increased ESR (100%). LRTI was among 13 (32.5%) patients and remaining were with complications associated with LRTI. 40 (100%) patients received IV fluids along with Duolin, Budecort, Augmentin, Cough syrup, and Deriphylline. Maximum drug interactions are seen in Pantoprazole + Deriphylline combination among 14 (35%). Process measures (type and frequency of drug therapy problems detected), economic measures (number of medications dispensed), and humanistic measures, (patient satisfaction with services) were the main outcomes in this process after providing MTM services.

Keywords: Lower respiratory tract infections; Medication therapy management; white blood cells; comorbid conditions; Clinical pharmacist; Anti - microbial therapy.

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INTRODUCTION

Lower respiratory tract infection (LRTI) is a generic term for an acute infection of the trachea, airways, and lungs, which make up the respiratory system.

LRTI's include bronchitis, bronchiolitis, influenza, Tuberculosis, pneumonia. These acute lower infections are a leading cause of sickness and mortality both in children and adults worldwide. Every year about 5 million people die of acute respiratory infections.^[1] According to the Global Burden of Disease 2015 study (GBD 2015), chronic obstructive pulmonary disease (COPD) and lower respiratory tract infections represent the third and fourth most common causes of death respectively.^[2] Among LRTI's, pneumonia represents the most frequent cause of mortality, hospitalization and medical consultation. Several factors (age, underlying disease, and environment) influence mortality, morbidity, and microbial etiology.^[1]

Bronchitis causes inflammation of the bronchial tubes. The inflammation leads to the swelling of the lining of these breathing tubes, narrowing the tubes and promoting secretion of inflammatory fluids. Bronchiolitis is a first time wheezing with a viral respiratory infection. It is a common respiratory illness in children less than 24 months with its peak inci-

dence between 3 to 6 months of age. Influenza is commonly referred as the flu, is an infectious viral disease caused by RNA viruses of the family Orthomyxoviridae (the influenza viruses) that affects birds and mammals. Tuberculosis is a second largest infectious disease caused by *Mycobacterium tuberculosis* that usually affects lungs although other organs may also be involved. Pneumonia is an inflammatory condition of the lung especially affecting the microscopic air sacs (alveoli), and the parenchyma of the lung.

Infections are caused by tiny organisms known as bacteria or viruses, which are usually the most common cause. They are carried in tiny droplets and passed between people by coughing, sneezing and at times by indirect contact with surfaces. People who are infected usually produce antibodies to fight the virus. If re-infected, the antibodies help to fight the infection with the same strain. Less frequently, these bacteria can go on to cause a LRTI. Symptoms of lower respiratory tract infections vary and depend on the severity of the infection. Less severe infections can have symptoms similar to the common cold, including stuffed up or a runny nose, dry cough, low fever, mild sore throat, and headache.^[3] In more severe infections, symptoms include a severe cough that may produce phlegm, fever, difficulty breathing, blue tint to the skin, rapid breathing, chest pain, and wheezing. Patients with LRTI and other comorbid conditions need excessive care among treatment because polypharmacy may lead to drug related problems. To overcome from these drug related problems, medication therapy management (MTM) process is undertaken with five different steps which provides interventions and improves patient's quality of life. Medication adherence, patient counselling and patient education are the important factors ^[4] among them.

The aim of this research is to study the medication therapy management of patients with lower respiratory tract infections admitted in ESI hospital-Bangalore and to improve the quality of life of patients by addressing the issues of polypharmacy, preventable adverse events, medication adherence, and medication misuse. To improve outcomes by helping people to better understand their health conditions and the medications used to manage them and to develop a model frame work of MTM, designs to improve care, enhance communication among patients and providers, improve collaboration among providers, and optimize medication use that leads to improved patient outcomes.

METHODOLOGY

Study design and site: It is a descriptive, observational, and interventional study which was conducted in an ESI hospital (Indiranagar, Bangalore). LRTI patients willingly participated in this study, and all necessary approvals from the institutional ethical committee at Gautham College of pharmacy, Bangalore were obtained before beginning the study.

Study sample: 40 inpatients are diagnosed with LRTI and undergone medication therapy during the study period of six months from November 2019 to April 2020 and were included in this study.

