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Impact of patient counseling on medication adherence in respiratory tract infection patients in a tertiary care teaching hospital

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Abstract

Respiratory tract infections (RTIs) significantly impact public health in India, with high morbidity and mortality rates. Effective management of RTIs relies on medication adherence (MA), which is often challenged by factors like forgetfulness, side effects, and socioeconomic barriers. This study aimed to evaluate the impact of patient counseling on MA among RTI patients and to assess the influence of demographic, socioeconomic, and clinical factors on adherence. A cross-sectional observational study was conducted at Vivekananda General Hospital Hubballi, India, from August 2023 to January 2024, involving 200 RTI patients. MA was measured using the Medication Adherence Report Scale (MARS) before and after patient counseling. Statistical analysis assessed the effect of age, gender, comorbidities, and socioeconomic status on adherence. MA significantly improved following patient counseling, with mean MARS scores increasing from 4.13±1.601 to 6.80±1.592 ($p<0.05$). Age was positively correlated with adherence, while factors like gender, infection type, and socioeconomic status had varied effects. Overall, patient counseling effectively enhanced adherence across all groups. The study underscores the importance of patient counseling in improving MA among RTI patients. Personalized interventions and addressing socioeconomic barriers are crucial for optimizing treatment outcomes.

Key words: respiratory tract infections, medication adherence, patient counseling, MARS scale, socioeconomic factors.

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Introduction

Respiratory tract infections (RTIs) are a significant public health issue worldwide, particularly in developing countries like India, where they account for a high burden of morbidity and mortality [1]. RTIs affect approximately 11.3% of the Indian population and are responsible for a lung disease mortality rate of 142.09 per 100,000 people, which is three times the global average [2]. This high mortality rate, coupled with the substantial number of disability-adjusted life years lost, underscores the urgent need for effective management of RTIs [3]. The presence of 34.3 million asthma patients in India further exacerbates the impact of RTIs, highlighting the necessity for stringent adherence to prescribed medications to achieve optimal treatment outcomes [4].

Medication adherence (MA) is crucial in managing RTIs, as it directly influences the effectiveness of the treatment regimen [5]. Non-adherence can lead to poor health outcomes, increased hospital readmissions, development of antibiotic resistance, and higher healthcare costs [6]. Common barriers to adherence include forgetfulness, lack of understanding of the treatment regimen, side effects of medications, high medication costs, and cultural beliefs [7]. Additionally, socioeconomic factors such as lower income and education levels significantly influence adherence, often leading to poorer health outcomes due to financial constraints and limited health literacy [8].

Despite the critical importance of MA, there is a lack of standardized tools specifically validated for measuring adherence in RTI patients [9]. The Medication Adherence Report Scale (MARS) is widely used to assess adherence in various conditions, but its validity for RTI patients has not been thoroughly investigated. Validating the MARS scale for RTI patients is essential to ensure it accurately measures adherence, thereby facilitating better monitoring and enabling targeted interventions to improve adherence [10].

Furthermore, MA is influenced by many factors, including demographic, socioeconomic, and clinical characteristics. Understanding the interplay of these factors in RTI patients is key to designing effective, personalized interventions [11]. Variables such as gender, age, income status, education level, length of hospitalization, type of RTI, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and place of residence are all potential determinants of adherence. By exploring these factors, healthcare providers can develop strategies tailored to the specific needs of RTI patients, ultimately improving adherence rates and patient outcomes [12].

This study aims to assess the impact of patient counseling on

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the MA of patients suffering from RTI. The findings will provide valuable insights into the barriers affecting adherence and emphasize the development of personalized interventions, enhancing patient outcomes and optimizing healthcare resources. By addressing the critical issue of MA in RTI patients, this study seeks to contribute to more effective management of RTIs and improve public health outcomes.

Materials and Methods

Study design

A cross-sectional study was conducted from August 2023 to January 2024. A pilot study determined the sample size, after which 200 RTI-diagnosed patients admitted to the pulmonology department at Vivekananda General Hospital, Hubballi, India, were included in the research.

Sample size

In our study, a sample size of 200 participants was determined through a precise calculation, ensuring sufficient power to detect meaningful effects while minimizing errors. This approach optimizes the reliability and validity of the study's findings.

Ethical considerations

The study's purpose was conveyed to the patients and their families. The patients provided written informed consent. The KLE College of Pharmacy Ethical Committee gave its approval to the study. (IEC Reference Number: KLECOPH/IEC/2023-24/08)

Study population

Inclusion criteria: patients of either gender above 18 years of age, diagnosed with respiratory disease, and admitted to the inpatient pulmonology department.

