Cost-Effectiveness of Psychotherapy for Cluster C Personality Disorders: A Decision-Analytic Model in The Netherlands

Djøra I. Soeteman, PhD; Roel Verheul, PhD; Anke M. M. A. Meerman, MA; Uli Ziegler, MD; Bert V. Rossum, MA; Jos Delimon, MA; Piet Rijnierse, MD; Moniek Thunnissen, PhD; Jan J. V. Busschbach, PhD; and Jane J. Kim, PhD

Objective: To conduct a formal economic evaluation of various dosages of psychotherapy for patients with avoidant, dependent, and obsessive-compulsive (ie, cluster C) personality disorders (Structured Interview for *DSM-IV* Personality criteria).

Method: We developed a decision-analytic model to assess the cost-effectiveness of 5 dosages of psychotherapy (ie, long-term outpatient psychotherapy, short-term and long-term day hospital psychotherapy, and short-term and long-term inpatient psychotherapy) over a 5-year time horizon in terms of cost per recovered patient-year and cost per quality-adjusted life-year (QALY). Model parameters were estimated using data from 466 patients with cluster C personality disorders who were admitted to 6 specialist centers of psychotherapy in The Netherlands and assigned to 1 of the 5 treatment groups. Probabilistic analysis was conducted to explore the stability of results over uncertain data ranges. Analyses were conducted from both societal and payer perspectives.

Results: From the societal perspective and below a threshold of €2,637 (US $3,351.92) per recovered patient-year, short-term day hospital psychotherapy resulted in the highest level of benefit for its cost; above the threshold, short-term inpatient psychotherapy was the most cost-effective choice. In terms of cost per QALY, this switch point was at a threshold value of €16,570 (US $21,062.29) per QALY. From the payer perspective, the optimal strategy changed from short-term day hospital psychotherapy to short-term inpatient psychotherapy at threshold values of €9,874 (US $12,550.94) per recovered patient-year and €66,302 (US $84,277.13) per QALY.

Conclusions: This study indicates that short-term day hospital psychotherapy and short-term inpatient psychotherapy are the most cost-effective treatment strategies for patients with cluster C personality disorders. The ultimate selection depends on what cost-effectiveness threshold is considered acceptable and what perspective is adopted.

Trial Registration: controlled-trials.com Identifier: ISRCTN73817429

J Clin Psychiatry 2011;72(1):51–59

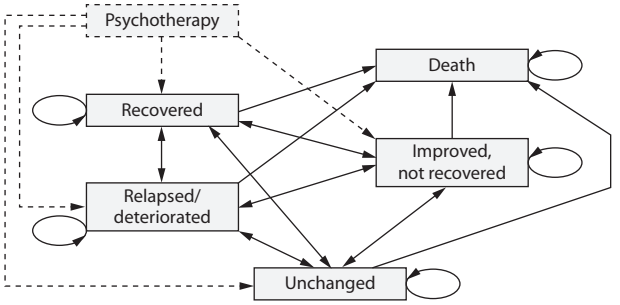
Submitted: *March 20, 2009; accepted August 3, 2009.*
Online ahead of print: *October 5, 2010 (doi:10.4088/JCP.09m05228blu).*
Corresponding author: *Djøra I. Soeteman, PhD, Viersprong Institute for Studies on Personality Disorders (VISPD), PO Box 7, 4660 AA Halsteren, The Netherlands (DSoetema@hsph.harvard.edu).*

Cluster C personality disorders, including avoidant, dependent, and obsessive-compulsive personality disorders, are among the most common mental disorders in the general population, with reported prevalence rates of 6.0–9.4%.[1,2] Moreover, these disorders are associated with high societal costs and a low quality of life.[3–5] Recently, a multidisciplinary clinical guideline of personality disorders,[6] summarizing the evidence from over 100 effectiveness studies, was published in The Netherlands. In this guideline, various modalities of psychotherapy, including outpatient, day hospital, and inpatient psychotherapy, were considered treatments of choice for cluster C personality disorders based on strong evidence of efficacy.[7] However, the economic impact of these recommendations has not yet been explored.

In a budget-constrained health care system, there is a clear need to search for the most cost-effective treatment option. Despite the high economic burden of personality disorders, little quantitative economic information is available that can guide decision making with respect to clinical practices and health care resource allocations. Recently, the Study on Cost-Effectiveness of Personality disorder TREatment (SCEPTRE) was designed to conduct an economic evaluation of various psychotherapeutic treatments for personality disorders. Patient-level primary data were available from the largest existing clinical trial of psychotherapy for personality disorders,[8] including over 900 patients that were followed for 3 years.

The objective of this study was to evaluate the cost-effectiveness of 5 dosages of psychotherapy in treating cluster C personality disorders (ie, long-term outpatient psychotherapy, short-term and long-term day hospital psychotherapy, and short-term and long-term inpatient psychotherapy). We incorporated clinical and economic patient-level data from the SCEPTRE trial in a decision-analytic model to compare the strategies over a 5-year time horizon in terms of costs per recovered patient-year and costs per quality-adjusted life-year (QALY). The decision analysis framework recognizes the need to make decisions on the basis of currently available evidence, even if that information is imperfect, and facilitates exploration of the uncertainty surrounding the decisions.[9] The findings from our study can be used to inform decision makers about the value for the cost of current treatment options for personality disorders.

Figure 1. State Transition Diagram of the Markov Model for Psychotherapy



METHOD

Model

We developed a Markov cohort model[9] to integrate clinical and economic data from the SCEPTRE trial (controlled-trials.com identifier: ISRCTN73817429). In general, the model comprises mutually exclusive and collectively exhaustive health states that represent knowable prognoses of a health condition. The Markov model simulates a cohort of patients that transition through the model over time, based on data from epidemiologic and clinical studies, and estimates the impact of different interventions on the patient population. The underlying clinical process driving the current model and by which the health states are defined is "clinically significant change," based on a statistical approach to defining meaningful change in psychotherapy research.[10] Patients are classified into 1 of 4 health states: (1) recovered (if the magnitude of change is statistically reliable and the patient ends up within normal limits on the variable of interest), (2) improved (if the patient shows statistically reliable change but ends therapy still somewhat dysfunctional), (3) unchanged (if the magnitude of change is not statistically reliable, therefore the method cannot determine whether or not the change is clinically significant), and (4) relapsed or deteriorated (if a statistically reliable change is in the opposite direction to that indicative of improvement). At anytime, patients can also die of suicide or age-specific background mortality. The structure of the Markov model is shown in Figure 1.