Data collection: Suitably designed data collection forms were prepared to collect the details from the inpatients in ESI hospital. Case report forms of patients were collected from the concerned wards and laboratory data is collected from the labs and further required data is collected by the interaction among the doctors, nurses, and patients. Informed consent was taken from each patient, containing the necessary information regarding the study. The data collection includes patient details like demographics, signs and symptoms, type of infectious disease and treatment given to the patient. Discussions were done with respective physicians, guide, and nurses for elaboration of the study regarding concerned patient reports.

Case report forms, laboratory reports like complete blood count, biochemistry reports and complete urine analysis and other required tests of the patient were analysed. Various parameters during hospitalization were studied, and all required details like patient demographics, vitals, systemic examination, diagnosis, treatment (dose, date of drug started and stopped), drug interactions and adverse drug reactions were monitored. The incidence of drug interactions in patients is seen and they most often involve medications to treat comorbid conditions. Data collected was analysed and compared with available studies. We contributed significantly by checking the treatment prescribed and detecting interactions, to reduce medication related problems and to optimize drug therapy for these patients.

Statistical tools: The parameters monitored were entered in Microsoft excel 2016 and applied descriptive studies for each parameter included in the patients. The incidence rate was calculated as the change in variable in patients (numerator) per the total number of patients in particular disease (denominator). The tables and graphs were drawn for each variable present in case sheets and also calculated percentages for each table.

RESULTS

Total number of the patients were 40, of whom 24 (60%) were males and 16 (40%) were females (Table 1 & Figure 1). Age wise distribution ranges from 0 to 90 years. 3 (7.5%) patients were in the age group of 0 to 10 years, 1(2.5%) patient was of 11 to 20 years, 3 (5%) patients were in the age group of 21 to 30 years, 3 (7.5%) patients were in the age group of 31 to 40 years, 7 (17.5%) patients were in the age group of 41 to 50 years, 16 (40%) patients were maximum in the age group of 51 to 60 years, 5 (12.5%) patients were in the age group of 61 to 70 years, 2 (5%) patients

were in the age group of 71 to 80 years. 1(2.5%) patient were in the age group of 81 to 90 years (Table 2 & Figure 2).

Table 1: Gender wise distribution in LRTI hospitalized patients

Sl.no	Gender	Number of patients	Percentage of patients (%)
1	Males	24	60
2	Females	16	40

Gender wise distribution

Figure 1: Gender wise distribution in LRTI hospitalized patients based on percentage

Table 2: Age wise distribution in LRTI hospitalized patients

Sl.no	Age group in years	Number of patients	Percentage of patients (%)
1	0 to 10	3	7.5
2	11 to 20	1	2.5
3	21 to 30	2	5
4	31 to 40	3	7.5
5	41 to 50	7	17.5
6	51 to 60	16	40
7	61 to 70	5	12.5
8	71 to 80	2	5
9	81 to 90	1	2.5

Figure 2: Age wise distribution in LRTI hospitalized patients based on percentage

Average duration of stay in hospital was 4 days in LRTI patients. On day 1 of hospitalization, 28 (70%) patients had normal body temperature (normal BT 97.7 - 99.5 °F), 12 (30%) patients had hyperthermia (>99.5 °F). On day 2 of hospitalization, 34 (85%) patients had normal body temperature, 6 (15%) Patients had hyperthermia (<97.7°F). All patients achieved a normal body temperature on days 3 and 4. None of the patients had hypothermia on hospitalized

days and hyperthermia was not observed on days 3 and 4 (Table 3 & Figure 3).

Figure 3: Distribution based on change in body temperature in LRTI hospitalized patients in percentage

On day 1 of hospitalization, 37 (92.5%) patients had a normal pulse rate (PR) 60-100 bpm, 3 (7.5%) Patients had tachycardia (>100 bpm). On day 2 of hospitalization, 39 (97.5%) patients had a normal PR, 1 (1.75%) Patient had tachycardia. On third and fourth day of hospitalization, 40 (100%) patients had a normal PR and none of them had bradycardia (<60 bpm) on hospitalized days. Tachycardia was also nil on days 3 and 4 (Table 4 & Figure 4).

