

BASELINE ADHERENCE SEVERITY, BEHAVIORAL DOMAINS, DISC ASSESSMENT, AND PREDICTORS OF RESPONSE TO PATIENT COUNSELLING IN DIABETES MELLITUS, HYPERTENSION, AND TUBERCULOSIS: A PROSPECTIVE INTERVENTIONAL STUDY

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ABSTRACT

Background: Medication adherence is an evolving behavior influenced by information, habit, symptom interpretation, health convictions, communication style, and behavioral tendencies. Although counselling has been shown to improve adherence in chronic disease, relatively little is understood about which adherence domains are most responsive, which groups of patients benefit most, whether response varies by baseline adherence severity, and how behavioral profiling tools such as DISC assessment may support patient-specific counselling. The present study assessed changes in adherence domains in patients with diabetes mellitus (DM), hypertension (HTN), and tuberculosis (TB), with baseline behavioral profiling using DISC assessment.

Methods: This study was a prospective interventional study of 387 adult patients undergoing long-term treatment for DM (n=161), HTN (n=153), or TB (n=73). Baseline measures included a socioeconomic classification (Kuppuswamy scale) and a behavioral profiling (DISC assessment). DISC assessment was performed to characterize broad behavioral tendencies that may influence communication preference, medication-taking behavior, receptivity to counselling, and self-management practices. A six-item study-specific Morisky-derived adherence composite comprising information on forgetfulness, carelessness, symptom-driven discontinuation, knowledge of long-term treatment benefit, and refill discipline was used to assess adherence. Following the baseline evaluation, structured patient counselling was provided. Follow-up adherence was reassessed on day 60 (± 10 days). Non-parametric paired and between-group analyses were conducted; multivariable linear regression was used to identify independent predictors of adherence change.

Results: Overall adherence went from 2.33 ± 1.59 at baseline to 4.75 ± 1.28 at follow-up (Wilcoxon $p < 0.0001$; effect size $r = 0.707$). Knowledge of long-term treatment benefit had the highest absolute item-level gain (+49.1 percentage points), followed by carelessness (+43.9 points), forgetfulness (+41.6 points), and timely refill behavior (+39.0 points). Poor baseline adherence significantly improved the mean score by a value of 3.94 ± 1.29 compared to moderate adherence of 1.05 ± 1.37 ; while good baseline adherence showed a ceiling effect (-1.83 ± 2.23 ; Kruskal-Wallis $H = 253.082$, $p < 0.0001$). Patients with diabetes had more absolute improvement than HTN and TB patients ($H = 93.837$; $p < 0.0001$). Baseline adherence score was the only independent change predictor maintained ($\beta = -1.237$, 95% CI -1.368 to -1.105 ; $p < 0.0001$) using adjusted analysis. DISC assessment was introduced to be an exploratory behavioural profiling tool that may be useful for interpreting counselling receptivity and possibility for counseling personalization, although DISC category was not established as an independent predictor of adherence change in the present analysis.

Conclusion: Structured patient counselling led to significant short-term benefits for medication adherence improvements, especially among low baseline adherence patients and in patients with diabetes. Counselling seemed to work via improved treatment understanding and correction of routine behavioral lapses. Baseline adherence severity may be the most clinically relevant marker in identifying adherence interventions. DISC assessment could serve as an additional behavioral framework for modifying communication and counselling style, but further DISC-stratified analysis is required to find its independent predictive value.

KEYWORDS: medication adherence; patient counselling; diabetes mellitus; hypertension; tuberculosis; Morisky scale; behavioral domains; baseline severity; DISC assessment; behavioral profiling

INTRODUCTION

Medication adherence continues to be one of the most important determinants of success in the management of chronic disease. For communicable and non-communicable diseases, the clinical utility of an individual's prescription drugs is decreased in patients not taking treatment regularly, discontinuing medicines prematurely, or failing to sustain long-term medication behavior [1,2]. Adherence is no longer viewed as a simple issue of patient compliance. Instead, it is perceived as a multidimensional construct that is affected by practical barriers, treatment beliefs, health literacy, perceived disease severity, socioeconomic conditions, behavioral tendencies, and clinician-patient communication [1-3].

The significant role of non-adherence is special in diabetes mellitus, hypertension, and tuberculosis. Inconsistent use of medicines in the setting of diabetes increases the incidence of an uncontrolled glycemic response and may contribute to both microvascular and macrovascular complications [4]. In the setting of hypertension, the disease is commonly asymptomatic, which leads individuals to perceive the treatment to be less urgent, and so to make long-term compliance fragile [5]. In tuberculosis, prolonged multidrug therapy, symptom fluctuation, stigmatization, side effects, and treatment fatigue obstruct continuity of care and could lead to relapse, treatment failure, and drug resistance [6]. Although these diseases differ clinically, all three require sustained medication use over time, making them suitable for comparative adherence research.

