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Modeling Psychiatric Patients' Treatment Decision Making*

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Decision-making processes of psychiatric inpatients were assessed at admission and prior to discharge, and compared to hospital staff members using a paired comparison paradigm in which subjects chose between hypothetical antipsychotic medications. Multidimensional analyses of binary choice matrices revealed that all subjects based decisions on the risks and benefits of medication, and weighted risks and benefits in roughly equal proportions. Hospital staff demonstrated greater internal consistency in their decisions than the inpatient sample at both time points. For newly admitted inpatients, severity of psychiatric symptoms and nonverbal intelligence were related to internal consistency of decision making, and behavioral indices of medication compliance predicted relative weighting of risks and benefits. For predischarge and comparison samples, verbal intelligence and treatment preferences predicted both outcome measures. Reliance on verbal reports of decision making may be misleading when assessing competence in acutely impaired psychiatric patients.

Psychiatric patients' ability to consent to treatment has received increasing attention from legal scholars and mental health clinicians. Court decisions consistently support psychiatric patients' right to refuse medical and psychiatric treatment if a patient is "competent" to make such decisions (Appelbaum, Lidz, & Meisel, 1987; Lidz et al., 1984). Moreover, the construct of competence, rooted in

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the legal doctrine of informed consent (Appelbaum et al., 1987; Faden & Beauchamp, 1986), has been increasingly identified as an important facet of forensic mental health. Although clinical evaluations of decision-making competence are conducted routinely, little research has addressed the validity of these assessments, in part because of difficulties in empirical measurement of decision-making ability.

Assessment of decision-making competence has been complicated by varying definitions of competence. The definitions most frequently cited are the "reasonableness" of a patient's decision, ability to recall relevant information, appreciation of the implications of the decision, and ability to rationally integrate information about risks, benefits, and probabilities into a decision that is consistent with one's personal values (Appelbaum & Grisso, 1988; Grisso, 1986; President's Commission, 1982; Roth, Meisel, & Lidz, 1977). Of these different standards of decision-making competence, ability to rationally integrate information has been recommended as the most appropriate standard for important decisions such as medical and pharmacological treatment (e.g., President's Commission, 1982).

Most empirical research with psychiatric patients, however, has only studied ability to recall information disclosed on informed consent protocols (see Lidz et al., 1984, for a review of this research). Studies have typically reported deficits in psychiatric patients' ability to recall such information, although deficits have also been reported in non-mentally-ill medical patients (Lidz et al., 1984). Recently researchers have begun to address more complex conceptualizations of decision making, such as ability to rationally integrate information, but this research typically relies on self-report and introspection about decision-making processes (Janofsky, McCarthy, & Folstein, 1992). Little research has focused on what may be a more relevant aspect of decision-making competence: ability to integrate information about risks, benefits, and probabilities in an internally consistent manner.

The decision-making processes of normal subjects, in contrast, have been the focus of experimental research for several decades, which has yielded methods and results that could be useful in helping to understand decision making in clinical populations. One notable result from this body of research is the consistent finding that introspection and self-report measures often yield inaccurate information about normal subjects' decision-making processes (Abelson & Levi, 1985; Nisbett & Wilson, 1977). Reported decision-making processes often do not explain actual behavior, which is better accounted for by other, unreported factors such as biases and stereotypes. In response to the shortcomings of self-reported decision-making processes, empirical models of behavior have been developed to identify factors that influence decisions and quantify the degree to which information is processed in an internally consistent manner (e.g., DeSarbo, Oliver, & DeSoete, 1986; Payne, 1982).

Rosenfeld, Turkheimer, and Gardner (1992) recently described the results of an experimental study of decision making among inpatient and outpatient subjects diagnosed with schizophrenia and a non-mentally-ill control group composed of family members. Using a paired-comparison gambling paradigm analogous to those used in experimental studies of normal decision making (Payne, 1982), the

authors found that the inpatient sample was significantly less able to utilize a consistent decision strategy than either the outpatient or comparison samples. Verbal ability (WAIS-R Vocabulary subtest score) was a strong predictor of internally consistent decision making in the outpatient and control samples, but not in the inpatient sample. Furthermore, when decision-making ability was assessed using a multidimensional scaling (MDS) model which relied only on ability to choose optimal alternatives (as opposed to degree of preference), no differences existed between groups in decision-making ability (Rosenfeld & Turkheimer, in press). All three samples based their decisions on the expected value of the gambles to roughly equal degrees.

The present study utilizes a forced-choice paired comparison paradigm to investigate psychiatric patients' decision making with regard to antipsychotic medications. Specifically, four aspects of decision making are explored: (1) the ability to weigh risks, benefits, and the probabilities of outcomes associated with antipsychotic medications in an internally consistent manner; (2) the relative weights attached to these three aspects of treatment decisions; (3) the relationships among psychiatric symptoms, information recall, cognitive measures, and dimensions of decision-making ability; and (4) changes in decision-making processes across the course of hospitalization and treatment.