Exclusion criteria: patients below 18 years of age, those attending the outpatient department, patients who were not conscious and oriented, patients who did not consent to participate in the study, and pregnant and lactating women were excluded.

Sample size calculation

The sample size of 200 patients for this study was determined using the following formula [Eq. 1], based on a pilot study:

$$n = \frac{[Z_{1-\alpha/2}]^2 p(1-p)}{d^2} \quad \text{[Eq. 1]}$$

Where n is the required sample size, Z is the critical value, p is the proportionality, d is the precision, and α is the confidence level.

Patient counseling

During counseling, we educated patients on medication use, side effects, and the importance of following prescriptions. We explained respiratory infections, their causes, and their risks. Emphasis was on proper antibiotic timing and dosage for effectiveness. Patients were advised on follow-ups, care routines, and educational resources to prevent resistance and promote better health management.

Data collection

The MARS was used to assess MA in RTIs patients. Patients were given verbal counseling on usage and adherence, and a follow-up evaluation was conducted 1 month later to evaluate any improvements.

Medication Adherence Report Scale

The MARS-5 is a self-reported tool designed to assess patient adherence to prescribed medications. It consists of 10 questions, with a total score ranging from 0 to 10. A score below 6 indicates poor adherence, while scores above 6 suggest better adherence. In our study, pre- and post-counseling. Pre-and post-counseling MARS-5 data were collected to evaluate the impact of patient counseling on patients' adherence to prescribed treatments.

Statistical analysis

The study used SPSS (IBM, Armonk, NY, USA) for statistical analysis, presenting continuous and categorical variables. The association between clinical variables and MA was assessed using t-tests and Pearson's correlation, with a p-value of less than 0.05 indicating significant relationships.

Results

Demographics of respiratory tract infection patients

Table 1 summarizes the clinical characteristics of the research patients. Of the 200 patients in the inpatient pulmonology department, 141 (70.50%) were male and 59 (29.50%) were female, suggesting a higher incidence of RTIs among males. The largest group of patients was from the 55-69 years age range, comprising 70 (35%) of the sample, followed by 25-39 years (42 patients, 21%), 40-54 years (41 patients, 20.50%), 70-84 years (26 patients, 13%), 18-24 years (17 patients, 8.50%), and 85-99 years (4 patients, 2%).

Geographically, 124 (62%) patients were from rural areas, while 76 (38%) were from urban areas. Participants had a diverse range of educational qualifications, a small percentage held bachelor's degrees, including arts (3.00%), science (2.00%), commerce (3.00%), and engineering (1.50%). A few had diplomas in engineering (1.00%) and nursing (0.50%). Additionally, 6.00% completed science, 3.50% commerce, and 2.00% arts at the intermediate level. A significant portion, 26.50%, had only schooling, while 40.50% were uneducated. This diversity reflects different socioeconomic backgrounds, which may influence healthcare access and outcomes.

Regarding occupation, farming was the most common job, with 54 (27%) participants engaged in this work. Other common occupations included construction labor (20 patients, 10%), industry workers (22 patients, 11%), and housewives (19 patients, 9.50%). The comorbidities observed in the study included hypertension in 52 participants (26.00%), type 2 diabetes mellitus in 13 (6.50%), and anemia in 8 (4.00%). Ischemic heart disease was present in 5 participants (2.50%), while 4 (2.00%) had alcohol use disorder. Chronic kidney disease was reported in 6 participants (3.00%). A significant portion, 80 participants (40.00%), had no comorbidities, and 26 participants (13.00%) had other unspecified comorbidities.

A significant portion, 175 (87.50%) patients, belonged to the low-income category. Finally, inflammatory biomarkers such as CRP and ESR showed increased levels, which is common in respiratory conditions, suggesting that RTIs in this population are primarily driven by inflammation.

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Table 1. Clinical characteristics of respiratory tract infection patients.