Figure 4: Distribution based on change in pulse rate in LRTI hospitalized patients in percentage

On day 1 of hospitalization, 37 (92.5%) patients had normal respiratory rate (RR 12-20 cpm) and 3 (7.5%) patients had tachypnea. On day 2 of hospitalization, 27 (67.5 %) patients had normal RR and 13 (32.5%) patients had tachypnea (> 20 cpm). On day 3 of hospitalization, 36 (90%) patients had normal RR and 4 (10%) patients had tachypnea. On day 4 of hospitalization, 39 (97.5%) patients had normal RR and 1(2.5%) patient had tachypnea. None of the patients had Bradypnea (< 12 cpm) in hospitalized days (Table 5 & Figure 5).

In systemic examination, especially in cardiovascular system examination, 29 (72.5%) patients had S₁S₂ positive, S₁ is Lub (First heart sound) and S₂ is Dub (Second heart sound). Unclear observation was in 11 (27.5%) patients. In respiratory system examination,

Table 3: Distribution based on change in body temperature in LRTI hospitalized patients

Patients having change in respiratory rate on		Day 1		Day 2		Day 3		Day 4	
Sl.no	Range	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)
1	Normal (97.7°F- 99.5 °F)	28	70	34	85	40	100	40	100
2	Hypothermia (< 97.7°F)	0	0	0	0	0	0	0	0
3	Hyperthermia (>99.5 °F)	12	30	6	15	0	0	0	0

Table 4: Distribution based on change in pulse rate in LRTI hospitalized patients

Patients having change in respiratory rate on		Day 1		Day 2		Day 3		Day 4	
Sl.no	Range	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)
1	Normal (60-100 Bpm)	37	92.5	39	97.5	40	100	40	100
2	Bradycardia (< 60 Bpm)	0	0	0	0	0	0	0	0
3	Tachycardia (>100 Bpm)	3	7.5	1	2.5	0	0	0	0

Table 5: Distribution based on change in respiratory rate in LRTI hospitalized patients

Patients having change in respiratory rate on		Day 1		Day 2		Day 3		Day 4	
Sl.no	Range	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)
1	Normal (12-20 Cpm)	37	92.5	27	67.5	36	90	39	97.5
2	Bradypnea (< 12 Cpm)	0	0	0	0	0	0	0	0
3	Tachypnea(> 20 Cpm)	3	7.5	13	32.5	4	10	1	10

Table 6: Systemic examination of Cardiovascular, respiratory, and central nervous system in LRTI hospitalized patients

Sl.no	System	S1S2+		Bilateral creps		NAD		NVBS		WNL		Unclear observation	
		In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)	In number	In percentage (%)
1	Cardio-vascular system	29	72.5	nil	nil	nil	nil	nil	nil	nil	nil	11	27.5
2	Respiratory system	nil	nil	5	12.5	6	15	11	27.5	nil	nil	18	45
3	Central Nervous system	nil	nil	nil	nil	3	7.5	nil	nil	9	22.5	28	70

Figure 5: Distribution based on change in respiratory rate in LRTI hospitalized patients in percentage

5 (12.5%) patients had bilateral crepts. No abnormalities detected (NAD) in 6 (15%) patients and non-vesicular breath sound (NVBS) was in 11 (27.5%) patients and unclear observation was among 18 (45%) patients. In central nervous system, 3 (7.5%) patients had NAD, 9 (22.5%) patients were within normal limits (WNL) and 28 (70%) patients had unclear observation (Table 6 & Figure 6). 20 (50%) patients had soft abdomen and 20 (50%) patients had unclear observation in abdomen examination. Congested throat was present in 5 (12.5%) patients and it was absent in 35 (87.5%) patients (Table 7 & Figure 7).