METHOD

Sample

Fifty-two psychiatric inpatients diagnosed with a psychotic disorder were drawn from the three acute admission wards of a 600-bed state hospital in western Virginia. Inclusion criteria were the presence of any of the following symptoms as defined by DSM-III-R (American Psychiatric Association, 1987): delusions, hallucinations, incoherence or marked loosening of associations, catatonic behavior, or grossly flat or inappropriate affect. In addition, all inpatient participants were prescribed antipsychotic medication at the time of entry into the study (although not all were taking these medications). Patients were excluded upon diagnosis of an organic mental disorder, I.Q. less than 70 established before onset of the illness, psychosis attributable to substance abuse, physical disorders, epilepsy, or hearing or speech difficulties severe enough to impede testing.

Forty non-mentally-ill comparison subjects were recruited from hospital staff. All clinical staff members (psychiatrists, social workers, nurses, and mental health workers) agreeing to participate in the study were included in the comparison sample (all hospital staff approached agreed to participate). This sample was chosen in order to generate a comparison group familiar with the risks and benefits of antipsychotic medications but without any history of treatment for a psychiatric disorder, or current observable or reported psychiatric symptoms.

Psychiatric inpatients who passed inclusion and exclusion criteria were approached by the principal investigator (BR) and offered participation in the study within the first week after admission. Participants were read an informed consent

form in accordance with state guidelines. Willingness to participate after the risks and benefits of the procedure had been disclosed was considered by the hospital Human Investigations Committee to be a sufficient test of competence to consent given the minimal risks involved in this procedure. Approximately half of all psychiatric patients approached agreed to participate in the study. Because non-participating patients did not consent to a review of their hospital records, we were unable to assess the representativeness of research participants.

Procedures

Initial testing was conducted by the principal investigator in a single session during the patient's first two weeks of hospitalization. Thirty patients were retested approximately one week prior to discharge (following notice from the attending psychiatrist that the patient was scheduled for discharge), provided that at least two weeks elapsed since the initial testing. Of the 22 patients not available for retesting, 6 were discharged prior to retesting, 6 refused to participate at discharge, and 10 were still hospitalized when the study terminated.

After informed consent was obtained, participants were read a brief description of the risks and benefits of antipsychotic medications, and administered a questionnaire designed to measure understanding of disclosed information based on their ability to recall and paraphrase this information (Understanding Treatment Disclosure or UTD) developed by Grisso and Appelbaum (1989, 1991). Participants were then presented with pairs of hypothetical antipsychotic medications (with varying levels of symptom remission, potential side effects, and probabilities of outcomes) represented on a computer screen (described in detail below). Participants chose the medication they preferred by using a mouse-controlled cursor. Participants were also administered an abbreviated intelligence test (Vocabulary, Block Design, and Arithmetic subtests of the Wechsler Adult Intelligence Scale—Revised, WAIS-R, Wechsler, 1981; prorated IQ estimates based on this triad of subtests correlate with full scale I.Q. at $r = .92$ in normal subjects, Brooker & Cyr, 1986; Cyr & Brooker, 1984) and a measure of decision making in which subjects explain their decision-making rationale in response to a hypothetical vignette (developed by Grisso & Appelbaum, 1990). The inpatient sample was rated on the Brief Psychiatric Rating Scale following a structured clinical interview conducted by the principal investigator (BPRS, Overall & Gorham, 1962). Interrater reliability was established using 20 BPRS interviews conducted jointly with a psychiatrist trained in the use of the instrument and calculated using an intraclass correlation coefficient (ICC(1,2), Shrout & Fleiss, 1979). Reliability for the average BPRS score was .81, and estimates of reliability for five factors associated with the BPRS (Guy, 1976; Hedlund & Vieweg, 1980) ranged from .56 to .94. After completing all tasks, participants were paid ten dollars.

Demographic information (e.g., level of education, number of previous hospitalizations, discharge diagnosis) was obtained from hospital records and interview. Diagnoses were reviewed with the attending psychiatrist, incorporating clinical information and hospital record to ensure concordance with DSM-III-R

criteria (there were no discrepancies between discharge diagnoses and information obtained during testing).

Decision-Making Measure

Decision making was assessed using a sequence of forced-choice comparisons between pairs of hypothetical antipsychotic medications presented schematically on a computer screen (Figure 1). Each medication was displayed as two sets of human figures, one colored according to the proportion of patients experiencing benefits and another colored according to the proportion experiencing side effects. Each set of figures was accompanied by a written description of the degree of benefit or side effect associated with the medication, and the probability of experiencing it (e.g., 80% chance of complete recovery). A large two-headed arrow was displayed at the bottom of the screen, labeled "STRONGLY PREFER" at either end and "SLIGHTLY PREFER" in the middle. A mouse-controlled cursor enabled subjects to choose one of the medications and indicate the strength of their preference. Two levels of probability of outcome, two levels of benefit, and two levels of side effects were combined to form eight medication alternatives. Participants were presented with all possible pairs of these eight hypothetical medications, generating 28 paired comparisons.