Four types of parameters were used in the model: (1) transition probabilities, which govern the movement between the 5 states at each cycle, (2) treatment costs of the 5 dosages of psychotherapy, (3) costs of health care utilization and productivity losses incurred by patients in each state, and (4) health state utilities, which reflect the health-related quality of life experienced by patients in each state. These data were obtained from a single patient-level data source (ie, the SCEPTRE trial). A nonrandomized clinical trial design was chosen to optimize feasibility and external validity. Naturalistic trials have several advantages for economic evaluation and accordingly have a high status.[11,12] To overcome the problem of selection bias, we controlled for initial differences in patient characteristics with the propensity score method (see below). The results are based on intention-to-treat analyses.

Transitions between health states in the model occur over time at a constant interval that was assumed to be 6 months, corresponding to multiple changes in pathology, symptoms, treatment decisions, or costs for patients with personality disorders. The time horizon of the analysis was 5 years, which is the duration of the clinical trial expanded by 2 years. Costs per recovered patient-year and costs per quality-adjusted life-year (QALY) were estimated over the 5 years using the model; costs and QALYs were discounted at an annual rate of 4.0% and 1.5%, respectively, consistent with guidelines for economic evaluations in The Netherlands.[13] The base case analysis was conducted from the societal perspective, and a secondary analysis was conducted from the payer perspective.

Recruitment and Assignment

Patients were recruited from a consecutive series of admissions to 6 mental health care institutes in The Netherlands offering specialized psychotherapy for adult patients with personality disorders. Diagnoses were based on the Dutch version[14] of the Structured Interview for *DSM-IV* Personality.[15] Interrater reliability was good.[3] For this particular study, inclusion criteria were a diagnosis of cluster C personality disorders, age 18 to 70 years, assignment to a specified dosage of psychotherapeutic treatment for personality disorders, and Dutch literacy. Exclusion criteria were psychotic disorders (eg, schizophrenia), organic cerebral impairment, and mental retardation. Comorbid Axis I and Axis II disorders were allowed.

From March 2003 to March 2006, 1,379 individuals completed the intake procedure and were selected for various treatment options. Of those, 466 patients were eligible, provided informed consent, and entered the study. The study was approved by the Dutch medical ethics committee.

The treatments in the 6 institutes differ widely in terms of setting, duration, intensity, theoretical framework, and therapeutic techniques. This study compares dosage, specified by a combination of treatment setting (outpatient, day hospital, and inpatient) and duration (short-term, or up to 6 months, versus long-term, or more than 6 months).

Patients were assigned to 1 of 6 treatment groups on the basis of a comprehensive assessment battery combined with the expert opinion of clinicians. Only a few patients with cluster C personality disorders were assigned to short-term outpatient psychotherapy (n = 18). Therefore, and because this particular dosage is not recommended in clinical guidelines, this option was excluded from the study. Thus, the treatments under study were long-term outpatient psychotherapy, short-term and long-term day hospital psychotherapy, and short-term and long-term inpatient psychotherapy.

In the long-term outpatient strategy, patients are offered up to 2 sessions per week of individual or group psychotherapy for more than 6 months. In the short-term day hospital strategy, patients are offered psychotherapy combined with sociotherapy and/or nonverbal therapies for 1 to 5 days per week for up to 6 months. In the long-term day

© Copyright 2010 Physicians Postgraduate Press, Inc.

Table 1. Demographic, Clinical, and Treatment Characteristics of 448 Study Participants by Psychotherapy Dosage

Characteristic	Long-Term Outpatient (n = 96)	Short-Term Day Hospital (n = 85)	Long-Term Day Hospital (n = 103)	Short-Term Inpatient (n = 63)	Long-Term Inpatient (n = 101)
Age, mean (SD), y	36.2 (9.0)	35.0 (9.5)	31.9 (9.7)	37.6 (9.3)	28.4 (6.6)
Sex, %					
Female	66.7	77.6	75.7	61.9	65.3
Comorbidity Axis II, %					
Pure cluster C (no comorbid cluster A/B)	60.4	65.9	61.2	85.7	63.4
Cluster C and cluster B	27.1	27.1	21.4	9.5	27.7
Cluster C and cluster A	7.3	2.4	4.9	1.6	4.0
Cluster C and both cluster A and B	5.2	4.7	12.6	3.2	5.0
Personality disorder, %					
Avoidant	53.1	52.9	67.0	66.7	73.3
Obsessive-compulsive	58.3	52.9	42.7	46.0	40.6
Dependent	13.5	28.2	28.2	17.5	26.7
Treatment characteristics, mean (SD)					
Duration, mo	15.5 (6.4)	5.4 (1.3)	12.1 (2.6)	4.3 (1.5)	10.2 (2.0)
No. sessions or d/wk	0.8 (0.5)	3.2 (1.5)	3.3 (1.4)	5.0 (0.0)	5.0 (0.0)

hospital strategy, patients are offered the same for more than 6 months. The inpatient strategy also offers psychotherapy combined with sociotherapy and/or nonverbal therapies, but patients reside in the treatment centers 5 days per week. The therapists were licensed psychiatrists or psychologists. They had a mean of 14.9 years (SD = 10.1) of postgraduate clinical experience. See Table 1 for an overview of demographic, clinical, and treatment characteristics of the study participants in each treatment group.

Input Data

Transition probabilities. The percentage of patients in the recovered, improved, unchanged, and relapsed or deteriorated health states was determined at 6, 12, 24, 36, and 42 months after baseline from the SCEPTRE trial. Based on the difference between the frequency distributions over time, the probabilities of transitioning from 1 state to another in each time period were calculated. The 1-year probabilities, ie, between 12–24 and 24–36 months, were first converted to rates and then to 6-month probabilities.[9] Several methods of extrapolating the transition probabilities were considered to fit the 5-year time horizon of the model. On the basis of the best fit to the data, we elected to average the last 2 observations from the trial and hold those values constant over the last 1.5 years of the analysis. Transition probabilities over time are provided in eAppendix 1.

