

# Why Don't They Listen? Adherence to Recommendations of Infectious Disease Consultations

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(See the editorial commentary by Tenenbaum on pages 1219–21)

The effectiveness of an infectious diseases (ID) consultation is dependent on adherence to the recommendations. To delineate the factors that affect adherence, we conducted a prospective cohort study of 465 consultations at 2 academic institutions in which we evaluated the consultation process, patient and consultant characteristics, types of recommendations, and compliance with recommendations. The overall compliance rate was 80%, with 85% adherence to crucial recommendations. Multivariate analysis revealed that adherence to ID recommendations was higher when the recommendations were therapeutic instead of diagnostic, when they related to a specific clinical question, when recommendations were deemed crucial by the ID service, if the primary service was medicine, and if the consultation note was legible and organized. Whether modification of consultant practice will lead to improved recommendation compliance and patient outcomes warrants further study.

The effectiveness of infectious diseases (ID) consultations depends on clinically astute recommendations. But without adherence to them, even the best recommendations are rendered ineffective. Use of appropriate antibiotics is clearly associated with better health outcomes [1–3], and because one-third of inpatients are started on inappropriate antibiotic therapy by the primary service, ID consultants—assuming that their recommendations are followed—can have a large beneficial impact. Although adherence to the recommendations of ID consultants (especially thera-

peutic recommendations) is important, there is uncertainty about the factors affecting adherence.

Studies of general medicine consultations report that rates of adherence to recommendations ranges from 53% to 90% [4–7]; the main predictors of adherence were a small number of recommendations, severely ill patients, presence of follow-up notes, and inclusion of specific details on dose and duration of drug therapy [6–8]. It is not known whether these same factors are important for ID consultations. We conducted a prospective cohort study of consecutive ID consultations at 2 institutions to determine the frequency of adherence to recommendations and to identify the factors that affect adherence.

## METHODS

A cohort of consecutive ID consultations was assembled at 2 hospitals during the period of February through April 2002 after receiving approval from the hospitals' institutional review boards. The 2 hospitals—one public and one private—are large, urban, tertiary care centers

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with separate internal medicine residency programs and consultation services but a joint ID fellowship program.

All consultations of adult patients were eligible for inclusion except for informal “curbside” or telephone consultations. Consultations were excluded if, within 24 h of consultation, the patient died, was discharged, or was transferred to the HIV service or private ID service.

**Data collection.** Data were collected prospectively on the day of consultation by an ID fellow (investigator) using a standardized instrument. A board-certified ID attending physician was responsible for completing a handwritten consultation note—clinical assessment and set of recommendations—that was written on the hospital’s standard consultation form and placed in the patient’s chart. A copy of this form was retained and assessed by the investigators.

We collected data from the following 4 domains: (1) patient characteristics, including demographic characteristics, severity of illness, HIV infection, ward location (hospital ward or intensive care unit), and physician service requesting the consultation; (2) characteristics of the consultation process, including whether recommendations were discussed by telephone or in person with the primary service; the formatting, organization, and legibility of the written consultation sheet; and the number of bulleted (or numbered) recommendations; (3) characteristics of the ID attending physicians performing the consultations, including his or her age and the number of years since the end of fellowship; and (4) characteristics of the individual recommendations themselves, including the type (therapeutic, diagnostic, isolation, or other), importance (“crucial” recommendations were prospectively determined by the ID fellow to be those few recommendations that were critical to the well-being of the patient), wording (“definitive” recommendations were those that were written using words such as “should,” “required,” “must,” “necessary,” and “imperative”), and whether the recommendation addressed a specific question of the primary service.

Each patient’s severity of illness was judged by an investigator on the day of the consultation using established criteria [7]: patients were “not ill” if they had no active medical issues (usually meaning that the patient was in rehabilitation); “moderately ill,” if they had non–life-threatening medical issues; and “severely ill,” if there were life-threatening medical issues (usually meaning that the patient was in an intensive care unit).

Communication with the primary service was assessed prospectively. The primary service was considered to be “called” if there was verbal communication between a member of the ID service and a member of the primary service on the day that the initial consultation was completed. A panel of 5 ID fellows independently judged the organization and legibility of every consultation note using a 3-point scale, blinded to out-

come (adherence), after the name of the ID attending physician had been removed or obscured.

**Outcome measurement.** Adherence to recommendations was assessed 1 and 3 days after the consultation. Recommendations that had already been completed before the consultation or were performed by the ID consulting team were excluded from analysis. Adherence was defined differently for the different types of recommendations: therapeutic or isolation recommendations required documented evidence of compliance within 24 h of the consultation (or within the time period specified in the consultation, if different); diagnostic or other recommendations required documented evidence of compliance within 72 h (or within the time period specified in the consultation, if different).