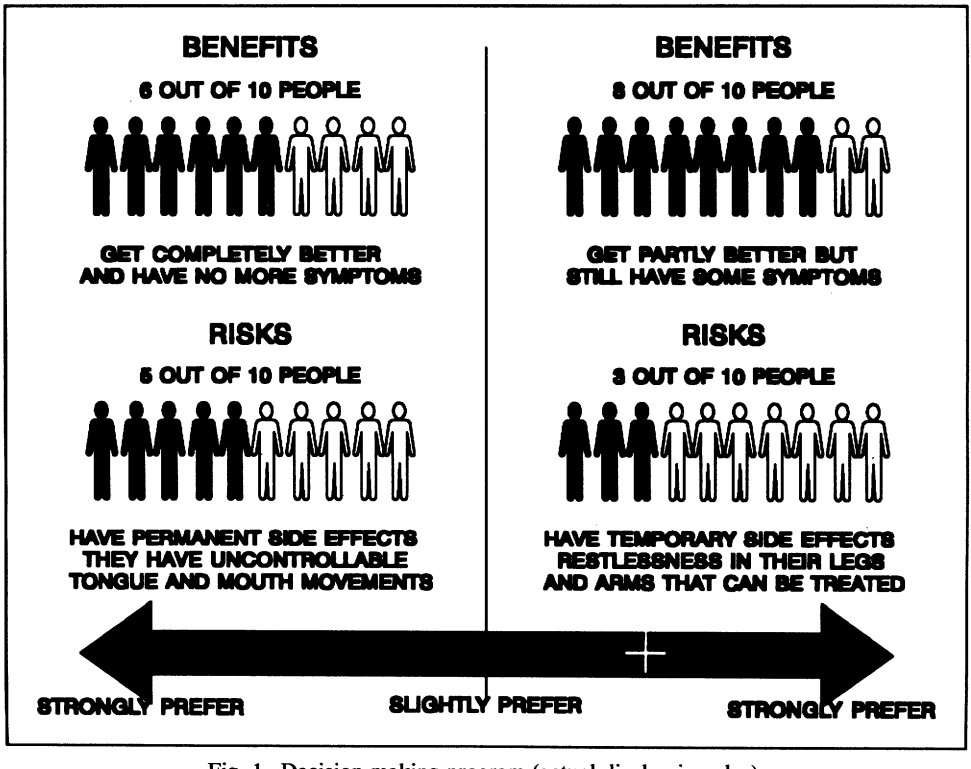

Fig. 1. Decision-making program (actual display in color).

Statistical Analyses

Medication preferences were analyzed with a multidimensional scaling model in which subjects and stimuli are located in an n-dimensional space. This model estimates two sets of coordinates, stimulus coordinates, which reflect the dimensions of information used to make decisions, and subject coordinates, which reflect the weights each subject applied to these dimensions (DeSarbo et al., 1986). The fitting equations for this maximum likelihood model have been described by their originator (DeSarbo et al., 1986) and are summarized in the Appendix.

The resulting stimulus coordinates were regressed onto the medication characteristics in order to determine the relationship between the medication alternatives and the obtained dimensions, and the solution was then rotated to best fit the known characteristics of the medications. Rotated subject coordinates were used to generate two independent outcome variables: one representing the internal consistency of subjects' choices among hypothetical medications (decision-making consistency), and another representing the weighting process used by subjects in reaching their decisions (relative importance of dimensions of information, or decision-making style).

A comparison of hierarchical regression models was then used to examine the characteristics that were related to the decision-making variables within each of the three samples (newly admitted psychiatric patients, psychiatric patients prior to discharge, and hospital staff members). First, all relevant variables were included in a multiple regression model. Nonsignificant variables were then deleted until removing any remaining variables yielded a significant decrease in R^2. Separate regression models were fitted for the clinical, cognitive, and demographic variables in each sample. Variables found to be significantly related to the dependent variables in the preliminary models ($p < .1$) were then fitted into a final prediction model.

The relationship between changes in decision making, cognitive abilities, and psychiatric symptoms was assessed with a multiple regression of gain scores (score at discharge minus score at admission; see Huck & McLean, 1985; Willet, 1988–1989). Similar to the hierarchical regression described above, nonsignificant variables were successively deleted from the regression models predicting change in internal consistency of decision making and relative weighting of risks and benefits.

Sample Characteristics

Fifty-two inpatients (24 women and 28 men) were tested an average of 9.3 days after admission. Thirty of these subjects were retested an average of 51.5 days later (ranging from 14 to 148 days between testings) upon notice from the attending psychiatrist that the patient was scheduled for discharge. Of the original 52 patients, 22 were diagnosed with schizophrenia, 16 with schizoaffective disorder, 7 with a bipolar mood disorder (mania or mixed type), and 7 with other psychotic illnesses. All patients were prescribed antipsychotic medication, although nine either had refused and/or continued to refuse medication at the time

of testing. Table 1 contains the demographic and clinical characteristics of the study participants. There were no significant differences ($p < .05$) in demographic characteristics or performance on clinical measures at admission between patients who were retested at discharge and those who were not.