Figure 6: Systemic examination of Cardiovascular, respiratory, and central nervous system in LRTI hospitalized patients based on percentage

Figure 7: Systemic examinations like presence of soft abdomen and congested throat in LRTI hospitalized patients based on percentage

29 (72.5%) patients had normal RBS levels (80-160 mg/dl), 1 (1.75%) patient had low RBS levels and 10 (25%) patients had high RBS (>160 mg/dl) levels. 30 (75%) patients had normal range of PPBS (70-140

mg/dl) and FBS (70-110 mg/dl), 10 (25%) patients had high PPBS (>140 mg/dl) and RBS levels (>160 mg/dl). None of the patients had low sugar levels of PPBS & FBS in the blood (Table 8 & Figure 8).

Figure 8: Blood sugar levels in LRTI hospitalized patients based on percentage

18 (45%) patients had normal range (5,000 - 10,000 cells/cumm), 3 (7.5%) patients had low and 9 (22.5%) patients had high WBCs (>10,000 cells/cumm). In males, 22 (91.66%) patients had normal levels, 2 (8.33%) patients had low haemoglobin levels. In females, 14 (87.5%) patients had normal levels, 2 (12.5%) patients had high haemoglobin levels. 38 (95%) patients had normal (1.5 - 4.0 Lakhs/cumm) and 2 (5%) patients had high platelet count (>4.0 Lakhs/cumm). 23 (57.5%) patients had normal level (50 - 75%), 6 (15%) patients had low and 11 (27.5%) patients had high neutrophils (>75%). 17 (42.5%) patients had normal level (25 - 40%), 9 (22.5%) patients had low and 14 (35%) patients had high Lymphocytes (>40%). 37 (92.5%) patients had normal range (1 - 6%) and 3 (7.5%) patients high Eosinophils (>6%). 39 (97.5%) patients had normal range (2 - 10%) and 1 (2.5%) patient had high monocytes (>10%). All the study population had high ESR. Most of the patients had normal range of parameters like monocytes, platelets, and haemoglobin besides they also had low count of neutrophils and lymphocytes. High levels of ESR is present in all patients (Table 9 & Figure 9).

Figure 9: Haematology reports in LRTI hospitalized patients based on percentage

13 (32.5%) patients had lower respiratory tract infection (LRTI). 6 (15%) patients had LRTI with diabetes mellitus. 4 (10%) patients had LRTI with diabetes mellitus and hypertension. 3 (7.5%) patients had

Table 7: Systemic examinations like presence of soft abdomen and congested throat in LRTI hospitalized patients

Sl.no	Parameters	Present		Absent		Unclear observation	
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
1	Soft abdomen	20	50	nil	nil	20	50
2	Congested throat	5	12.5	35	87.5	nil	nil

Table 8: Blood sugar levels in LRTI hospitalized patients

Sl.no	Parameters	Normal range		Low		High	
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
1	RBS	29	72.5	1	2.5	10	25
2	PPBS	30	75	0	0	10	25
3	FBS	30	75	0	0	10	25

Table 9: Haematology reports in LRTI hospitalized patients

Sl.no	Parameters	Normal range		Less than normal range		More than normal range	
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
1	WBC	18	45	3	7.5	9	22.5
2	Hb in males	22	91.66	2	8.33	0	0
3	Hb in females	14	87.5	2	12.5	0	0
4	Platelet count	38	95	0	0	2	5
5	Neutrophils	23	57.5	6	15	11	27.5
6	Lymphocytes	17	42.5	9	22.5	14	35
7	Eosinophils	37	92.5	0	0	3	7.5
8	Monocytes	39	97.5	0	0	1	2.5
9	ESR in males	0	0	0	0	24	100
10	ESR in females	0	0	0	0	16	100

Table 10: Complications associated with LRTI

Sl.no	Disease condition	Number of patients	Percentage of patients (%)
1	Lower respiratory tract infection	13	32.5
2	Lower respiratory tract infection with diabetes mellitus	6	15
3	Lower respiratory tract infection with diabetes mellitus and hypertension	4	10
4	Lower respiratory tract infection with hypertension	3	7.5
5	Lower respiratory tract infection with bronchial asthma	3	7.5
6	Lower respiratory tract infection with chronic obstructive pulmonary disorder	9	22.5
7	Lower respiratory tract infection with viral fever	2	5