Costs. Costs were estimated from both societal and payer perspectives. The calculations from the societal perspective included direct medical costs (ie, primary treatment costs and costs of health care utilization postdischarge) and direct nonmedical costs (ie, lost productivity due to time spent in treatment), as well as indirect costs (ie, future lost productivity due to disease), while the payer perspective included only direct medical costs. Mean primary treatment costs for the 5 strategies were calculated by multiplying the resource quantities with the 2007 unit costs or prices of the corresponding treatment options. We obtained data from the hospital finance departments on staff salaries, equipment, buildings, and departmental overheads, and we used a microcosting approach to derive the cost of a treatment session and an inpatient day. The resource quantities were collected from the hospital data systems. Costs due to productivity loss because of patients' time in treatment were also estimated and included in the analysis from the societal perspective. The mean (SE) treatment costs were €10,005 (€1,134) (US $12,717.46 [$1,441.44]; euros were converted to US dollars by using the exchange rate on August 26, 2010, of 1 euro = 1.27111 US dollars) for long-term outpatient psychotherapy, €16,813 (€1,361) (US $21,371.17 [$1,729.98]) for short-term day hospital psychotherapy, €27,648 (€2,654) (US $35,143.65 [$3,373.53]) for long-term day hospital psychotherapy, €25,933 (€859) (US $32,963.70 [$1,091.88]) for short-term inpatient psychotherapy, and €49,260 (€2,435) (US $62,614.88 [$3,095.15]) for long-term inpatient psychotherapy.

Postdischarge costs due to health care utilization and productivity losses may still be substantial; therefore, we assigned a cost to each health state. The Trimbos and Institute for Medical Technology Assessment Questionnaire on Costs Associated With Psychiatric Illness (TiC-P) was used to collect data on direct medical and indirect costs.[16] Bottom-up methodology was used to calculate the direct medical costs; for example, the total number of medical visits (eg, outpatient visits, hospital lengths of stay, use of medication) was multiplied by the 2003 unit prices of the corresponding health care services.[17,18] The reference unit prices of health care services for 2003 were adjusted to prices in 2007 using the consumer price index.[19] The mean direct medical costs per 4 weeks were multiplied by 6.5 to calculate the half-yearly costs to correspond to the model cycle length. In addition, the TiC-P includes a short form of the Health and Labor Questionnaire consisting of 3 modules that measure indirect costs: absence from work, reduced efficiency at work, and difficulties with job performance.[20] The days of short-term absence from work and actual hours missed at work because of health-related problems were multiplied by the net income of the patient per day and per hour, respectively. The number of lost working days per patient was calculated, taking into account the number of days and hours of paid employment of the patient per week. To value long-term absence from work, we applied the friction-cost method. This method takes into account the economic circumstances that limit the losses of productivity to society, which is related to the fact that a formerly unemployed person may replace a person who becomes disabled.[21] The period needed to replace a worker (the so-called friction period) is estimated to

© Copyright 2010 Physicians Postgraduate Press, Inc.

Table 2. Values for Model Input Parameters: Health State Costs and Utilities Over Time From the Societal Perspective

	Recovered	Improved	Unchanged	Relapsed or deteriorated
Health state costs,[a] mean (SE), €				
1–2 y	6,714 (2,257)	15,287 (5,126)	7,836 (1,913)	42,526 (12,866)
3 y	3,390 (818)	6,754 (2,801)	4,474 (934)	13,753 (6,818)
4–5 y	1,903 (304)	6,284 (3,377)	6,852 (1,562)	15,229 (9,092)
Health utilities,[b] mean (SE)				
0.5 y	0.87 (0.02)	0.76 (0.09)	0.69 (0.13)	0.43 (0.09)
1.0 y	0.84 (0.03)	0.72 (0.04)	0.70 (0.03)	0.43 (0.09)
1.5 y	0.82 (0.02)	0.69 (0.03)	0.67 (0.02)	0.52 (0.06)
2.0 y	0.84 (0.02)	0.64 (0.04)	0.70 (0.03)	0.42 (0.09)
2.5 y	0.83 (0.02)	0.67 (0.04)	0.72 (0.02)	0.61 (0.07)
3.0 y	0.88 (0.02)	0.55 (0.08)	0.63 (0.06)	0.53 (0.28)
4–5 y	0.86 (0.01)	0.67 (0.04)	0.70 (0.02)	0.16 (0.06)

[a]Mean cost estimates of a half year spent in each of the model health states. Estimates include postdischarge costs due to health care utilization and productivity losses. As costs may vary according to time in model, we calculated different cost estimates for the first 2 years, the third year, and the last 2 years in the model. [b]Mean quality of life utilities of a year spent in each of the model health states. In the model, the reported utility weights were divided by 2 to fit the half-yearly cycle. As quality of life may vary according to time in model, we calculated different utility weights for time intervals of 6 months until year 3. For the last 2 years in the model, a constant utility weight was used.

be 5 months. Hence, the maximum indirect costs to society were confined to productivity losses during a period of 5 months. The mean costs associated with spending 6 months in each health state are summarized in Table 2. To reflect the change in costs over time, we further delineated these data by number of years in the model. For each strategy, the model calculates the expected cost by taking a weighted average of the costs of each health state and the proportion of the cohort in each health state at each 6-month period; the total expected cost of the strategy is then calculated by summing over the 5-year time horizon.

Health utilities. To reflect the diminished quality of life of patients with personality disorders, health utility weights were assigned to each health state, using the EuroQol EQ-5D.[22] The descriptive system of the EQ-5D records quality of life in 5 dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is divided into 3 response levels: no problems, some or moderate problems, and extreme problems or complete inability. The combination of scores makes up a total of 243 different possible health states, each weighted to arrive at a single index score between −0.33 (worst imaginable health state) and 1.00 (best imaginable health state). The Dutch norm scores were used for calculating the mean EQ-5D index values.[23] The mean quality of life utilities of a year spent in each of the model health states for each cycle are summarized in Table 2. The expected number of QALYs for each strategy was estimated by weighing the duration of time in a particular health state by the utility of that health state and then summing over all health states in each cycle. The expected number of QALYs per patient over 5 years was calculated by summing over all cycles.

Mortality rates. In our model, we assumed that patients in the recovered health state had a risk of death equivalent to that observed in the general population. These age- and sex-specific mortality rates were obtained from standard life tables.[24] Moreover, we assumed patients in the improved, unchanged, and relapsed or deteriorated health states faced an elevated risk of death due to suicide, estimated to be a half-yearly probability of 0.00127 based on the SCEPTRE data.

Propensity Score Method

To overcome the problem of selection bias, we controlled for initial differences in patient characteristics with the multiple propensity score method.[25] The estimated propensity score is defined as the conditional probability of assignment to a particular treatment, given a set of observed pretreatment characteristics. Details of the method and the variables used to estimate the propensity scores are described elsewhere.[8,26] Multinomial regression analyses were conducted to adjust the transition probabilities for the multiple propensity scores.