The sample of 40 hospital staff members (28 women and 12 men) included 7 psychiatrists and psychiatric residents, 8 social workers, 10 nurses, and 15 mental health workers. As noted in Table 1, the comparison sample was more educated, scored higher on the prorated intelligence test and the three WAIS-R subtests, and recalled more information about risks and benefits of medication (as measured by the UTD scale).

Patients' performance on a number of variables changed significantly between admission and discharge testing. A repeated measures multiple analysis of variance (MANOVA) incorporating all the clinical variables assessed at admission and discharge revealed an overall significant effect across time, $F(16,43) = 4.60$, $p < .0001$. Evaluation of matched-t statistics (Table 2) revealed that mean BPRS score and each of the five BPRS factors were significantly higher at admission than at discharge (indicating a greater degree of pathology at admission). Prorated intelligence estimates and the three individual WAIS-R subtests also increased significantly, although comparable increases are commonly found upon retesting with the WAIS-R regardless of change in clinical condition (Wechsler, 1981). In addition, UTD scores increased significantly over the course of hospitalization, indicating a greater ability to recall disclosed information, although no data regarding practice effects due to retesting have been reported with this measure.

RESULTS

Binary Multidimensional Scaling Analyses

MDS analyses revealed that a two-dimensional model generated the best fit for each sample (Table 3). A two-dimensional solution derived for the complete data set yielded a goodness-of-fit index not significantly worse than the summed

Table 1. Sample Characteristics of Admission and Comparison Subjects

	Comparison subjects $N = 40$ (SD)	Inpatient subjects $N = 52$ (SD)	t^a
Age	38.42 (8.6)	35.56 (8.6)	1.58
Years of education***	15.10 (3.3)	12.65 (2.3)	4.26
Full scale I.Q.***	99.10 (12.2)	87.25 (11.6)	4.82
Vocabulary**	10.02 (1.5)	8.15 (2.3)	3.71
Block design**	9.75 (2.3)	7.85 (2.8)	3.51
Arithmetic**	9.73 (2.6)	7.35 (2.3)	4.69
UTD score***	8.80 (0.9)	6.46 (2.2)	6.36
Mean weight***	2.85 (1.1)	1.58 (1.3)	4.96
Relative weight	0.44 (0.1)	0.41 (0.2)	0.89

[a] $df = 90$ for all t-tests.
** = $p < .001$. *** = $p < .0001$.

Table 2. Clinical Measures at Admission and Discharge

	Admission subjects $N = 30$ (*SD*)	Discharge subjects $N = 30$ (*SD*)	Matched t^a
BPRS mean score***	2.59 (0.6)	1.84 (0.5)	7.09
Anxiety/depression*	2.78 (1.0)	2.34 (0.8)	2.65
Anergia*	2.37 (1.4)	1.72 (0.7)	2.55
Thought disorder***	3.00 (1.3)	1.72 (0.8)	5.34
Activation***	2.44 (0.8)	1.61 (0.7)	4.76
Hostile/suspiciousness*	2.31 (1.1)	1.82 (0.9)	2.64
Full scale I.Q.***	85.37 (12.1)	90.40 (12.0)	4.63
Vocabulary**	7.77 (1.9)	8.23 (2.2)	3.75
Block design*	7.57 (3.1)	8.57 (3.3)	2.67
Arithmetic**	7.07 (2.3)	8.20 (2.6)	4.38
UTD score**	6.17 (2.1)	7.67 (1.8)	3.92
Mean weight	1.63 (1.4)	1.70 (1.1)	0.20
Relative weight	0.42 (0.2)	0.42 (0.2)	0.23

[a] $df = 29$ for all matched t-tests.
* = $p < .05$. ** = $p < .001$. *** = $p < .0001$.

goodness-of-fit indices for the three subject groups derived separately (Table 3). All subsequent analyses, therefore, are based on the subject and stimulus coordinates derived from the combined data set in order to allow between-group comparisons.

Table 3. Results of Binary Multidimensional Scaling Analyses

			Inpatients at admission		
	−2 11	*df*	χ^2	*df* Ch.	*P*
1-Dimension	−511.5	58			
2-Dimension	−411.5	116	100	58	.001
3-Dimension	−365.5	174	46	58	n.s.
			Inpatients at discharge		
	−2 11	*df*	χ^2	*df* Ch.	*P*
1-Dimension	−236.6	36			
2-Dimension	−178.4	72	58.2	36	.01
3-Dimension	−178.4	108	0	36	n.s.
			Comparison subjects		
	−2 11	*df*	χ^2	*df* Ch.	*P*
1-Dimension	−198.9	46			
2-Dimension	−102.6	92	96.3	46	.0001
3-Dimension	−86.7	138	16.1	46	n.s.
			Model comparison		
			−2 11	*df*	
Combined data set model			692.5	280	
Sum of individual models			695.9	256	

Dimension one of the eight MDS-derived stimulus coordinates was correlated with potential side effects or risks of medication, $r(N = 8) = .94$, $p < .001$, and dimension two was correlated with potential benefits, $r(N = 8) = .88$, $p < .005$. The relative probability of receiving benefits or side effects was not related to either dimension in the MDS solution, indicating that participants were not influenced by probabilities in making their decisions. Figure 2 contains the two-dimensional solution for these data and illustrates the relationship of this solution to the risks and benefits of medications.