Table 11: Drugs used in LRTI hospitalized patients

Sl.no	Drugs	Number of patients	Percentage of patients %
1	IV Fluids	40	100
2	Deriphylline	37	92.5
3	Monocef	31	77.5
4	Pantodac	17	42.5
5	Duolin	40	100
6	Budecort	40	100
7	Augmentin	40	100
8	Montek LC	37	92.5
9	Cough syrup	40	100
10	Humalog	10	25
11	Metformin	10	25
12	Lasix	7	17.5
13	Dytor	7	17.5
14	Methyl prednisalone	3	7.5
15	Polytaz	9	22.5
16	paracetamol	28	70

LRTI with hypertension and LRTI with bronchial asthma. 9 (22.5%) patients had LRTI with Chronic obstructive pulmonary disorder. 2 (5%) patients had LRTI with viral fever. Most of the infected cases have LRTI infections only i.e. in 13 (32.5%) patients and least infected cases have LRTI with viral fever i.e. in 2 (5%) patients (Table 10 & Figure 10).

Figure 10: Complications associated with LRTI hospitalized patients based on Percentage

Figure 11: Drugs used in LRTI hospitalized patients based on percentage

The drugs used in the therapy of LRTI hospitalized patients are 40 (100%) patients received IV fluids, Duolin, Budecort, Augmentin, Cough syrup and Deriphylline. 37 (92.5%) patients received Deriphylline and Montek LC. 31 (77.5%) patients received Monocel, 17 (42.5%) patients received Pantoprazole, 10 (25%) patients received Humalog and metformin, 7 (17.5%) patients received Lasix and dytor, 3 (7.5%) patients received Methyl prednisalone, 9 (22.5%) patients received Polytaz and 28 (70%) patients received paracetamol (Table 11 & Figure 11).

Table 12: Drug interactions

Sl.no	Interacting drugs	Number of patients	Percentage of patients (%)
1	Pantoprazole + Deriphylline	14	35
2	Torsemide + metformin	4	10
3	Methyl prednisalone + Deriphylline	3	7.5

Pantoprazole + Deriphylline had drug interactions among 14 (35%) patients. Torsemide + Metformin

had drug interactions among 4 (10%) patients. Methyl prednisalone + Deriphylline had drug interactions among 3 (7.5%) patients (Table 12 & Figure 12).

Figure 12: Drug interactions in LRTI hospitalized patients

DISCUSSION

Lower respiratory tract infections (LRTIs) are the commonest health problem demanding frequent consultation and hospitalization and are more prevalent in males than females. The reasons behind high risk in males of LRTI is attributable to tobacco, smoking, alcohol consumption etc. producing decreased local immunity in the respiratory tract due to defective mucociliary clearance, mucous plugging, airway collapse, respiratory muscle fatigue and the consequence of medication used [5]. Females enrolled in the study comprised largely of housewives, who being less mobile experienced, less exposure to respiratory risk factors. Almost patients admitted with the reason of fever, cough, tiredness, weakness, breathlessness, body ache, difficulty in breathing in our study. The main symptoms were cough, snuffle, fever, chilly, chest distress and pain and elevation of blood sugar levels in diabetic patients. Similar symptoms were found in a study conducted by Shah BA et al [6].

Almost 33 (82.5%) patients had normal blood pressure and 7 (17.5%) patients had high blood pressure. This indicates 17.5% of study population had hypertension and vitals will vary on the basis of other disease conditions. In systemic examination of patients, positive S₁S₂ was seen among 29 (72.5%) patients, bilateral crepts and congested throat was observed among 5 (12.5%) patients and was less common. Soft abdomen was noted among 20 (50%) patients. Bilateral crepts are due to inflammation of the bronchial tubes, pulmonary edema etc. 9 (22.5%) patients had hypoxia.