**Data analysis.** We analyzed adherence to recommendations while accounting for several layers of clustering—rec-

**Table 1. Characteristics of the 465 infectious diseases consultations.**

Characteristic	No. (%) of consultations
Hospital	
Private	263 (57)
Public	202 (43)
Reason for requesting consultation	
Therapeutic help	229 (49)
Therapeutic and diagnostic help	47 (10)
Diagnostic help	55 (12)
Prevention or other	8 (2)
No reason specified	126 (27)
Primary service	
General medicine	181 (39)
Medicine, neurology, or cardiology ICU	91 (20)
Orthopedic surgery	53 (11)
Hematology/oncology	25 (5)
Surgery ICU	21 (5)
General surgery	18 (4)
Obstetrics/gynecology	10 (2)
Family practice	5 (1)
Psychiatry	3 (1)
Other	58 (13)
Patient age, years	
18–40	123 (26)
41–60	203 (44)
61–80	115 (25)
>80	24 (5)
Patient’s HIV status	
Negative	51 (11)
Positive	51 (11)
Unknown	363 (78)

**NOTE.** ICU, intensive care unit.

**Table 2. Bivariate relationship between individual predictors and adherence to infectious diseases consultation recommendations.**

Predictor	No. (%) of consultations or recommendations <sup>a</sup>	Adherence rate, %	Difference, %	<i>P</i>
Hospital-level				
Private hospital	263 (57)	87	13	<.001
Public hospital	202 (43)	74		
Patient-level				
Age, years				
18–40	123 (26)	77	0	.01
41–60	203 (44)	80	3	
61–80	115 (25)	85	8	
>80	24 (5)	77		
Location				
Ward	353 (76)	81	1	.75
ICU	112 (24)	80		
Severity of illness				
Moderately ill or not ill	367 (79)	81	1	.85
Severely ill	98 (21)	80		
HIV status				
Positive	51 (11)	81	0	.98
Unknown or negative	414 (89)	81		
Physician-level				
No. of years since fellowship				
<6	188 (40)	81	4	<.001
6–10	79 (17)	89	12	
>10	198 (43)	77		
Sex				
Female	305 (66)	81	1	.62
Male	160 (34)	80		
Consultation-level				
Legibility and organization				
Fair or good	455 (98)	81	22	<.001
Poor	10 (2)	59		
Primary service called				
Yes	359 (77)	82	8	<.001
No	106 (23)	74		
No. of recommendations				
≤5	276 (59)	85	7	<.001
≥6	189 (41)	78		
Rationale given				
Yes	404 (87)	82	12	<.001
No	61 (13)	70		
Primary service				
Medicine	337 (72)	82	6	.002
Surgery or other	128 (28)	76		
Follow-up notes				
Yes	88 (19)	84	4	.04
No	377 (81)	80		

(continued)

**Table 2. (Continued.)**

Predictor	No. (%) of consultations or recommendations <sup>a</sup>	Adherence rate, %	Difference, %	P
Recommendation-level				
Type of recommendation				
Therapeutic or isolation	1102 (47)	92	22	<.001
Diagnostic or other	1247 (53)	70		
Crucial recommendation				
Yes	1507 (64)	85	13	<.001
No	842 (36)	72		
Pertinent to question from primary service				
Yes	1309 (56)	85	10	<.001
No	1040 (44)	75		
Definitively worded (imperative)				
Yes	30 (1)	80	0	.95
No	2319 (99)	80		

**NOTE.** ICU, intensive care unit.

<sup>a</sup> Data are no. of consultations except for recommendation-level predictors, for which they are the no. of recommendations ( $n = 2349$ ).

ommendations were clustered within patient, patients within consultant, and consultants within hospital. Because standard statistical techniques assume that observations are independent, our clustered data required a more complex approach. Using a hierarchical, logistic, mixed model (GLIMMIX procedure in SAS statistical software [SAS Institute]), we were able to assess how characteristics of recommendations, patients, written consultations, consultants, and hospitals simultaneously affected adherence to recommendations. We also constructed models to explore interactions between hospital and other predictors and to identify predictors of adherence to specific subgroups of recommendations (i.e., crucial, therapeutic, and diagnostic).

We had planned for a minimum sample size of 400 to assure that ~10–20 potential predictors could be analyzed with reliability, assuming ~5 recommendations per patient and an estimated 80% adherence. Analyses were performed using SPSS statistical software, version 10 (SPSS), and SAS software, version 6 (SAS Institute).