The two-dimensional solution was rotated, using procrustes rotation (Loehlin, 1987), to best approximate the risk and benefit dimensions and simplify interpretation of the data. By rotating subject and stimulus coordinates, the transformed subject coordinates represent the degree to which a subject attended to the risks and benefits of medication in making decisions.

Subject coordinates on the two dimensions were then transformed to generate two uncorrelated dependent variables. The first, hereafter referred to as mean weight, was computed as the sum of the absolute values of the subject coordinates, reflecting the internal consistency of a subject's decisions (distance from the origin). The second, hereafter referred to as relative weight, was computed as the absolute value of dimension one divided by the mean weight, reflecting the relative importance of the two dimensions of the MDS solution.

Hospital staff members demonstrated significantly more internal consistency in their decision making (mean weight) than the inpatient sample, $t(91) = 4.96$, $p < .0001$. As revealed by Figure 3, despite a significant difference in mean weight scores across groups, a majority of newly admitted psychiatric patients (44 of 52) and all psychiatric patients prior to discharge performed within the range of mean weight scores obtained by the comparison sample. Decision-making style (relative weight), on the other hand, did not differ significantly between inpatient and comparison samples, $t(91) = 0.89$, $p =$ n.s.

No significant changes in group means were noted in either of the MDS-

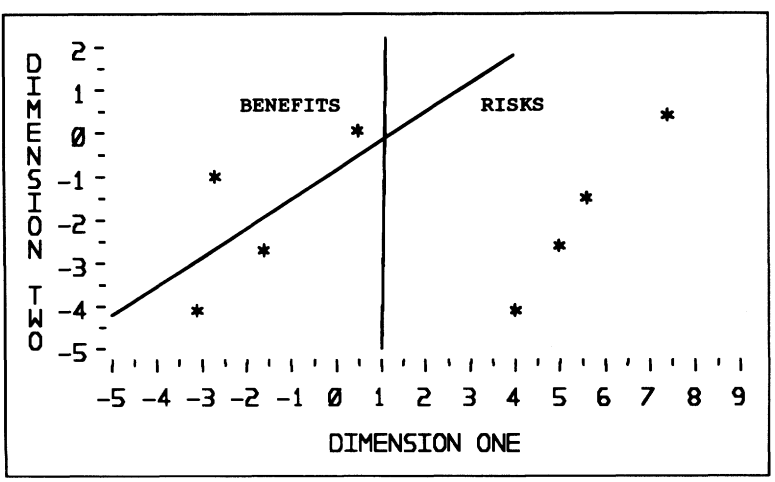

Fig. 2. Two-dimensional solution (stimulus coordinates and rotated solution).

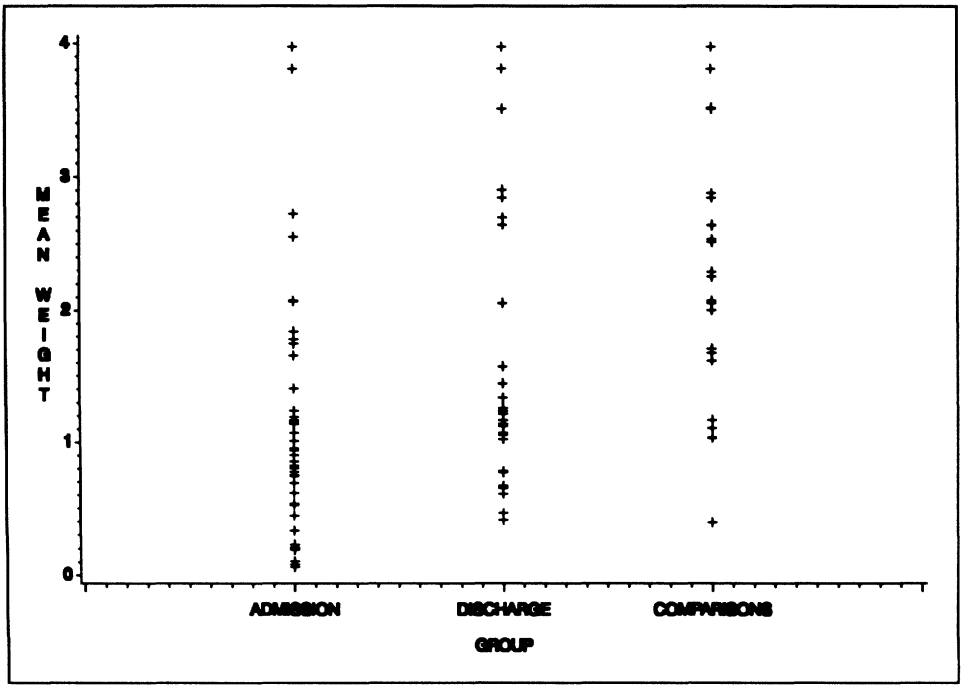

Fig. 3. Scatterplot of mean weight scores by subject group.

generated measures of decision making, mean weight or relative weight, t's(29) = 0.20 and 0.23, p's = n.s. Inpatient participants' decision-making consistency at admission and discharge were not significantly correlated, $r(N = 30) = .05$, p = n.s., although a modest correlation was found between relative weight at admission and discharge, $r(N = 30) = .33$, $p < .10$.