Categories	Number of subjects, n (%)
Gender	
Male	141 (70.50)
Female	59 (29.50)
Age in years	
18-24	17 (8.50)
25-39	42 (21)
40-54	41 (20.50)
55-69	70 (35)
70-84	26 (13)
85-99	4 (2)
Residence	
Urban	76 (38)
Rural	124 (62)
Qualification	
Bachelor of arts	8 (3.00)
Bachelor of science	5 (2.00)
Bachelor of commerce	7 (3.00)
Engineering degree	3 (1.50)
Diploma	
Diploma in engineering	2 (1.00)
Diploma in nursing	1 (0.50)
Diploma in pharmacy	0 (0.00)
Other diplomas	0 (0.00)
Twelfth grade	
Science (intermediate)	12 (6.00)
Commerce (intermediate)	7 (3.50)
Arts (intermediate)	4 (2.00)
Other intermediate courses	0 (0.00)
Schooling	53 (26.50)
Uneducated	82 (40.50)
Occupation	
Farmer	54 (27)
Construction labor	20 (10)
Industry worker	22 (11)
Housewife	19 (9.50)
Other occupations	85 (42)
Comorbidities	
Hypertension	52 (26.00)
Type 2 diabetes mellitus	13 (6.50)
Anemia	8 (4.00)
Ischemic heart disease	5 (2.50)
Alcohol use disorder	4 (2.00)
Chronic kidney disease	6 (3.00)
No comorbidities	80 (40.00)
Others	26 (13.00)
Income	
Above poverty line	25 (12.50)
Below poverty line	125 (87.50)
Employment Status	
Poorly employed	129 (64.50)
Unemployed	37 (18.50)
Well employed	34 (17)
Social habits	
Smokers	58 (29)
Non-smokers	142 (71)
Alcoholic	56 (28)
Non-alcoholic	144 (72)
C-reactive protein	
Normal range (<10 Mg/L)	20 (10)
Mild range (10-40 Mg/L)	133 (66.50)
Moderate range (40-100 Mg/L)	24 (12)
Severe range (>100 Mg/L)	23 (11.50)
Normal range (>10 Mm/Hr)	5 (2.50)
Erythrocyte sedimentation rate	
Mild range (10-40 Mm/Hr)	77 (38.50)
Moderate range (40-70 Mm/Hr)	55 (27.50)
High range (>70 Mm/Hr)	63 (31.50)
Diagnosis	
Lower respiratory tract infection	181 (90.50)
Upper respiratory tract infection	19 (9.50)

Impact of patient counseling on medication adherence

The MA scores were measured for all 200 patients. The patients were verbally counseled on the importance of maintaining MA. A month later, the MA of these patients was reassessed. Table 2 shows the MA scores both before and after patient counseling. We noted a significant increase in MA following the counseling session. Specifically, the MA improved from 4.13±1.601 to 6.80±1.592 post-counseling, with $p<0.05$ for both pre-and post-intervention measurements. This demonstrates that patient counseling had a statistically significant positive effect on MA among the individuals investigated. MA scores were significantly improved following the intervention, underscoring the efficacy of patient counseling in promoting better adherence to prescribed treatment regimens.

Impact of various factors on medication adherence

The data from Table 3 demonstrate the influence of various demographic and clinical factors on MA scores before and after counseling. Significant improvements were observed across all age groups, indicating that counseling had a positive effect on MA. Specifically, participants in all age ranges (18-24 years, 25-39 years, 40-54 years, 55-69 years, and 70-84 years) showed substantial increases in their mean MA scores, with p-values less than 0.05, confirming that these changes were statistically significant. This suggests that age played an important role in the response to counseling, with older participants showing notable improvements in adherence.

In terms of gender, both males and females showed improvements in MA scores after counseling, but the changes were not statistically significant, as the p-values for both pre-and post-counseling scores were above 0.05. Similarly, the type of infection [lower RTIs (LRTI) *vs*. upper RTIs (URTI)] did not significantly impact the results, as both groups exhibited improvements but without statistical significance.

Regarding comorbidities, both individuals with and without comorbidities showed improvements in their MA scores, but again, these changes were not statistically significant, suggesting that the presence of comorbid conditions did not significantly alter the effect of counseling on adherence. The economic status of participants (below the poverty line *vs*. above the poverty line) also did not significantly affect the post-counseling improvements, indicating that counseling was equally effective across different socioeconomic statuses.

Educational qualifications showed a mixed result: educated individuals did not demonstrate statistically significant improvements in MA scores, while uneducated individuals had a significant increase in their scores post-counseling ($p<0.05$). This suggests that uneducated individuals might benefit more from counseling, possibly due to a greater need for education on the importance of MA.

The residence status (urban *vs*. rural) and length of hospitalization (less than 5 days *vs*. more than 5 days) did not significantly influence the results, with no significant differences in MA scores across these groups. This implies that the positive effects of counseling on MA were consistent regardless of where participants lived or how long they were hospitalized.

In conclusion, the analysis highlights that while counseling led to significant improvements in MA across most variables, the most notable factors influencing these improvements were age and education. Other factors, such as gender, infection type, comorbidities, economic status, and residence, did not show a strong association with the effectiveness of counseling on MA.

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Table 2. Impact of patient counseling on medication adherence.

Medication adherence	Mean ± standard deviation	p
Pre-counseling	4.13±1.601	0.05*
Post-counseling	6.80±1.592	

*Statistically significant p<0.05.