Medication adherence has been measured in clinical practice using several validated and semi-structured approaches. Of all self-report instruments, the Morisky adherence framework is still employed as it encompasses actionable behaviors like forgetfulness, carelessness, stopping treatment when symptoms improve, and stopping treatment when symptoms worsen [7,8]. These domains are clinically applicable as they represent barriers that can be addressed through counselling. Emerging adherence science has emphasized that effective interventions should go beyond general advice and should address behavioral, perceptual, practical, and communication-related barriers [2,9].

One of the most easily implementable adherence intervention strategies in routine care is counselling. Systematic reviews have concluded that education for the patient, motivational reinforcement, and pharmacist- or clinician-mediated counselling can improve adherence across a large range of chronic diseases, but the relative size of the effect varies by disease, the intensity of the intervention, and baseline patient characteristics [9–12]. In diabetes, education and behavioral support combined for adherence show a higher degree than education alone [10]. In hypertension, intervention for adherence tends to be more successful when it is consistently built up over time and tailored to the patient's context [11]. Education in tuberculosis is likely to be more successful in combination with supportive mechanisms, supervision, or frequent contact [12]. These findings suggest that the effect of counselling may differ not only by disease group but also by the type of adherence barrier being targeted.

Along with disease and socioeconomic factors, patient behavior and communication style may also influence how counselling is received and translated into daily medication-taking behavior. The DISC framework is a behavioral profiling model that broadly describes individuals according to four behavioral dimensions: Dominance, Influence, Steadiness, and Conscientiousness. Although DISC assessment is not a diagnostic psychological instrument, it can help describe communication tendencies, decision-making style, response to guidance, and preference for structure or reassurance. In medication adherence counselling, such profiling may help clinicians adjust the tone, emphasis, and structure of counselling. For example, some patients may respond better to direct goal-oriented counselling, while others may benefit more from routine reinforcement, supportive reassurance, or detailed explanation.

One of the most important gaps in the adherence literature is that many studies only reflect global adherence scores without investigating which behavioral domains improve most, whether all patients get the same level of benefit, whether baseline adherence severity predicts response, or whether behavioral profiling can be used to improve the effectiveness of more individualized counselling. These are important clinical questions. If counselling is most effective with patients with specific baseline risk profiles or improves some domains more than others, this may provide opportunity to improve and deploy an adherence intervention more effectively.

Thus, the current study used a prospective interventional cohort of diabetes mellitus, hypertension, and tuberculosis patients that presented us four questions: firstly, which adherence behaviors improved the most after counselling; secondly, whether the response varied according to disease group and baseline adherence severity; thirdly, which baseline variables independently predicted change in adherence; and fourthly, how DISC behavioral profiling could be utilized as an exploratory framework for understanding counselling receptivity and medication-taking behavior. This research aimed to provide a more clinically actionable understanding of counselling benefit by examining response stratification, behavioral domains, and baseline behavioral profiling rather than considering only overall pre–post change.

MATERIALS AND METHODS

Study Design

This study employed a prospective interventional design to explore the impact of structured patient counselling on medication adherence in patients receiving long-term pharmacotherapy for chronic disease. Baseline measures were performed and participants were re-assessed after counselling during a predefined follow-up visit. This paper presents an analytic framework of that same prospective dataset which takes its cues from baseline adherence severity, domain-specific behavioral change, DISC behavioral assessment, and predictors of counselling response.

Study Setting and Duration

The study was conducted in a clinical care environment among out-patients, in-patients, and ambulatory patients with diabetes mellitus, hypertension, or tuberculosis. Longitudinal data were collected across two separate study visits: baseline assessment on day 0 and follow-up assessment on day 60, with an allowable follow-up window of ± 10 days based on feasibility and patient availability.

Study Population

The study population consisted of adult patients diagnosed with diabetes mellitus, hypertension, or tuberculosis and receiving pharmacotherapy as part of routine clinical care. A total of 387 participants were included in the final analytical cohort, comprising 161 patients with diabetes mellitus, 153 with hypertension, and 73 with tuberculosis.

Sample Size and Sampling Framework

A minimum sample size of 360 participants had been planned at the design stage using a 95% confidence level and inflation for anticipated dropout. Recruitment was undertaken from a sufficiently large eligible patient population to ensure adequate representation of all three disease cohorts. The final analyzed sample exceeded the planned minimum and was considered adequate for comparative and subgroup analyses.

Eligibility Criteria

Inclusion Criteria

Participants were included if they met all of the following criteria:

1. Adults diagnosed with diabetes mellitus, hypertension, tuberculosis, or chronic disease requiring long-term pharmacotherapy.
2. Patients receiving medication treatment for more than 6 months.
3. Patients attending clinical care as out-patients, in-patients, or ambulatory patients.
4. Patients able to read, write, and speak sufficiently to complete study tools and understand counselling content.