Predicting Decision-Making Consistency (Mean Weight)

A multiple regression model was used to assess the relationship between mean weight (internal consistency) and clinical and demographic variables. As noted above, separate hierarchical regression models were fit within three categories of variables (intellectual and cognitive variables, psychiatric symptom variables, and demographic variables) for each sample, and the remaining variables were then entered into a final multiple regression employing the same hierarchical procedure.

The final multiple regression model predicting the internal consistency of decision making in newly admitted psychiatric patients accounted for 34% of the variance of mean weight scores, $F(4,46) = 5.82$, $p < .001$ (only 51 subjects were used in this analysis because of missing data). Lower average BPRS ratings were significantly related to higher mean weight scores, $t(50) = -2.18$, $p < .05$, as was better performance on the Block Design subtest of the WAIS-R, $t(50) = 2.81$, $p < .01$. Patients diagnosed with schizophrenia, schizoaffective, or a bipolar disorder

scored significantly higher on the mean weight variable compared to patients diagnosed with other psychotic disorders such as psychotic disorder NOS or brief reactive psychosis (using a dummy-coded variable), $t(50) = 2.62$, $p < .02$ (there was no difference in performance between schizophrenic, schizoaffective, or bipolar patients), while increased age at first hospitalization predicted higher mean weight scores, $t(50) = 2.09$, $p < .05$.

Among inpatients prior to discharge, the final multiple regression model accounted for 35% of the variance in mean weight scores, $F(3,26) = 4.59$, $p < .02$. This model revealed that symptoms of anxiety and depression the BPRS anxiety–depression factor, including items measuring somatic concern, anxiety, depressive mood, and guilt feelings) predicted less internally consistent decision making (lower mean weight scores), $t(29) = -2.81$, $p < .02$. Patients with more education, on the other hand, demonstrated more internally consistent decision making on this measure, $t(29) = 4.59$, $p < .02$. With these variables already in the model, however, greater understanding of the information relevant to antipsychotic medication decisions (UTD scores) was inversely related to consistency of decision making, $t(29) = -2.18$, $p < .05$, indicating that at each level of education, subjects who recalled more of the disclosed information obtained lower mean weight scores.

The final regression model predicting mean weight scores among hospital staff members yielded a model that accounted for 37% of the variance, $F(2,37) = 10.70$, $p < .0005$. Higher WAIS-R Vocabulary scores significantly predicted higher mean weight scores, $t(39) = 4.57$, $p < .0001$, while years of education was inversely related to internal consistency of decision making, $t(39) = -3.24$, $p < .005$, reflecting relatively poorer performance of hospital staff with higher education (i.e., social workers and physicians) compared with less educated hospital staff (nurses and mental health workers).

Predicting Decision-Making Style (Relative Weight)

In predicting participants' relative weighting of the risks and benefits of medication (decision-making style), a statistical method similar to that used to predict mean weight was employed. The final regression model predicting decision-making style accounted for 37% of the variance of newly admitted patients' relative weight scores, $F(3,46) = 9.17$, $p < .0001$. Patients not taking medication prior to admission were more likely to focus their attention on potential benefits in making their medication decisions, $t(49) = 2.42$, $p > .02$, although as the length of time without medication increased, attention to potential side effects of these medications similarly increased, $t(49) = 4.66$, $p < .0001$. Patients diagnosed with schizophrenia or a mood disorder also focused significantly more attention on the risks of medication than subjects diagnosed with other psychotic disorders, $t(49) = 2.87$, $p < .01$.

Among inpatients prior to discharge, the only variable that predicted relative weighting of risks and benefits was choice of treatment (therapy or medication) made in response to a hypothetical vignette included in the measure of decision making developed by Grisso and Appelbaum (1990). Patients choosing therapy

over medication in this vignette weighted the risks associated with the hypothetical medications of the paired comparison task more heavily, while patients choosing a medication in the vignette placed more emphasis on the possible benefits of treatment. This variable accounted for 19% of the variance of relative weight scores, $F(1,28) = 6.46$, $p < .05$. No clinical or demographic variables predicted relative weight accorded risks and benefits in this model.

Similarly, among hospital staff members, only the choice of therapy versus medication in the hypothetical vignette predicted decision-making style in a model accounting for 13% of the variance, $F(1,38) = 5.41$, $p < .05$. As with inpatients prior to discharge, choice of psychotherapy over medication in the hypothetical vignette significantly predicted greater emphasis on risks, while choice of medication predicted greater focus on potential benefits in the paired comparison task.