Probabilistic Sensitivity Analysis

In order to explore the impact of uncertainty across multiple parameters simultaneously, we conducted a probabilistic analysis in which distributions were assigned to the input parameters of the model, ie, γ distributions for costs and β distributions for utilities. We assumed probability parameters followed a Dirichlet distribution, a continuous distribution that is the multivariate generalization of the β distribution.[9] These distributions reflect the characteristics of the type of parameter and its method of estimation (eg, probabilities are bound by the values of 0 and 1, and cost data are often highly skewed). The probabilistic analysis was undertaken by randomly sampling from each of the parameter distributions and calculating the expected costs, expected recovery rate, and QALY for each strategy using that combination of parameter values in the model. This process was replicated 1,000 times (ie, second-order Monte Carlo simulation) for each treatment option and represented on a cost-effectiveness plane. The outcomes projected from all 1,000 simulations were used in the cost-effectiveness analysis.

Cost-Effectiveness Analysis

We compared the 5 psychotherapy dosage strategies by conducting a cost-effectiveness analysis. Strategies that were more costly and less effective than an alternative option were considered suboptimal (ie, strongly dominated) and were therefore eliminated from the final cost-effectiveness calculations. For the remaining strategies, the incremental cost-effectiveness ratio (ICER) was calculated as the additional cost divided by the additional health benefit of the treatment, compared with the next best nondominated treatment. The mean values of costs and QALYs across all 1,000 simulations were used to calculate the ICER associated

© Copyright 2010 Physicians Postgraduate Press, Inc.

with each strategy. The most cost-effective strategy was then identified by comparing the ICERs of different strategies against various threshold values, which reflect the decision maker's willingness to pay (WTP) for an additional unit of effect. Strategies below a specific WTP value generally represent good value for money; the "most cost-effective" strategy is the strategy with the highest ICER below the WTP threshold, representing the option that yields the highest level of benefit for its cost.

In order to reflect the uncertainty in the parameter values, cost-effectiveness acceptability curves (CEACs) were created to indicate the probability of each option being cost-effective conditional on the decision maker's WTP for a recovered patient-year or QALY.[27] The curve summarizes the proportion of simulations in which strategies are identified as being cost-effective at different potential WTP threshold values. Finally, the cost-effectiveness acceptability frontier (CEAF) was plotted to portray each CEAC over the range of threshold values for which each option is estimated to be the most cost-effective, as well as the threshold ICER at which there are changes in the optimal dosage (ie, "switch points").[28]

Table 3. Discounted Costs and Health Outcomes Over 1 and 5 Years From the Societal Perspective

	1 Year			5 Years		
Psychotherapy Dosage	Costs[a]	% Recovered[b]	QALYs[c]	Costs[a]	% Recovered[b]	QALYs[c]
Short-term day hospital	€ 40,070	26.0	0.70	€ 89,411	46.8	3.44
Long-term outpatient	€ 36,766	19.2	0.69	€ 89,936	31.3	3.30
Short-term inpatient	€ 44,460	60.9	0.78	€ 91,620	49.0	3.57
Long-term day hospital	€ 56,772	37.1	0.71	€ 105,940	49.8	3.49
Long-term inpatient	€ 73,456	40.8	0.73	€ 119,946	43.7	3.49

[a]Values represent mean cumulative costs per patient, including treatment costs and costs involved with spending time in each of the model health states. [b]Percentage of patients resided in the recovered health state. [c]Mean number of QALYs gained per patient. For someone spending his or her time in perfect health, the maximum amount of QALYs would have been 1.0 at 1 year and 5.0 at 5 years. For the current model, this will be slightly lower, as the most optimal health state (recovered) is assigned a utility weight of 0.82–0.88 over time.
Abbreviation: QALYs = quality-adjusted life-years.

Table 4. Cost-Effectiveness Analysis Over a 5-Year Time Horizon

Societal Perspective		
Psychotherapy Dosage	Cost per Recovered Patient-Year	Cost per QALY
Short-term day hospital	…[b]	…[b]
Long-term outpatient	Strongly dominated[a]	Strongly dominated[a]
Short-term inpatient	€ 2,637[c]	€ 16,570[c]
Long-term day hospital	Strongly dominated[a]	Strongly dominated[a]
Long-term inpatient	Strongly dominated[a]	Strongly dominated[a]
Payer Perspective		
Psychotherapy Dosage	Cost per Recovered Patient-Year	Cost per QALY
Short-term day hospital	…[b]	…[b]
Long-term outpatient	Strongly dominated[a]	Strongly dominated[a]
Short-term inpatient	€ 9,874[c]	€ 66,302[c]
Long-term day hospital	Strongly dominated[a]	Strongly dominated[a]
Long-term inpatient	Strongly dominated[a]	Strongly dominated[a]

[a]These strategies are more costly and less effective than an alternative strategy and are thus considered dominated. [b]This strategy is nondominated and considered the comparison group in the ICER mentioned. [c]This strategy is more effective than short-term day hospital psychotherapy, but also more costly. The values represent incremental ICERs calculated as the difference in QALYs or recovered patient-years between the strategy (short-term inpatient psychotherapy) and the next best nondominated strategy (short-term day hospital psychotherapy).
Abbreviations: ICER = incremental cost-effectiveness ratio, QALY = quality-adjusted life-year.
Symbol: … = not applicable.