ESR had higher diagnostic odds ratios than any of the symptoms and signs. Leukocyte count was remarkable in patients hospitalized for COPD exacerbations with purulent sputum. [7] Patients with diabetes mellitus (DM) are likely to develop many types of infections, which affect the transport of glucose into tissues. Diabetes increases the susceptibility to different kinds of respiratory infections and is often identified as an independent risk factor for developing lower respiratory tract infections. [8]

Antibiotic prescribing rates were high in acute bronchitis.^[9] Antimicrobial therapy is a principal management component for these diseases. Montelukast is a potent, specific, oral cysteinyl leukotriene 1 (cysLT1) receptor antagonist which improves bronchial asthma symptoms and reduces inhaled corticosteroids requirement and provides overview of evidence for the use of montelukast in patients with bronchial asthma and exercise induced asthma sleep disorder, respiratory syncytial virus (RSV), bronchiolitis and cystic fibrosis.^[10] Mortality rate was nil in our study.

Antibiotic resistance is a major public-health problem, in particular since resistance of microorganisms increases with the consumption of antibiotics.^[11, 12] The majority of antibiotics are prescribed in primary care, mainly for the treatment of acute respiratory tract infections.^[13] Oxygen supplementation is often recommended for people with severe lower respiratory tract infections.^[14,15] Oxygen can be provided in a non-invasive manner using nasal prongs, face masks, a head box or hood, a nasal catheter, or a nasopharyngeal catheter. For children younger than 15 years old, nasopharyngeal catheters or nasal prongs are recommended over a face mask or head box. A Cochrane review in 2014 presented a summary to identify children complaining of severe LRTI. However, further research is required to determine the effectiveness of supplemental oxygen and the best delivery method.

Here we intervened to address medication related problems when necessary. A suitable intervention form was designed for clinical pharmacist intervention. After completion of medication therapy review (MTR), personal medication record (PMR) and medication action plan (MAP), the problems related to drugs are noted by clinical pharmacist. We provided a response to a drug related problem. We performed intervention to improve the safety and efficacy of medications in collaboration with the physicians. We also provided counseling to the patients for their disease conditions. We informed them regarding drug interactions and their effect on patients with LRTI diseases. In some patients with multiple complications requiring referral to another physician or pharmacist for disease management. we educated them about how to manage chronic diseases like diabetes and hypertension.

We provided MTM services to all the study population throughout the 6 months period and identified drug-related problems and relayed the recommendations to their physician and physicians accepted our recommendations. Patients reported feeling better about their medications after receiving MTM services. Process measures (type and frequency of drug therapy problems detected, and services performed), economic measures (number of medications dispensed), and humanistic measures (patient satisfaction with services) were the main outcomes in this process. We provided the educational services like

medication use, disease management, adherence, and self-care. Nearly all patients received some form of medication adherence or disease education associated with problem detection and resolution. MTM may reduce outpatient visits to address side effects. This process is broadly applicable to a range of chronically ill adult patient populations. A majority of interventions were directed at populations with multiple and chronic conditions such as diabetes and hypertension. Specifically, we found evidence that MTM results in improvement when compared with usual care for some measures of medication adherence.

CONCLUSION

LRTI varies according to serotype, age, socioeconomic status, and environmental factors. Classical cases have clinical symptoms of fever, cough, tiredness, weakness, breathlessness, body aches, and difficulty in breathing. Antimicrobial therapy is a principal management component for these diseases. It is often difficult to diagnose and differentiate atypical infections from these infections. Clinical findings and radiological imaging may help to identify and treat atypical infections. Prescribing the appropriate antibiotic is important to obtain the optimal patient response. When more than one drug has been suggested, preference should be given to the drug with the fewest adverse effects and lowest cost, and particularly the one patient is likely to take.

MTM services provide an opportunity for clinical pharmacists to develop direct patient care services, patient care activities including patient counseling, disease management, and all currently provided pharmacy services. In addition to Medicare-eligible patients, MTM services are appropriate for anyone with medication-related needs. MTM is offered as an all-encompassing model that incorporates the philosophy of pharmaceutical care, techniques of patient counseling, and disease management in an environment that facilitates the direct collaboration of patients, pharmacists, and other health professionals. Clinical pharmacists are strategically positioned to provide MTM services and effectively communicate with providers to improve quality of care for patients. Thus, MTM has been helping countless number of patients to better understand their health conditions and the medications used to manage them. MTM has resulted in reductions in physician visits, emergency department visits, hospital days.

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CONFLICTS OF INTEREST

The author declares no conflict of interests.

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