Exclusion Criteria

Patients were excluded if they were unable to communicate adequately for questionnaire completion and counselling comprehension, were not on established long-term pharmacotherapy, or did not complete the required study assessments.

Ethical Considerations

The source thesis stated that the study was conducted after obtaining institutional ethical clearance and informed participation from eligible patients. However, the ethics committee approval number was not available in the source material used for preparation of this manuscript. Confidentiality of collected participant data was maintained during compilation and analysis.

Study Instruments and Baseline Assessment

Socioeconomic Assessment

Socioeconomic status was assessed using the Kuppuswamy scale. This instrument was used to classify participants according to established socioeconomic categories and to allow exploratory analysis of socioeconomic influences on adherence and counselling response.

Behavioral Profiling Using DISC Assessment

Behavioral tendencies were assessed at baseline using the DISC framework. DISC assessment broadly characterizes behavioral patterns according to four dimensions: Dominance, Influence, Steadiness, and Conscientiousness. In the present study, DISC assessment was used to describe interpersonal and behavioral patterns that could plausibly influence medication adherence, receptivity to counselling, communication preferences, and self-management practices.

The DISC profile was treated as an exploratory baseline behavioral variable. Its inclusion was intended to support a broader interpretation of adherence behavior beyond demographic and disease-related characteristics. Because medication adherence requires repeated decision-making, routine formation, understanding of treatment benefit, and communication with health-care providers, behavioral tendencies may influence how patients receive counselling and implement medication advice. For example, patients with stronger goal-directed tendencies may respond to outcome-focused counselling, whereas patients with routine-oriented tendencies may benefit from practical scheduling reinforcement and repeated reassurance.

In this analysis, DISC assessment was not used to make diagnostic psychological classifications. It was included as a behavioral profiling tool to help frame patient-specific counselling considerations. Where adequate category frequencies were available, DISC categories could be described across adherence severity groups and counselling response categories. However, inferential interpretation of DISC findings was limited to avoid overstatement where subgroup numbers were small or where DISC category-specific results were not available in the analyzed dataset.

Medication Adherence Assessment

Medication adherence was measured using a six-item study-specific adherence composite derived from Morisky-based adherence domains. The instrument captured the following adherence-related behaviors:

1. Forgetfulness in taking medicines.
2. Carelessness about taking medicines.
3. Stopping medicines when feeling better.
4. Stopping medicines when feeling worse.
5. Awareness of long-term treatment benefit.
6. Timely medication refill behavior.

The total composite score ranged from 0 to 6, with higher scores indicating better adherence.

For interpretive analysis, adherence severity was categorized as:

- Poor adherence: score 0–2
- Moderate adherence: score 3–4
- Good adherence: score 5–6

In addition to the total composite score, the instrument permitted domain-level interpretation through motivation-related and knowledge-related subcomponents.

Intervention: Structured Patient Counselling

Structured counselling on medication adherence was administered to all participants following baseline assessment. The counselling emphasized the importance of taking medication at prescribed intervals, maintaining continuity of treatment, understanding the consequences of missed doses, avoiding symptom-driven discontinuation, and refilling medicines promptly. Counselling was presented in patient-specific language and was designed to correspond pragmatically to routine biomedical counselling rather than an intensive individualized behavioral intervention.

DISC assessment was considered relevant to counselling delivery because patients may differ in communication style, confidence, need for explanation, and preference for structure. Although counselling was delivered in a standardized format, the behavioral profiling framework supported interpretation of how patient tendencies could influence receptivity to counselling messages. In clinical practice, such profiling may help refine counselling by emphasizing goals, reassurance, routine-building, or detailed explanation according to patient needs.

Follow-up Assessment

Participants returned for follow-up on day 60 with an allowable variation of ± 10 days. At follow-up, medication adherence was reassessed using the same study instrument and a standardized administration method consistent with baseline evaluation. This repeat measurement was used to determine post-counselling adherence status and quantify change from baseline.

Outcome Measures

Primary Outcome

The primary outcome was the change in the six-item adherence composite score between baseline and follow-up.

Secondary Outcomes

Secondary outcomes included:

1. Change in motivation and knowledge subscores.
2. Item-wise change in specific adherence behaviors.
3. Disease-wise comparison of adherence improvement across diabetes mellitus, hypertension, and tuberculosis cohorts.
4. Change in adherence according to baseline adherence severity.
5. Categorical transition from poor, moderate, or good adherence at baseline to follow-up.
6. Clinically meaningful responder analysis, defined as a ≥ 2 -point improvement in adherence score.
7. Identification of independent predictors of change in adherence score.
8. Exploratory description of baseline behavioral tendencies using DISC assessment and their possible relevance to adherence behavior and counselling response.