RESULTS

One-Year and 5-Year Costs and Health Outcomes

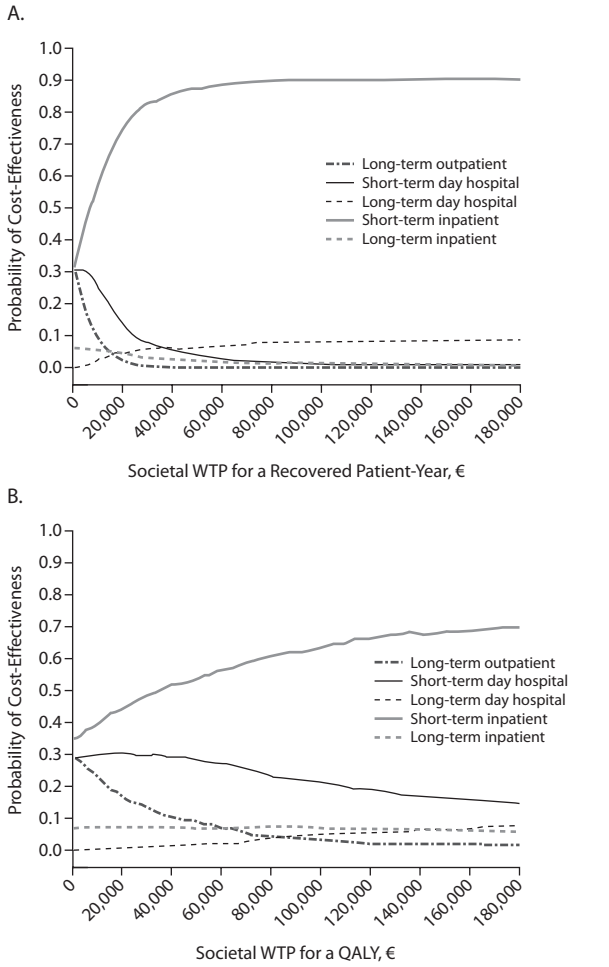
The mean 1-year and 5-year costs and health outcomes from the societal perspective are presented in Table 3. The table shows that the treatment options differ widely in both costs and health outcomes at 1 year, while these differences tend to become less pronounced over time. Short-term inpatient psychotherapy stands out as the most effective option at 1 year, and long-term outpatient psychotherapy appears to be the least effective option at both time points. Despite differences in treatment costs, long-term outpatient psychotherapy, short-term day hospital psychotherapy, and short-term inpatient psychotherapy are associated with similar overall costs at both time points. Furthermore, the costs associated with these 3 treatments are substantially lower than with long-term day hospital psychotherapy and long-term inpatient psychotherapy.

Cost-Effectiveness Analysis From the Societal Perspective

The cost-effectiveness analysis over a 5-year time horizon is displayed in Table 4. The values represent the ICER expressed as cost per recovered patient-year and cost per QALY. Long-term day hospital psychotherapy and long-term inpatient psychotherapy were strongly dominated (ie, more costly and less effective) by short-term inpatient psychotherapy, and thus eliminated. Long-term outpatient psychotherapy was dominated by short-term day hospital psychotherapy and thus had to be eliminated; however, differences in costs between these strategies were small. Of the remaining treatment strategies, short-term day hospital psychotherapy yields the lowest costs and health benefits; short-term inpatient psychotherapy yields higher costs and effects and was associated with an ICER of €2,637 (US $3,351.92) per recovered patient-year and an ICER of €16,570 (US $21,062.29) per QALY compared to short-term day hospital psychotherapy.

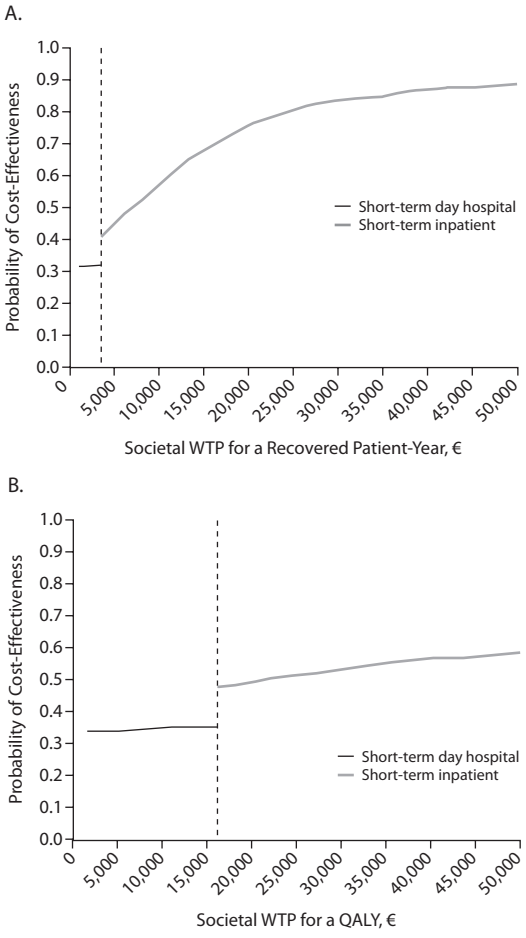
To explore the uncertainty in model parameter values, we conducted a probabilistic analysis and plotted the relationship between cost and health outcomes for each of the 5 competing psychotherapy dosages over 1,000 simulations in the cost-effectiveness plane (eAppendix 2). We found substantial uncertainty about both costs and effects for all treatment options; however, the uncertainty around the effects was greater when health outcomes were expressed

Figure 2. Cost-Effectiveness Acceptability Curves (CEAC) Showing the Probability of Each Option Being Cost-Effective at Different Values of the Societal WTP ([A] CEAC for Recovered Patient-Year and [B] CEAC for QALY)



Abbreviations: QALY = quality-adjusted life-year, WTP = willingness to pay.

Figure 3. Cost-Effectiveness Acceptability Frontiers (CEAF) Showing the Optimal Dosage for Each Value of the Societal WTP ([A] CEAF for Recovered Patient-Year and [B] CEAF for QALY)[a]



[a]The switch points, at which there is a change in the optimal option from short-term day hospital psychotherapy to short-term inpatient psychotherapy, were located at a threshold value of €2,637 (US $3,351.92) per recovered patient-year and €16,570 (US $21,062.29) per QALY.

Abbreviations: QALY = quality-adjusted life-year, WTP = willingness to pay.

in terms of recovered patient-years (eAppendix 2A) as opposed to QALYs (eAppendix 2B). Furthermore, the observed differences in health effects among the 5 treatment strategies were more pronounced in terms of recovered patient-years than QALYs.

Figure 2 shows the CEAC representing the probability of each option being cost-effective at different values of the societal WTP for a unit of health benefit. In terms of both cost per recovered patient-year and cost per QALY, short-term inpatient psychotherapy has the highest probability of being cost-effective independent of the value of the societal WTP, whereas long-term day hospital psychotherapy and long-term inpatient psychotherapy have a negligible probability of being cost-effective. The CEAC crosses the Y-axis at the probability that the intervention under evaluation is cost-saving.[29] According to the current analysis, 3 dosages (ie, short-term day hospital psychotherapy, short-term inpatient psychotherapy, and long-term outpatient psychotherapy) have a probability of being cost-saving in approximately one-third of the cases.