Table 3. Influence of multiple factors on medication adherence.

Variables	Mean ± standard deviation	p
Age		
18-24 years		
Pre-counseling	4.24±1.348	0.05*
Post-counseling	7.29±1.649	0.05*
25-39 years		
Pre-counseling	4.36±1.722	0.05*
Post-counseling	7.17±1.208	0.05*
40-54 years		
Pre-counseling	4.20±1.600	0.05*
Post-counseling	6.37±1.529	0.05*
55-69 years		
Pre-counseling	3.91±1.576	0.05*
Post-counseling	6.46±1.674	0.05*
70-84 years		
Pre-counseling	4.31±1.644	0.05*
Post-counseling	7.50±1.606	0.05*
Gender		
Male		
Pre-counseling	4.23±1.611	0.137
Post-counseling	6.89±1.529	0.133
Female		
Pre-counseling	3.86±1.559	0.176
Post-counseling	6.56±1.725	0.200
Type of infection		
Lower respiratory tract infection		
Pre-counseling	4.07± 1.615	0.134
Post-counseling	6.74± 1.603	0.110
Upper respiratory tract infection		
Pre-counseling	4.68±1.376	0.110
Post-counseling	7.32±1.416	0.080
Comorbidities		
Present		
Pre-counseling	4.10±1.725	0.745
Post-counseling	6.78±1.705	0.856
Absent		
Pre-counseling	4.18±1.338	0.725
Post-counseling	6.82±1.360	0.846
Economic status		
Below the poverty line		
Pre-counseling	4.15±1.637	0.527
Post-counseling	6.82±1.611	0.489
Above the poverty line		
Pre-counseling	3.96±1.338	0.583
Post-counseling	6.60±1.472	0.514
Qualification		
Educated		
Pre-counseling	4.18±1.588	0.529
Post-counseling	6.98±1.574	0.531
Uneducated		
Pre-counseling	4.04±1.626	0.05*
Post-counseling	6.53±1.591	0.05*
Residence		
Urban		
Pre-counseling	4.09±1.489	0.821
Post-counseling	6.79±1.445	0.969
Rural		
Pre-counseling	4.15±1.671	0.816
Post-counseling	6.80±1.682	0.968
Days of hospitalization		
Less than 5 days		
Pre-counseling	4.21±1.767	0.609
Post-counseling	6.79±1.671	0.996
More than 5 days		
Pre-counseling	4.08±1.514	0.627
Post-counseling	6.80±1.557	0.996

*Statistically significant (p<0.05).

Discussion

Our study analyzed 200 patients from the inpatient pulmonology department of Vivekananda General Hospital, Hubballi, focusing on the critical role of patient counseling in improving MA among patients with RTIs. Patient counseling, an essential intervention, significantly enhanced adherence rates, with the mean MA score increasing from 4.13±1.601 before counseling to 6.80±1.592 after counseling (p=0.05). The counseling sessions provided detailed discussions about patients' conditions, medication importance, correct usage, and strategies to overcome adherence barriers. This approach helped patients understand their treatment plans better and fostered a sense of responsibility and empowerment in managing their health. The findings align with existing literature, such as studies by Cutler and Everett (2010) and Conn *et al.* (2016), which emphasize the positive impact of patient counseling on MA [13,14]. Additionally, Venkatesan *et al.* (2014) highlighted the effectiveness of structured counseling in improving adherence among chronic disease patients [15]. Our study demonstrates that incor-

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porating structured patient counseling into routine clinical practice is crucial for enhancing MA, ensuring optimal treatment outcomes, reducing complications, and improving the overall quality of life for patients.

It also revealed a higher incidence of RTIs among males compared to females. The age group with the highest occurrence was 55-69 years, aligning with findings by Antje Hader *et al*. which identified individuals aged 55 and above as being at higher risk of severe respiratory infections due to age-related changes [16,17]. Patients from rural areas (124 or 62%) outnumbered those from urban areas (76 or 38%), which is consistent with a study by Hassanat *et al.*, who reported that rural children are more affected by acute respiratory infections compared to urban children [18]. The majority of patients were uneducated, which could contribute to their poor quality of life. This finding is supported by Eagan *et al*., who concluded that higher education levels help individuals prevent infections [19]. Most participants worked in farming, exposing them to mold spores, pesticide vapors, and dusty conditions. Sigsgaard *et al*. reported that agricultural professions, as well as construction, mining, glass/ceramic/mineral work, fur/leather work, and metal work, are associated with an increased risk of respiratory infections [20].