## RESULTS

Sixteen ID physicians performed 465 consultations and made 2349 recommendations, for a mean of 5 (2 therapeutic and 3 diagnostic) recommendations per consultation (range, 1–21 recommendations). There was adherence to 80% of all recommendations and to 85% of recommendations prospectively identified as crucially important to the patients' well-being. Baseline characteristics of the consultations are summarized in table 1.

**Bivariate associations with adherence.** Table 2 presents the relationships between predictors and adherence. For 7 predictors, there was at least a 10% difference in adherence among the levels of the predictor. The biggest difference was for type of recommendation: 92% of therapeutic (or isolation) recommendations were followed, whereas only 70% of diagnostic (or other type) recommendations were followed. A similar difference was seen for consultation note legibility: recommendations of notes rated as having "fair" or "good" legibility and organization had 81% adherence, compared with 59% adherence for notes rated as having "poor" legibility and organization. However, only 10 consultation notes (2%) had problematic ("poor") legibility; therefore, this factor, despite its significance, can explain little of the variation in adherence.

Other significant predictors in bivariate analyses included the hospital, the importance of the recommendation (as judged by the ID fellow), the number of years since the ID attending physician completed fellowship training, whether a rationale was provided justifying the recommendations, and whether the recommendations were pertinent to the specific question posed by the primary service.

**Multivariable model of adherence.** The hierarchical logistic model identified 6 independent predictors of adherence (table 3). Adherence was greatest if the medicine service at the private hospital asked for help with treatment decisions and the ID consultant wrote a legible note that offered therapeutic recommendations considered to be crucially important by the ID fellow.

None of the physician-level factors (sex, number of years

**Table 3. Predictors of adherence to infectious diseases consultation recommendations in a logistic regression mixed model.**

Predictor	Adjusted probability of adherence to recommendation, <sup>a</sup> %	Difference in adjusted probabilities, %	OR (95% CI)	P
Type of recommendation				
Therapeutic or isolation	89	38	7.6 (5.7–10.0)	<.001
Diagnostic or other	51			
Legibility and organization				
Fair or good	84	24	3.5 (1.1–11.2)	.03
Poor	60			
Hospital				
Private	84	23	3.2 (1.9–5.5)	<.001
Public	61			
Crucial recommendation				
Yes	82	19	2.7 (2.1–3.5)	<.001
No	63			
Pertinent to question				
Yes	82	19	2.7 (1.9–3.6)	<.001
No	63			
Primary service				
Medicine	79	11	1.9 (1.2–2.9)	.006
Surgery	68			

<sup>a</sup> Adjusted for all other predictors in the hierarchical logistic mixed model.

since fellowship, or an indicator variable identifying individual physicians) were significant independent predictors. For the 2 physicians who worked at both hospitals, there was a consistent “hospital effect,” with adherence at the public hospital lower than at the private hospital. Patient characteristics (HIV status, severity of illness, location, and patient age) were also unassociated with adherence.

Although communicating with the primary service (“calling”) was strongly associated with adherence in bivariate comparisons, it was not significant in the multivariable model. However, hospital appears to have modified the effect of calling. When stratified by hospital, calling the primary service improved adherence at the private hospital (OR, 2.3;  $P = .009$ ) but not at the public hospital (OR, 0.9;  $P = .7$ ).

**Crucial recommendations.** When the primary service did not follow a crucial recommendation, the most common situation was not obtaining an imaging study, a specimen for culture or staining, or other diagnostic test (table 4). Failing to adhere to crucial therapeutic recommendations was unusual; for 18 patients, a crucial recommendation to start therapy with a new antibiotic was not followed.

**Hospital differences.** We identified an interaction between hospital and type of recommendation while exploring differences between hospitals. For therapeutic recommendations, the

difference in adherence between hospitals was only 6% (95% for the private hospital and 89% for the public hospital); for diagnostic recommendations, the difference was 19% (80% vs. 61%).

The 2 hospitals share the same surgery housestaff but have 2 distinct medicine housestaff. However, the hospital difference in adherence was slightly more pronounced when surgery services were compared (24% difference) than when medicine services were compared (18% difference), suggesting that the hospital difference could not be explained by differences in housestaff physician characteristics at the 2 institutions.

## DISCUSSION

Recommendations of ID consultants at 2 large hospitals were followed 80%–90% of the time. Adherence depended on hospital, the primary service, the legibility of the consultation note, the recommendation’s perceived importance to patient care, whether it addressed a question posed by the primary service, and whether it addressed treatment (or isolation) as opposed to diagnosis.