Data Management and Statistical Analysis

Quantitative and categorical statistical methods were used to analyze the data. Continuous variables were represented as mean $\pm$ standard deviation or median with interquartile range, depending on the distribution of data. Frequency and percentage were used for categorical variables. Because normality assumptions were not met for many continuous variables and paired differences, non-parametric methods were used when appropriate. Within-group pre–post comparisons were conducted using the Wilcoxon signed-rank test. Between-group comparisons were conducted using the Mann-Whitney U test or Kruskal-Wallis test, with adjusted post hoc pairwise analyses where applicable. Categorical variables were compared using chi-square-based procedures. Paired item-wise behavioral change was assessed using McNemar-based methods where appropriate. Changes in adherence severity categories over time were assessed using Bowker symmetry testing.

Independent predictors of change in adherence score after counselling were obtained through a multivariable linear regression model. Covariates entered into the model included baseline adherence score, age, sex, socioeconomic score, disease group, and other clinically relevant baseline factors in the dataset. DISC behavioral profile was considered as an exploratory behavioral variable. Where adequate category frequencies were available, DISC categories were compared descriptively across adherence severity groups and counselling response categories. However, DISC-related inferential interpretation was limited because DISC category-specific outcome estimates were not established as independent predictors in the present manuscript. A two-sided p-value < 0.05 was considered statistically significant.

RESULTS

The last sample included 387 subjects. Baseline age, weight, sex distribution, BMI group, smoking history, and years postdiagnosis were consistent across disease cohorts. However, the socioeconomic profile differed significantly across groups and baseline non-adherence burden was markedly stratified. The lowest baseline adherence rates were found in diabetes patients (median adherence composite = 1 [0,2]) compared to 3 [2,4] in hypertension and tuberculosis patients. It was clinically relevant, as this difference suggested a greater modifiable adherence deficit for the diabetes group prior to counselling.

Counselling correlated with a significant increase in adherence across the cohort as a whole. The mean six-item adherence composite increased from 2.33 ± 1.59 to 4.75 ± 1.28 . Improvements were evident across the full behavioral spectrum of the adherence instrument, indicating that counselling influenced both what patients knew about treatment and how they behaved in day-to-day medication use. Motivation and knowledge subscores were also improved significantly, suggesting that the intervention acted through more than one mechanism.

Responses were highly dependent on how adhered to baseline one was. By baseline, poor adherers had a better mean improvement with the greatest change in upward motion across patients classified in favorable adherence categories. Though average baseline adherence showed modest improvement, for those with good adherence already experiencing a ceiling effect, some participants regressed toward lower follow-up scores. Multivariable analysis indicated that baseline adherence score was the sole independent predictor of change, thereby indicating the importance of pre-intervention non-adherence in estimating counselling benefit was more important than sex, age, BMI, disease group, or socioeconomic score.

DISC assessment was included as a baseline behavioral profiling measure. It was considered an exploratory instrument to explore patient communication styles, therapy receptiveness, and tendencies around behavior pertinent to self-management. The present results are in line with the broader clinical relevance of behavioral assessment in adherence care, but DISC category-specific effects were not presented as independent statistical predictors because the current analyzed results identified baseline adherence score as the dominant independent predictor of change.

Table 1. Baseline characteristics across disease cohorts

Variable	DM (n=161)	HTN (n=153)	TB (n=73)	p-value
Age, years, median [IQR]	48 [38, 58]	48 [39, 60]	50 [38, 60]	0.9406
Kuppuswamy total score, median [IQR]	10 [5, 14]	11 [9, 13]	11 [9, 13]	0.0125
Baseline 6-item adherence composite, median [IQR]	1 [0, 2]	3 [2, 4]	3 [2, 4]	<0.0001
Female, n (%)	80 (49.7)	73 (47.7)	37 (50.7)	0.8987
Poor baseline adherence, n (%)	130 (80.7)	64 (41.8)	24 (32.9)	<0.0001

The baseline demographic characteristics were similar across each of the three disease cohorts but large differences were identified in their socioeconomic characteristics and adherence severity. Diabetes patients entered the intervention with the lowest adherence scores and the highest proportion of poor baseline adherence. From a clinical point of view, this is relevant because it implies an outsize burden on behavioural levels prior to intervention entry; this treatment may require a greater dependence on the initial adherence status as opposed to just the disease label and thus on the response of the counselling approach.