However, the probability of a strategy being cost-effective is not sufficient to determine the optimal option. If the societal objective is to maximize health gain, then decisions should be made on the basis of expected net benefit, regardless of the uncertainty (probability) associated with the decision.[27] To identify the optimal treatment option, (ie, the option with the highest expected net benefit for a given cost), the CEAFs were plotted (Figure 3). The CEAF of cost per recovered patient-year shows the range of threshold values over which short-term day hospital psychotherapy (€0 to €2,637 [US $0 to $3,351.92]) and short-term inpatient psychotherapy (above €2,637 [US $3,351.92]) have the highest expected net benefit and can be considered the optimal choice. The switch point, at which there is a change in the

© Copyright 2010 Physicians Postgraduate Press, Inc.

optimal option, corresponds to the ICER between short-term day hospital and short-term inpatient psychotherapy. In terms of costs per QALY, the switch point was located at a threshold value of €16,570 (US $21,062.29). If society's WTP for a QALY is below this threshold, short-term day hospital is the most cost-effective choice; above this value, the optimal strategy would be short-term inpatient psychotherapy.

Cost-Effectiveness Analysis From the Payer Perspective

The CEAF of cost per recovered patient-year and cost per QALY from the payer perspective show the same pattern of results as from the societal perspective, with short-term day hospital psychotherapy and short-term inpatient psychotherapy being the optimal treatments. However, the switch points were located at higher threshold values: €9,874 (US $12,550.94) per recovered patient-year, and €66,302 (US $84,277.13) per QALY (Table 4).

DISCUSSION

Using decision-analytic modeling, we estimated the cost-effectiveness of 5 dosages of psychotherapy for cluster C personality disorders over a 5-year time horizon from both the societal and payer perspective. To our knowledge, this is the first economic evaluation focusing on various dosages of psychotherapy for this particular patient population. It is important to note that current clinical guidelines are confined to borderline personality disorders, except for the Dutch Multidisciplinary Clinical Guideline of Personality Disorders, which spans the broad spectrum of personality disorders.[6] However, all available guidelines are exclusively based on effectiveness data. This study therefore has the potential to contribute significantly to the knowledge base guiding rational decision making with respect to clinical practices and health care resource allocation.

This economic evaluation yields 2 cost-effective treatment options for cluster C personality disorders. Our findings indicate that if societal WTP does not exceed €2,637 (US $3,351.92) per recovered patient-year or €16,570 (US $21,062.29) per QALY, short-term day hospital psychotherapy provides the highest expected net benefit and can be considered the preferred option. Above these values, short-term inpatient psychotherapy is the optimal choice. Reasonably, we can assume that society is willing to spend more than €2,637 (US $3,351.92) per recovered patient-year, and thus, in terms of cost per recovered patient-year, short-term inpatient psychotherapy is the optimal choice. Our results in terms of cost per QALY can be interpreted according to recommendations by the Dutch Council for Public Health and Health Care.[30] For acutely life-threatening illnesses (with a maximum burden of disease), an explicit maximum of €80,000 (US $101,688.80) per QALY was recommended. For less life-threatening illnesses that only affect quality of life, the council recommends a proportional lower acceptable threshold. Cluster C personality disorders are associated with a severe impairment in quality of life.[4] The observed burden of 0.47 (ie, mean EQ-5D index value of 0.53; range, 0.52 to 0.54) indicates that treatments may cost up to €37,600 (US $47,793.73) per QALY to be acceptable. On the basis of this threshold value, short-term inpatient psychotherapy can be identified as the most cost-effective and thus optimal option, as it provides the greatest benefit below the threshold.

Differences in health effects among strategies were more pronounced when outcomes were expressed in terms of recovered patient-years than in terms of QALYs. While this phenomenon has been reported previously by a cost-effectiveness analysis comparing 2 psychotherapies for borderline personality disorders,[31] it seems surprising because 2 independent studies reported a Pearson correlation coefficient of −0.49 between the EQ-5D and recovery measures, indicating reasonable convergence.[32,33] Our results suggest that, despite the sensitivity of the EQ-5D in distinguishing quality of life associated with particular health states, QALYs are nonetheless less adequate measures for discriminating levels of change between the different dosages of psychotherapy. Despite the observed divergence, however, the cost-effectiveness results for the 2 effect measures were qualitatively consistent, thereby supporting the robustness of the findings.

Interestingly, it appears that a dosage that initially seems expensive (ie, short-term inpatient psychotherapy; treatment costs €25,933 [US $32,963.70]) turns out to be the most cost-effective option over time when costs due to other health care utilization and productivity losses are accounted for. In contrary, the dosage that initially seems the cheapest (ie, long-term outpatient psychotherapy; treatment costs €10,005 [US $12,717.46]) is unmasked as a less cost-effective treatment. These findings demonstrate the added value of cost-effectiveness analysis from a broader perspective than just the treatment costs.

Several clinical implications can be derived from our analyses. From a health-economic perspective, short-term inpatient psychotherapy and short-term day hospital psychotherapy should be considered the options of first choice for patients with cluster C personality disorders, based on accepted willingness to pay thresholds. Interestingly, this conclusion is consistent with several efficacy and effectiveness studies.[7] Note, however, that this study is intended to inform recommendations from the public health (ie, population) perspective and is not inherently designed to inform decision making at the individual level. Although we used primary patient-level data from a clinical study, we used those data to inform population averages (and plausible ranges) for our parameters. As a result, we were limited in our ability to examine individual-level heterogeneity such that there will undoubtedly be some patients, for example, for whom another treatment dosage may be the best option. Also, we find it important to emphasize that cost-effectiveness is only 1 aspect of medical decision making; other important factors that were not considered in our model include (1) strong patient preference for another option or (2) contraindications for short-term day hospital or inpatient treatment. The latter may be the case in those patients who lack the psychological

strength required to profit from such treatments that are usually characterized by a rather confrontational or expressive therapeutic milieu.[7] It is important to note, however, that our results identify long-term outpatient psychotherapy, long-term day hospital psychotherapy, and long-term inpatient psychotherapy as suboptimal treatment options for this patient group. Future research should investigate patient-treatment matching hypotheses in this respect. Moreover, although the patient group under study is homogeneous in the sense that the patients all have cluster C personality disorders, the potential for the resulting cost-effectiveness to vary across different subgroups should be examined.

The major strength of this study was the collective use of the state-of-the-art technology and patient-level primary data to estimate the cost-effectiveness of health care interventions. Decision-analytic modeling provides a framework for informed decision making under conditions of uncertainty. Furthermore, the availability of primary data from such a large patient trial provided a unique opportunity to inform the parameters of our model, as most modeling studies are based on secondary data.