The overall adherence rate of 80% was higher than that reported in most previous studies of general internal medicine consultations. Many of the predictors of adherence identified

**Table 4. Crucial infectious diseases consultation recommendations not followed by the primary service.**

Class, recommendation	No. of consultations
Therapeutic	
All	47
Start antibiotic	18
Discontinue antibiotic	13
Remove line or perform surgery	9
Change antibiotic dose	4
Other	3
Diagnostic	
All	169
Perform imaging study	52
Obtain specimen for culture or stain	43
Perform procedure	34
Obtain laboratory test	27
Other diagnostic recommendations	13
Isolation	1
Other	9

in those studies were not important in this study of ID consultations. For example, the number of recommendations, the patients' severity of illness, and the presence of a follow-up note did not predict adherence when other factors were also considered.

As Petrak et al. [9] note, "most infectious diseases specialists believe it is obvious and evident that their care is valuable" (p. 1013), yet there are only a few published studies on how frequently ID recommendations are followed or the clinical consequences of those recommendations. Wilkins et al. [10] estimated that 41% of the 776 infected patients studied were receiving suboptimal treatment at the time of consultation; there was complete adherence to the ID consultants' advice in 84% of consultations and partial adherence in another 11%. Fowler et al. [3] studied the effects of adherence on patient outcomes. In their study of patients with *Staphylococcus aureus* bacteremia, patient outcomes were significantly better when there was adherence to the antibiotic recommendations of ID consultants.

In our study, compliance with treatment recommendations was far more likely than was compliance with diagnostic recommendations. The most frequent reason why the primary service requested an ID consultation was a request for help in making treatment decisions—primarily, choosing appropriate antibiotics—which is consistent with results from other studies of ID consultations [11, 12]. The greater adherence with crucial recommendations was reassuring, suggesting that nonadherence was not haphazard—evidence that the primary service could discriminate among recommendations.

When the primary service chose not to follow a therapeutic

recommendation, it was most often a refusal to stop an antibiotic regimen rather than to start one (data not shown). Most of the crucial recommendations that were not followed regarded imaging and other diagnostic studies (table 4).

These findings highlight 3 limitations of the study. First, we did not measure the clinical consequences of adherence. It is possible that, for some patients, not adhering to recommendations may have benign clinical consequences. Second, we did not judge the quality, soundness, or completeness of the recommendations. Third, we did not assess the reasons for nonadherence. The primary service, in some cases, may have possessed convincing evidence that obviated compliance with particular recommendations. In addition, both the public and the private hospitals have large residency programs with active teaching services. As such, the results of this study may not be generalizable to settings where the patterns of communication are different.

Effective communication has always been considered to be critically important in consultation [13]. It seems obvious that better communication between the consultant team and the primary service should increase adherence with recommendations. However, calling the primary service and writing follow-up notes after the consultation did not improve adherence in this study, after adjusting for the effects of type of recommendation (therapeutic or diagnostic) and other significant factors. In fact, the effect of calling the primary service appeared to be different at the 2 hospitals: at the private hospital, calling increased adherence to recommendations, but at the public hospital, calling appeared to have no effect.

The reason for the 13% difference in adherence between hospitals is unclear. One explanation is that the relative scarcity of resources at the public hospital made it more difficult to fully and promptly comply with all recommendations, especially with the diagnostic studies. This hypothesis is supported by a 28% difference between hospitals in adherence to diagnostic recommendations, compared with only a 4% difference for therapeutic recommendations.

One goal of the research project was to identify predictors that might be amenable to change. In particular, we had expected that calling the primary service and writing a well-organized coherent consultation note would predict compliance and thus justify an educational intervention. Although a legible and organized note did increase adherence to recommendations, only a small number of notes (<3%) were illegible and disorganized. It is likely that a policy of typewritten notes, which is routine at many institutions, would improve adherence for the few attending physicians with poor penmanship. It is uncertain whether a standard policy of calling the primary service after every consultation would improve adherence, especially at the public hospital, where there was no association between calling and adherence (even when the written con-

sultation was disorganized and hard to read). Nevertheless, as discussed above, it is hard to imagine such a policy not improving the quality of care.

Our results also suggest that it might be prudent for ID consultants to pay particular attention to their nontherapeutic recommendations, which are at greatest risk of not being followed, especially if they are perceived as peripheral to the primary service's principal question. And although our observational study failed to identify relationships between adherence and many potentially mutable factors (e.g., calling, listing recommendations at the beginning of the note, and limiting the number of recommendations), it remains possible that such relationships were masked by confounding and could only be illuminated in a randomized trial testing interventions that target these factors.

Furthermore, future projects should address the limitations of the study, as stated earlier, and they should be designed to measure quality of recommendations, as well as the consequences of nonadherence. The addition of a nonteaching hospital as a site of investigation would allow for differences in consultant practices.

The value of ID consultations necessarily depends on adherence to their recommendations. Thus, as we strive to improve the value of our services [9], we should focus on the quality of our recommendations and on maximizing adherence.

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