Table 2. Overall and item-wise improvement after counselling

Outcome	Baseline	Follow-up	p-value
6-item adherence composite	2.33 ± 1.59	4.75 ± 1.28	<0.0001
Motivation subscore	0.98 ± 0.99	2.22 ± 0.83	<0.0001
Knowledge subscore	1.35 ± 0.94	2.52 ± 0.70	<0.0001
Forgets medicine favorable response, n (%)	132 (34.1)	293 (75.7)	<0.0001
Careless about taking medicine favorable response, n (%)	134 (34.6)	304 (78.6)	<0.0001

Stops when feeling better favorable response, n (%)	165 (42.6)	314 (81.1)	<0.0001
Stops when feeling worse favorable response, n (%)	188 (48.6)	304 (78.6)	<0.0001
Knows long-term benefit favorable response, n (%)	169 (43.7)	359 (92.8)	<0.0001
Refill on time favorable response, n (%)	112 (28.9)	263 (68.0)	<0.0001

Counselling led to increases in the overall adherence score, as well as all behavioural areas measured by the instrument. The greatest improvement was noted for knowledge with respect to long-term treatment benefit, indicating that patients' knowledge of the purpose and continuity of treatment was especially amenable to modification. Significant ameliorations in forgetfulness, carelessness, and refill discipline suggest that counselling led to a practical behavior change more than mere awareness-raising. Last, symptom-worsening-related discontinuation improved least, suggesting a more-or-less persistent perceptual barrier.

Table 3. Change in adherence score by disease group and baseline severity

Group	n	Mean change $\pm$ SD	Median [IQR]	p-value
Disease group				
DM	161	3.39 $\pm$ 2.89	4 [3, 5]	
HTN	153	1.83 $\pm$ 1.60	2 [1, 3]	
TB	73	1.53 $\pm$ 1.62	2 [0, 3]	<0.0001
Baseline severity				
Poor (0–2)	218	3.94 $\pm$ 1.29	4 [3, 5]	
Moderate (3–4)	134	1.05 $\pm$ 1.37	1 [0, 2]	
Good (5–6)	35	-1.83 $\pm$ 2.23	-1 [-3, 0]	<0.0001

The extent of improvement varied markedly between disease categories and was also more significant between the baseline adherence severity strata. The absolute improvement was the greatest in patients with diabetes, but the sharpest clinical gradient was observed when subjects were divided into a baseline adherence category. Low-adherence participants were more positively affected overall, moderate-adherence participants had a modest improvement, and good-adherence participants demonstrated a ceiling effect. This trend also indicates that the burden of pre-intervention adherence is a significant predictor of counselling response and could be useful to prioritize patients for intensified adherence counselling.

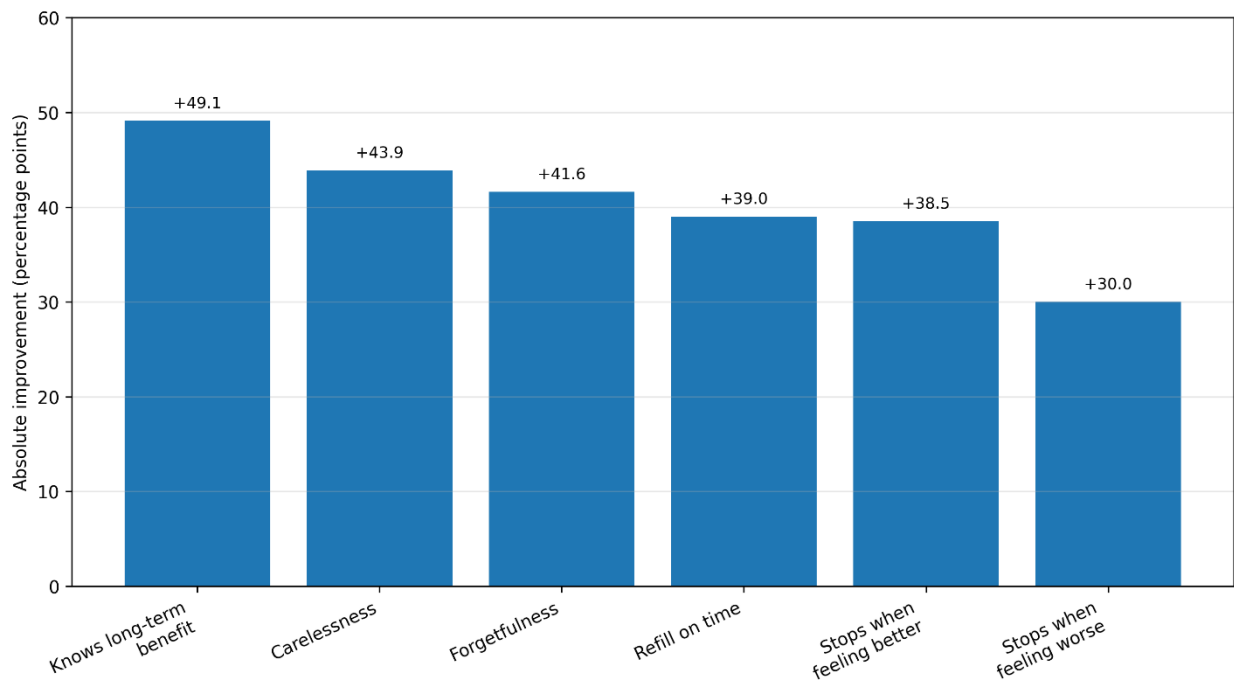
Table 4. Adjusted predictors of change in adherence score