Assessing Decision-Making Abilities Over Time

The relationship between changes in cognitive and symptom characteristics and changes in decision making was assessed using a hierarchical multiple regression model incorporating change scores (score at admission minus score at discharge, equivalent to a repeated measures ANOVA for pretest/posttest designs, Huck & McLean, 1975; Willet, 1988–1989). These analyses yielded a final regression model accounting for 25% of the variance of mean weight change scores, $F(2,27) = 4.49$, $p < .05$.

The final regression model indicated that greater decreases in perceptual and thought disturbances (the BPRS Thought Disorder factor, including items measuring Conceptual Disorganization, Grandiosity, Hallucinatory Behavior, and Unusual Thought Content) predicted greater increases in mean weight scores, $t(29) = 2.10$, $p < .05$. Conversely, decreases in symptoms of paranoia and suspiciousness (the BPRS Hostile-Suspiciousness factor, including items measuring Hostility, Suspiciousness, and Uncooperativeness) over the course of hospitalization significantly predicted smaller increases, or even decreases, in mean weight scores, $t(29) = 2.68$, $p < .05$. No model was found that significantly predicted changes in decision-making style over time.

DISCUSSION

These analyses suggest that the typical method for assessing decision-making competence, in which clinicians rely on verbal abilities and self-reported decision-making processes (clinical interviews focused on a patient's recall of relevant information or description of their decision-making rationale), may yield inaccurate conclusions regarding the decision-making ability of acutely ill psychiatric patients. In acutely ill psychiatric patients, verbal measures of intellectual and cognitive functioning were unrelated to decision-making ability, which were instead related to overall psychopathology, nonverbal problem-solving ability, and demographic indices of illness chronicity. Similarly, verbal report of decision preferences were unrelated to patients' relative weighting of risks and benefits

while behavioral indices of medication compliance were. Among inpatients prior to discharge and hospital staff members, verbal measures of decision making and cognitive functioning were more accurate predictors of decision making.

Thus, as acute psychiatric symptoms recede, the relationship between decision-making abilities and verbal abilities becomes stronger, and the methods typically used by clinicians may be more accurate. However, patients without significant psychopathology are not typically referred for evaluations of decision-making competence. In addition, ability to recall disclosed information was unrelated to consistent decision making for any sample, indicating that reliance on tests of recall may be inadequate for the assessment of higher levels of decision-making capacity in anyone.

These findings highlight the importance of developing and validating measures of problem solving and reasoning which provide a more accurate representation of the cognitive abilities necessary for competent decision making in the presence of mental illness. Although this decision-making paradigm was not designed to serve as such a measure (and no cutoff score has been established that would indicate which participants demonstrated decision-making abilities that would be considered incompetent), it may be useful as a mechanism for validating other clinical instruments.

Several factors, however, must be considered in interpreting these findings. The first is the possible impact of motivation. Unlike past research by our group, which demonstrated comparable internal consistency of decision making between psychiatric patients and non-mentally-ill subjects (when subjects received payment relative to their ability to choose optimally between alternative gambles; Rosenfeld & Turkheimer, in press), subjects in this study were paid only for their participation, with no additional incentive for more consistent or accurate decision making. The significant differences observed between psychiatric and comparison samples, therefore, may reflect differences in performance rather than ability. The issue of motivation, however, is present in nearly all clinical evaluations with legal relevance (e.g., competence to stand trial), and although limiting the conclusiveness of results described here, it does not limit the utility of experimental models of decision making. A second factor which must be acknowledged is the reliance on hierarchical regression models for analyzing predictors of decision making. Despite the increased possibility of chance results with hierarchical models, the consistency of these findings with past research (Rosenfeld et al., 1992) supports the validity of the results reported here.

Another consideration in interpreting these data involves the choice of comparison subjects. Significant differences were observed between the psychiatric and comparison samples on all variables measured, indicating that these groups were by no means equivalent. This comparison sample, however, was not chosen to provide a standard for evaluating the performance of psychiatric patients (since poorer performance on any measure requiring complex cognitive functioning is expected for psychiatric patients). Rather, this comparison sample was chosen to provide a description of the typical decision-making processes and range of decision-making abilities demonstrated by non-mentally-ill subjects who were knowledgeable about psychosis and the risks and benefits of treatment with an-

tipsychotic medication. The comparison sample, therefore, provides a reference against which to compare the decision-making processes of psychiatric patients, and highlights similarities between the decision-making strategies of patients and hospital staff as well as the differences.

Given the significant differences between experimental and comparison samples, the use of comparable decision-making processes across samples is striking. Newly admitted patients and those same patients prior to discharge utilized a decision-making strategy similar to non-mentally-ill hospital employees in making decisions about antipsychotic medications. Both patients and hospital staff weighted risks and benefits in roughly comparable proportions, and neither group appeared to be influenced by the probability of receiving benefits or side effects from treatment. This latter finding may reflect a relative insensitivity on the part of participants to probability information, or the modest difference between the two different probabilities used in the decision-making program.