A significant portion of patients (120 or 60%) had comorbid conditions, which substantially increased the risk, severity, and mortality associated with RTIs in adults. This is similar to the results of a study by Ejaz *et al*. [21]. Additionally, 175 patients (87.5%) had lower annual incomes, and comparable findings by Adam *et al*. indicated that lower income is associated with higher respiratory symptoms [22]. The financial burden of medical bills is significant as most patients were unemployed or poorly employed (166 or 83%) [23]. Furthermore, 181 patients (90.5%) were diagnosed with LRTIs, corroborating the findings of Lieberman *et al.*, who also reported a higher incidence of LRTIs compared to URTIs [24].

We found that patient counseling and informative sessions helped participants to be more adherent to their medications. The p-value was <0.05 which signifies that there is a significant difference between the two groups. Another study by Su *et al.* reveals that patient counseling and education significantly improve MA, emphasizing the role of clinical pharmacists in optimizing medication use and improving health outcomes, particularly in patients with RTIs and chronic conditions [25].

We found that age had a statistically significant impact on MARS scores ($p<0.05$), in the age group of 55-69 years and 85-99 years were less adherent to medications. On patient counseling, mean scores in all age groups were significantly increased. A comparative study by Yin *et al.* stated that motivational interviewing dramatically raised the mean MARS score, indicating improved drug adherence after counseling in patients with COPD and asthma; also, a study by Wang *et al.* reported similar results where age affects MA of patients due to structural and physiological changes with age [26,27].

There was no statistically significant correlation found between MARS score and various clinical characteristics of patients like gender, diagnosis, comorbidities, income, education, residency, and days of hospitalization. Pre-counseling females (3.86±1.559) were less adherent than males (4.23±1.611); post-counseling, both genders were adherent to their medications (6.89±1.725). Mahmoodi *et al*. revealed that because of the complexity of treatments, increased side effects, and gender variations in health-seeking behaviors, women routinely take longer to adhere to prescriptions for chronic diseases [28]. Patients with no comorbid conditions (4.18±1.338) were more adherent to medications than those who had existing comorbid conditions (4.10±1.725). An absolute study by Franssen *et al.* stated that patients with comorbid conditions were less adherent to medications [29].

Educated patients were more adherent (4.18±1.588) than uneducated patients with respiratory disease (4.04±1.626); Homętowska *et al.* stated similar findings [30]. When income was compared with MARS scores patients above the poverty line were not adherent to medications but below the poverty line patients were adherent. Ali *et al.* stated that income significantly affects MA in patients [31]. Our results state that above the poverty line, patients sometimes struggle with medication costs, forgetfulness, poor communication, and practical barriers that can hinder adherence.

When residence was considered, patients at rural residency (4.15±1.671) were more adherent to medications than urban residence patients (4.09±1.489). An opposite study by Yuri Sasaki *et al.* found that the risk of poor adherence was higher in rural areas compared to urban areas [32]. Later, we considered diagnosis: patients with URTI (4.68±1.376) were adherent to their medications as compared to LRTI patients (4.07±1.615). Post-counseling, patient's average adherence mean was (7.32±1.416). A comparative study by Khan *et al.* stated similar results, where patients with URTIs exhibit greater treatment adherence because of things like knowing what their illness is, communicating clearly, receiving educational interventions, and the psychological effects of their symptoms [33].

Days of hospitalization were categorized into two groups: patients admitted for less than 6 days and patients admitted for more than 6 days. Patients admitted for less than 6 days (4.21±1.767) were more adherent than patients admitted for more than 6 days (4.08±1.514). Our study concludes that shorter hospitalizations are associated with higher adherence scores. Dong *et al.* stated that non-adherence to medication leads to the increased severity of existing disease conditions [34].

Conclusions

Our study found that patient counseling significantly improved MA among RTI patients in a tertiary care teaching hospital setting. By educating patients on the importance of their medications, addressing individual concerns, and providing personalized strategies to overcome barriers, we observed enhanced patient understanding, better adherence, and improved health outcomes. We evaluated several factors, including age, gender, occupation, income, employment status, length of hospital stays, comorbidities, and residence. Our findings underscore the value of incorporating tools like MARS in clinical practice and highlight the critical role of patient counseling in promoting MA. Additionally, our study emphasizes the need for personalized interventions, addressing socioeconomic barriers, and tailoring care to individual patient needs to optimize RTI management.

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Informed consent: the patients provided written informed consent.

Patient consent for publication: written informed consent was obtained from patients after clearly explaining the objectives of the study and the intention to publish the clinical findings. The patient was assured that participation was entirely voluntary, and that all personal information would remain confidential in accordance with ethical publishing standards.

Availability of data and materials: data and materials are available from the corresponding author upon request.

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