Predictor	Beta	95% CI	p-value
Baseline adherence score	-1.237	-1.368 to -1.105	<0.0001
Male sex	0.162	-0.085 to 0.410	0.1987
Age	-0.003	-0.014 to 0.007	0.5273
SES total score	0.022	-0.007 to 0.051	0.1348
Disease group: HTN	-0.163	-0.524 to 0.199	0.3781
Disease group: TB	-0.226	-0.652 to 0.201	0.3003

Baseline adherence score emerged as the only independent indicator of improvement following counselling after adjusting for potential confounding factors. Once baseline adherence was incorporated into the model, neither age, sex, disease category, nor socioeconomic score independently accounted for change. This is clinically useful because it implies that baseline screening for poor adherence may be preferable to demographic or disease-based assumptions when selecting patients for adherence-based intervention.

Figure 1. Item-Wise Absolute Improvement In Adherence Behaviors After Counselling

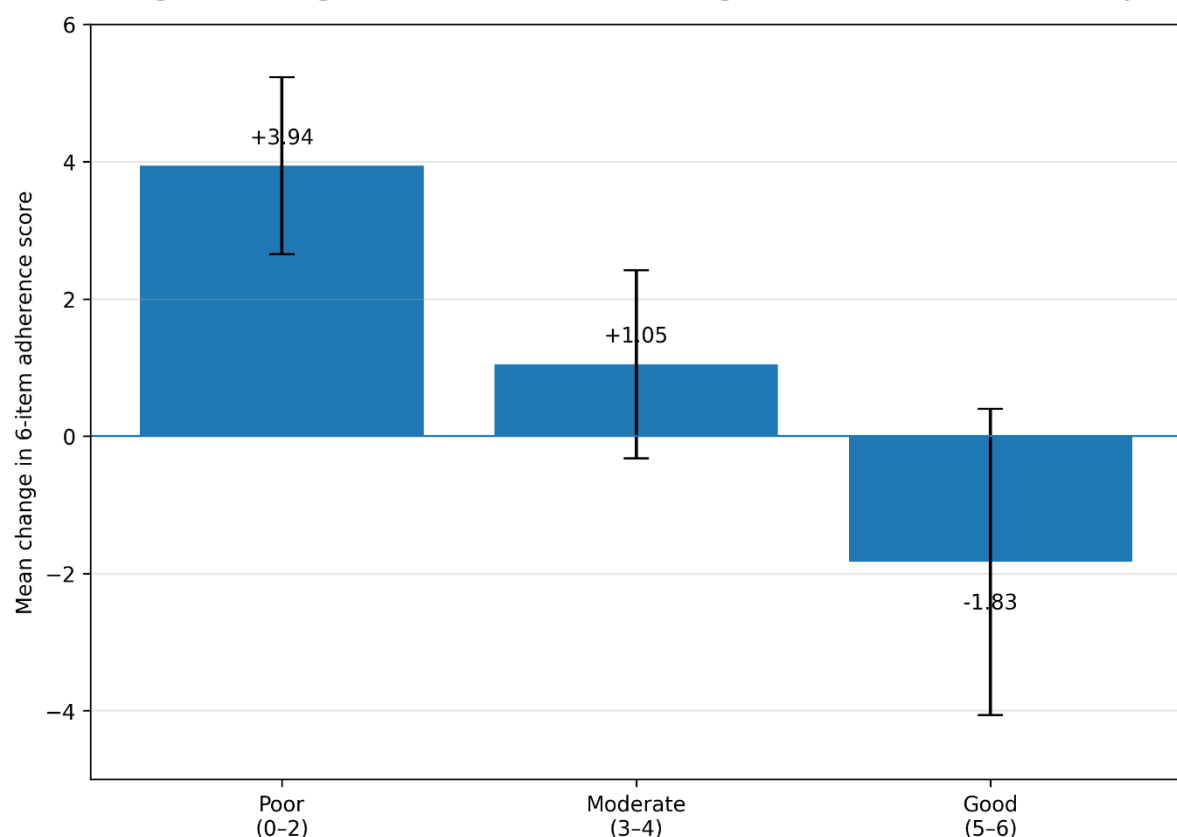
Figure 1. Item-wise Absolute Improvement in Adherence Behaviors After Counselling



All behavioral variables that measure adherence had been improved by counselling, although the degree of improvement differed across domains. The largest improvement was long-term treatment benefit awareness which suggests that counselling had its most prominent effect on treatment knowledge and illness perception. Significant improvements in forgetfulness, carelessness, and refill discipline indicate that, in addition to improving medication adherence, counselling may have shaped practical drug-taking patterns too. The smaller improvement in stopping treatment when feeling worse suggests that symptom-related concerns may require more targeted reinforcement and closer clinical follow-up.