Although decision-making processes were comparable across samples, internal consistency was not. The inpatient sample demonstrated significantly less internal consistency in their decisions at both admission and discharge when compared to hospital staff. Despite this significant difference, however, most acutely ill patients and all patients prior to discharge demonstrated decision-making consistency within the range of non-mentally-ill hospital staff (despite the possible impact of motivation). This finding suggests that the law's presumption of competence (until proven otherwise) may be justified, even for acutely psychotic psychiatric patients.

The existence of significant differences in decision-making consistency observed in this study, however, deviates from our past research and warrants further exploration. It may be the case, as suggested by Janis and Mann (1977), that emotional stress associated with treatment decision making impaired psychiatric patients' ability to utilize a consistent decision-making strategy, resulting in the significantly poorer performance demonstrated by the inpatient sample. Alternatively, the paired comparison in the present study may be a more complicated task than the gambling decisions studied by Rosenfeld and Turkheimer (in press), requiring a greater reliance on verbal skills (subjects read information presented on a computer screen). Thus, a greater difference would be expected between mentally ill and non-mentally-ill participants.

Finally, one result from the analysis of decision making over the course of hospitalization warrants recapitulation. As symptoms of paranoia and suspiciousness receded during the course of hospitalization and treatment (including antipsychotic medications), patients' corresponding ability to use an internally consistent decision-making strategy decreased. This result may indicate that the cognitive abilities required to form paranoid beliefs are related to those required for consistent decision making. Alternatively, however, this may reflect the impact of antipsychotic medication on psychiatric patients' decision making. There may be a subset of patients for whom hospitalization and treatment actually impede their ability to make decisions for themselves.

Although legal decisions about issues such as patients' competence to consent to treatment continue to rely on clinical interviews and ability to recall

disclosed information, these data suggest that more comprehensive, behavior-based measures for assessing competence are needed. Further research on the development of such instruments, as well as on the relationship between motivation and performance on empirical measures of decision making, is necessary. In addition, research examining the relationships between specific psychiatric symptoms, cognitive abilities, motivation, and components of decision making in psychiatric and medical patients may help elucidate these complex interactions.

APPENDIX

The binary multidimensional scaling (MDS) model locates subjects and stimuli in an n-dimensional space such that stimulus coordinates weighted by subject coordinates yield a latent utility (estimate of overall worth) for each stimulus for each subject. The model derives latent utilities which best represents the pattern of preferences observed (where subjects are predicted to choose the stimulus with higher latent utility).

The latent utility, U, of stimulus j for subject i is defined as the sum of the coordinates of the stimulus on the n dimensions, weighted by the subject coordinates on the n dimensions:

$$U_{ij} = \sum_{n=1}^{N} a_{in} b_{jn}$$

where n represents a dimension in a N-dimensional space, a_{in} is the nth coordinate of subject i, and b_{jn} is the nth coordinate of stimulus j. The observed utility V_{ij} is equal to

$$V_{ij} = U_{ij} + e_{ij}$$

where e is normally distributed error with mean 0 and variance 1. Given a choice between two stimuli j and k, the probability that subject i will choose stimulus j is given by

$$\Phi \left[\sum_{n=1}^{N} a_{in}(b_{jn} - b_{kn}) \right]$$

where Φ is the cumulative normal distribution. A log likelihood function can be derived from this expression (DeSarbo et al., 1986) which is maximized in terms of parameters a_{in} and b_{jn} for given dimensionality.

Thus, in any given paired comparison, the probability that a subject will have chosen a particular stimulus is a function of the difference between the two latent utilities. Therefore, as subject coordinates (a_{in}) deviate from the origin, the probability of correctly predicting actual choices from the model increases, because the magnitude of latent utilities (and the differences among them) increase. More

simply put, larger absolute values of subject coordinates indicate that a subject has applied a more internally consistent decision strategy in making his or her choices. Likewise, smaller subject coordinates indicate a greater tendency toward random decisions.

Stimulus coordinates (b_{jn}), on the other hand, represent characteristics of the decision stimuli (hypothetical antipsychotic medications) which all subjects use to varying degrees in making their decisions. Interpretation of the dimensions revealed by the MDS solution is performed by regressing stimulus coordinates onto the characteristics of the stimuli (risks, benefits, probabilities, and interaction effects, Arabie, Carroll, & DeSarbo, 1987). The dimensions can then be rotated using a least-squares procrustes procedure (Loehlin, 1987, pp. 166–167) to more closely approximate known characteristics of the decisions.

Models of increasing dimensionality were fit until the change in the asymptotic chi-square statistic (a goodness-of-fit measure) was no longer statistically significant given the loss in degrees of freedom (Loehlin, 1987, p. 62–67). Separate solutions were derived for each of the three subject groups (inpatients at admission, inpatients prior to discharge, and comparison subjects). The goodness-of-fit indices for each of these solutions were then summed, and compared to the goodness-of-fit of a single MDS solution estimated for the combined subject pool. The asymptotic chi-square statistic was used to assess the statistical significance of the loss in goodness-of-fit for the combined group model against the gain in degrees of freedom.

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