Our analysis has a number of limitations. First, the model is developed using data from a treatment-seeking patient population, and in particular for those who seek specialized psychotherapy for personality problems. Therefore, the applicability of the results to non–treatment seekers, forensic care, or patients who admit with a primary Axis I diagnosis, is limited. Second, this study compares only dosage, whereas the included treatments may also differ in terms of other characteristics, such as theoretical orientation and therapeutic techniques. This limitation is somewhat mitigated by studies showing that theoretical orientation as a treatment parameter might only account for minor differences in effects—if any[34,35]—and is not likely to be associated with costs. Finally, the data source for our model was a nonrandomized clinical trial that might be limited because patients were not randomized over treatment conditions. However, this apparent drawback might be considered an advantage within the context of economic evaluations because nonrandomized studies are likely to be more representative and thus externally valid with respect to costs and effects.[11,12] Moreover, randomization between existing treatment options is no longer feasible, because once information about a therapy's clinical effectiveness is available, patients may not be willing to participate in experiments simply to evaluate their value for the cost. Exactly because of this reason, the same research group recently failed to conduct a randomized clinical trial comparing inpatient and outpatient psychotherapy for cluster C personality disorders. To overcome the problem of selection bias, we controlled for initial differences in patient characteristics with the propensity score method.[26]

It can be concluded from our model-based analysis that short-term day hospital psychotherapy and short-term inpatient psychotherapy are the optimal treatment dosages for cluster C personality disorders in terms of cost per recovered patient-year and cost per QALY, while the ultimate choice depends on what cost-effectiveness threshold is acceptable. It is important to note that the decision for the optimal choice is surrounded by uncertainty, and that there is a possibility of making a wrong decision on a patient level. In order to reduce the uncertainty associated with that decision, future work should include a so-called value-of-information analysis that addresses whether or not it is cost-effective to undertake additional research regarding 1 or more uncertain parameters in the decision model.

Author affiliations: Department of Medical Psychology and Psychotherapy, Erasmus Medical Center, Rotterdam (Drs Soeteman and Busschbach); Department of Clinical Psychology, University of Amsterdam (Dr Verheul); Viersprong Institute for Studies on Personality Disorders (VISPD), Halsteren (Drs Soeteman, Busschbach, and Verheul and Mr Delimon); Center of Psychotherapy De Gelderse Roos, Lunteren (Ms Meerman); Medical Center Zaandam (Dr Ziegler); Altrecht, Utrecht (Mr Rossum); Center of Psychotherapy Arkin, Amsterdam (Dr Rijnierse); GGZ Westelijk Noord-Brabant (GGZWNB), Bergen op Zoom (Dr Thunnissen), The Netherlands; Center for Health Decision Science, Department of Health Policy and Management, Harvard School of Public Health, Boston, Massachusetts (Dr Kim).
Potential conflicts of interest: None reported.
Funding/support: This research was supported by the Trustfonds of the Erasmus University, Rotterdam, The Netherlands.
Acknowledgments: We acknowledge the contributions of the participating specialist centers of psychotherapy in The Netherlands: Center of Psychotherapy De Gelderse Roos, Lunteren; Medical Center Zaandam; Altrecht, Utrecht; Center of Psychotherapy Arkin, Amsterdam; GGZWNB, Bergen op Zoom; Center of Psychotherapy De Viersprong, Halsteren.

REFERENCES

1. Torgersen S, Kringlen E, Cramer V. The prevalence of personality disorders in a community sample. *Arch Gen Psychiatry*. 2001;58(6):590–596.
2. Lenzenweger MF, Lane MC, Loranger AW, et al. DSM-IV personality disorders in the national comorbidity survey replication. *Biol Psychiatry*. 2007;62(6):553–564.
3. Soeteman DI, Hakkaart-van Roijen L, Verheul R, et al. The economic burden of personality disorders in mental health care. *J Clin Psychiatry*. 2008;69(2):259–265.
4. Soeteman DI, Verheul R, Busschbach JJV. The burden of disease in personality disorders: diagnosis-specific quality of life. *J Pers Disord*. 2008; 22(3):259–268.
5. Bender DS, Dolan RT, Skodol AE, et al. Treatment utilization by patients with personality disorders. *Am J Psychiatry*. 2001;158(2):295–302.
6. Landelijke Stuurgroep Richtlijnontwikkeling in de GGZ. *Multidisciplinaire Richtlijn Persoonlijkheidsstoornissen* [Multidisciplinary Clinical Guideline of Personality Disorders]. Utrecht, The Netherlands: Trimbos-instituut; 2008.
7. Verheul R, Herbrink M. The efficacy of various modalities of psychotherapy for personality disorders: a systematic review of the evidence and clinical recommendations. *Int Rev Psychiatry*. 2007;19(1):25–38.
8. Bartak A, Spreeuwenberg MD, Andrea H, et al. Effectiveness of different modalities of psychotherapeutic treatment for patients with cluster C personality disorders: results of a large prospective multicentre study. *Psychother Psychosom*. 2010;79(1):20–30.
9. Briggs AH, Sculpher MJ, Claxton K. *Decision Modelling for Health Economic Evaluation*. New York, NY: Oxford University Press; 2006.
10. Jacobson NS, Truax P. Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. *J Consult Clin Psychol*. 1991;59(1):12–19.
11. Drummond MF, Sculpher MJ, Torrance GW, et al. *Methods for the Economic Evaluation of Health Care Programmes*. 3rd ed. New York, NY: Oxford University Press; 2005.
12. Glick HA, Doshi JA, Sonnad SS, et al. *Economic Evaluation in Clinical Trials*. New York, NY: Oxford University Press; 2007.
13. Health Care Insurance Board (CVZ). Dutch Guidelines for Pharmacoeconomic Research. 2006. http://www.ispor.org/PEguidelines/source/HTAGuidelinesNLupdated2006.pdf.
14. De Jong CAJ, Derks FCH, Van Oel CJ, et al. *Gestructureerd Interview voor de DSM-IV persoonlijkheidsstoornissen (SIDP-IV)*. Sint Oedenrode,

© Copyright 2010 Physicians Postgraduate Press, Inc.