Figure 2. Change In Adherence Score According To Baseline Adherence Severity

Figure 2. Change in Adherence Score According to Baseline Adherence Severity



Adherence after counselling was strongly influenced by baseline adherence severity. The biggest improvements were observed among participants with poor baseline adherence, indicating significant behaviour modifiability when baseline deficits were marked. Improvements were smaller among those with moderate adherence, whereas participants with good baseline adherence exhibited a ceiling effect and little possibility of further improvement. This pattern supports the application of baseline adherence screening to identify patients most likely to derive meaningful benefit from counselling.

DISCUSSION

The current prospective interventional study demonstrated that structured patient counselling significantly improved medication adherence in patients with diabetes mellitus, hypertension, and tuberculosis. However, the improvement was not consistent for all patients or across all adherence domains. The major findings were that counselling had a large effect on certain behavioural domains (specifically treatment understanding and routine medication-taking lapses); good effect was seen among patients with poor baseline adherence; and, response was better predicted by baseline adherence score as compared to demographic or disease-related characteristics. The integration of DISC assessment provided a behavioral profiling approach to interpretation of adherence and counselling receptivity.

Such results are consistent with previous adherence literature showing non-adherence is multifactorial, and that interventions are most effective when they tackle practical and perceptual barriers [1,2]. Osterberg and Blaschke described adherence as central to treatment success across chronic disease [1], and Brown and Bussell emphasized that adherence failures frequently arise from modifiable patient-level and system-level factors rather than intentional refusal alone [2]. The substantial post-counselling gains in forgetfulness, carelessness, and refill discipline observed in the present study suggest that many of these barriers can be behaviorally addressed through targeted counselling.

The increase in knowledge-related domains is consistent with previous work that involved Morisky-derived constructs and related adherence measures [7,8]. The greatest absolute improvement in this study was in knowledge of long-term treatment benefit, which suggests that counselling was especially effective in correcting misconceptions about the need for continuing therapy. This is in line with evidence that educational and motivational components can facilitate self-management behavior if counselling links treatment behavior to future health outcomes [9,10]. However, education is seldom enough on its own. The parallel improvement in daily adherence behaviors in this cohort suggests that counselling was successful because it linked abstract disease knowledge with practical medication habits.

The study's diabetes outcomes are worth particular note. The lowest baseline adherence and the largest post-counselling gain were obtained among participants with diabetes. This is corroborated in systematic reviews indicating that patient education coupled with behavioral reinforcement and patient engagement tends to be effective in type 2 diabetes [10,13]. Khunti et al. demonstrated that improved adherence to pharmacotherapy in type 2 diabetes is linked to better clinical outcomes such as reduced hospitalization and mortality risk [14]. The greater behavioral response observed in current diabetes patients may represent greater baseline disruption of medication routines, allowing more room for measurable improvement after structured counselling. It may also suggest that diabetes patients perceive a clearer personal benefit once the rationale for long-term treatment is explained.

We also noticed a substantial improvement in the hypertension cohort, but smaller than the diabetes cohort. That mirrors the overall hypertension adherence literature that suggests interventions are helpful but often produce moderate effect sizes [11,15]. Conn et al. reported statistically significant benefits of adherence interventions on hypertensive subjects, but overall effects were modest [11]. One possible reason is that hypertension is often asymptomatic and patients may have less symptom-driven motivation to maintain medication behavior. Within this framework, counselling may enhance motivation and understanding, but one counselling intervention may result in much less behaviour change in patients who do not perceive disease consequences more concretely.

Tuberculosis offers a distinct adherence problem. Previous systematic reviews have demonstrated that educational initiatives can result in improved tuberculosis adherence, with the greatest effectiveness typically being evident when education is reinforced by supervision, reminders, family involvement, or broader patient-centered strategies [12,16]. In our current study, tuberculosis patients had an overall improvement, but symptom-related adherence barriers seemed more resistant to treatment. This is clinically plausible given that tuberculosis therapy is prolonged and side effects can be substantial, and transient symptom worsening can be misinterpreted as treatment failure or intolerance. The results suggest brief counselling may be useful but may not be adequate for all tuberculosis-related adherence challenges.

One of the main benefits of this study is that it provides a clear gradient across the baseline severity of adherence. Individuals with poor baseline adherence demonstrated the highest mean improvement, patients with moderate adherence showed smaller improvement, and patients currently classified as good adherers showed a ceiling effect. This finding is consistent with behavior-change theory and intervention studies that suggest those with the largest initial deficit are the most significantly impacted (in terms of measurable opportunity for improvement [9,17]). The multivariable evidence that baseline adherence score was the only independent predictor of change supports this interpretation. Such knowledge is actionable, on a clinical level: screening for

poor baseline adherence may be the most effective way to identify patients who are probably in a better position to benefit most from counselling.

The inclusion of DISC behavioral profiling provides a further dimension to the conceptualization of adherence response. Medication adherence is not only dependent on type of disease, or socioeconomic status; it is related to communication style, preference for structure, perceived control, interpersonal behavior, and responsiveness to advice. DISC evaluation may allow clinicians to frame counselling in relation to the patients. Individuals with more dominant behavioral predispositions, such as patients experiencing dominant behavioral inclinations, may benefit from goal orientated counseling that focuses on control, measurable targets, and the consequences of non-compliance rather than the desired outcome, for instance. The interventions that worked well for people with influence-oriented tendencies would be interactive counseling, encouragement and the social reinforcement. Similarly, patients who are steadiness-oriented seem to respond to regular reinforcement, reassurance, and continuity of support. A patient with conscientiousness-oriented traits will probably respond to detailed explanation, written instructions, and structured monitoring.

These DISC-related results of the current manuscript, however, should be treated with caution. As the main independent predictor of response, the current analysis classified baseline adherence score as the strongest one. Accordingly, DISC assessment should be viewed as supportive and exploratory, rather than a definitive predictor of adherence change. The most practical value of the work in this dataset could be conceptual: it offers insight into how counselling might be implemented in a more individualized manner based on behavioral and communication patterns. This means that future research needs to carry out a predefined DISC-stratified analysis to ascertain whether DISC profiles are associated with baseline adherence severity, domain-specific barriers, or differential response to counselling.

The item-wise organisation of the adherence instrument also offers a mechanistic explanation of the counselling effect. The greatest gains occurred in knowledge of long-term benefit, carelessness, forgetfulness, and refill behavior. These are areas that can plausibly improve after one structured counselling contact because they depend on understanding, intention, routine formation, and daily organization. In contrast, discontinuing medication when feeling worse improved less, especially in tuberculosis. This suggests that concerns about adverse effects, symptom attribution, and treatment mistrust may be more resistant to change and may require ongoing counselling, clinician accessibility, and active adverse-effect management. Similar findings have been observed in broader adherence reviews, where perceptual barriers often remain more resistant than practical barriers [2,9].

The study has many strengths. It used a prospective design, included three major disease groups in the same protocol, and encompassed behavioral domains, categorical transitions, and predictor analysis beyond a single aggregate score. By incorporating DISC assessment in this study, its behavioral orientation was further fortified, as it recognized that adherence depended on the patient's communication style and behavioral tendencies. As a result, the findings are easier to interpret clinically than studies that tell the story only in terms of average change in scores.

However, limits are to be acknowledged. Assessments of adherence were based upon self-report, which is subject to recall bias and social desirability effects [7,8]. The follow-up was relatively short in duration and, therefore, the lasting quality of the benefit of counselling cannot be determined. Counselling fidelity, duration and inter-counsellor variation were not objectively quantified. Clinical endpoints, such as HbA1c, the control of blood pressure, sputum conversion, hospitalization or relapse, were not related to adherence change in the present dataset. Although DISC was utilised as baseline behavioural profiling measures, the present manuscript did not consider the DISC category as a sole predictor of adherence changes. Future studies applying a predefined DISC-stratified analysis may help make sense of the knowledge of behavioral profiles and inform the development of more targeted counselling strategies. The ethics approval number also was not reflected in the thesis source material used for drafting this manuscript.

Future testing should determine if repeated or staged counselling is more effective than a single counselling intervention, especially for patients with tuberculosis and those experiencing persistent symptom-related barriers. Baseline adherence screening should be included in everyday chronic disease management, so that intensified counselling targeted at poor adherers might also be beneficial. Studies which connect domain-specific adherence changes to hard clinical outcomes will enhance the translational relevance and reveal if improvements in behavior observed here translate into actual disease control benefits. It should also be investigated whether DISC-guided counselling results in better adherence outcomes than that of standard counselling, particularly when the content of the counselling is modified according to patients' communication style and behavioral tendency.

CONCLUSION

Structured patient counselling induced substantial short-term change in medication adherence among patients with diabetes mellitus, hypertension, and tuberculosis. However, the advantage was not generalizable to all patients or all adherence domains. The intervention was most beneficial for improving understanding of long-term treatment benefit and correcting practical daily gaps such as forgetfulness, carelessness, and delayed refill behavior. The biggest improvement was seen in those patients who had poor baseline adherence; and baseline adherence score was the only independent predictor of post-adjustment response. In summary, these results

demonstrate that counselling is not only efficacious but also clinically targetable. Characterizing baseline adherence severity may help identify which patients would benefit most from intensified counselling in routine chronic disease care. DISC assessment adds a potential for exploratory behavioral profiling by enabling clinicians to consider how communication style, orientation towards routine, and receptivity to advice may influence adherence behavior. Nonetheless, the DISC category here was to be understood as supportive rather than independently predictive. Research with a DISC-stratified and DISC-guided intervention is required to determine whether the use of behavioral profiling may enhance not only the personalization but also the efficiency of adherence counselling.

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