The Netherlands: Stichting Verslavingszorg Oost-Brabant; 1996.
15. Pfohl B, Blum N, Zimmerman M. *Structured Interview for DSM-IV Personality (SIDP-IV)*. Washington, DC: American Psychiatric Press; 1995.
16. Hakkaart-van Roijen L. *Manual Trimbos/iMTA Questionnaire for Costs Associated With Psychiatric Illness* [in Dutch]. Rotterdam, The Netherlands: Institute for Medical Technology Assessment; 2002.
17. Oostenbrink JB, Bouwmans CAM, Koopmanschap MA, et al. *Manual for Cost Research: Methods and Unit-Prices for Economic Evaluations in Health Care* [in Dutch], updated version. Amstelveen, The Netherlands: The Health Care Insurance Board (CVZ); 2004.
18. Health Care Insurance Board (CVZ). Pharmacotherapeutic Compass. 2005. http://www.fk.cvz.nl.
19. Consumer Price Index. Central Bureau for Statistics [in Dutch] Web site. http://statline.cbs.nl
20. van Roijen L, Essink-Bot ML, Koopmanschap MA, et al. Labor and health status in economic evaluation of health care: The Health and Labor Questionnaire. *Int J Technol Assess Health Care*. 1996;12(3): 405–415.
21. Koopmanschap MA, Rutten FFH. A practical guide for calculating indirect costs of disease. *Pharmacoeconomics*. 1996;10(5):460–466.
22. Brooks R, Rabin R, de Charro F. *The Measurement and Valuation of Health Status Using EQ-5D: A European Perspective*. London, England: Kluwer Academic Publishers; 2003.
23. Lamers LM, Stalmeier PFM, McDonnell J, et al. Measuring the quality of life in economic evaluations: the Dutch EQ-5D tariff [in Dutch]. *Ned Tijdschr Geneeskd*. 2005;149(28):1574–1578.
24. Life tables. Central Bureau for Statistics [in Dutch] Web site. http://statline.cbs.nl
25. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika*. 1983;70(1):41–55.
26. Bartak A, Spreeuwenberg MD, Andrea H, et al. The use of propensity score methods in psychotherapy research: a practical application. *Psychother Psychosom*. 2009;78(1):26–34.
27. Fenwick E, Claxton K, Sculpher MJ. Representing uncertainty: the role of cost-effectiveness acceptability curves. *Health Econ*. 2001;10(8): 779–787.
28. Barton GR, Briggs AH, Fenwick EAL. Optimal cost-effectiveness decisions: the role of the cost-effectiveness acceptability curve (CEAC), the cost-effectiveness acceptability frontier (CEAF), and the expected value of perfection information (EVPI). *Value Health*. 2008;11(5):886–897.
29. Fenwick E, O'Brien BJ, Briggs A. Cost-effectiveness acceptability curves—facts, fallacies and frequently asked questions. *Health Econ*. 2004;13(5):405–415.
30. Council for Public Health and Health Care. *Sensible and Sustainable Care* [in Dutch]. The Hague, The Netherlands; 2006. www.rvz.net/data/download/Advies_DenZ_samenvatting_engels.doc
31. van Asselt ADI, Dirksen CD, Arntz A, et al. Out-patient psychotherapy for borderline personality disorder: cost-effectiveness of schema-focused therapy v. transference-focused psychotherapy. *Br J Psychiatry*. 2008; 192(6):450–457.
32. Soeteman DI, Timman R, Trijsburg RW, et al. Assessment of the burden of disease among inpatients in specialized units that provide psychotherapy. *Psychiatr Serv*. 2005;56(9):1153–1155.
33. van Asselt ADI, Dirksen CD, Arntz A, et al. The EQ-5D: a useful quality of life measure in borderline personality disorder? *Eur Psychiatry*. 2009; 24(2):79–85.
34. Svartberg M, Stiles TC, Seltzer MH. Randomized, controlled trial of the effectiveness of short-term dynamic psychotherapy and cognitive therapy for cluster C personality disorders. *Am J Psychiatry*. 2004;161(5) :810–817.
35. Leichsenring F, Rabung S, Leibing E. The efficacy of short-term psychodynamic psychotherapy in specific psychiatric disorders: a meta-analysis. *Arch Gen Psychiatry*. 2004;61(12):1208–1216.

eAppendixes 1 and 2 are available at PSYCHIATRIST.COM.

eAppendix 1. Mean 6-Month Probabilities of Transitioning From One State to Another in Each Time Period, After Propensity Score Adjustment[a]

	First 6-mo Probabilities[b]				
From ↓ To →	Recovered	Improved	Unchanged	Relapsed/ deteriorated	Death
Long-term outpatient	0.23	0.11	0.48	0.18	...
Short-term day hospital	0.21	0.07	0.60	0.12	…
Long-term day hospital	0.42	0.13	0.23	0.22	…
Short-term inpatient	0.69	0.07	0.20	0.04	…
Long-term inpatient	0.43	0.11	0.32	0.14	…

From Recovered to Recovered

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.68	0.70	0.68	0.83	0.76
Short-term day hospital	0.84	0.76	0.87	0.92	0.90
Long-term day hospital	0.77	0.74	0.88	0.86	0.87
Short-term inpatient	0.83	0.74	0.85	0.84	0.84
Long-term inpatient	0.79	0.78	0.85	0.89	0.87

From Recovered to Improved

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.06	0.07	0.08	0.08	0.08
Short-term day hospital	0.05	0.08	0.03	0.03	0.03
Long-term day hospital	0.12	0.10	0.04	0.02	0.03
Short-term inpatient	0.12	0.15	0.07	0.05	0.06
Long-term inpatient	0.10	0.05	0.05	0.07	0.06

From Recovered to Unchanged

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.20	0.17	0.18	0.04	0.11
Short-term day hospital	0.05	0.11	0.06	0.03	0.05
Long-term day hospital	0.08	0.13	0.05	0.09	0.07
Short-term inpatient	0.02	0.09	0.05	0.08	0.06
Long-term inpatient	0.09	0.14	0.07	0.02	0.05

From Recovered to Relapsed/Deteriorated

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.06	0.07	0.06	0.04	0.05
Short-term day hospital	0.05	0.05	0.03	0.03	0.03
Long-term day hospital	0.03	0.03	0.03	0.02	0.03
Short-term inpatient	0.02	0.03	0.03	0.03	0.03
Long-term inpatient	0.02	0.03	0.03	0.02	0.02

From Unchanged to Unchanged

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.88	0.82	0.69	0.80	0.74
Short-term day hospital	0.79	0.70	0.80	0.67	0.73
Long-term day hospital	0.80	0.68	0.68	0.67	0.67
Short-term inpatient	0.79	0.65	0.52	0.72	0.62
Long-term inpatient	0.72	0.77	0.75	0.82	0.79

From Unchanged to Recovered

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.03	0.06	0.16	0.07	0.11
Short-term day hospital	0.10	0.18	0.09	0.13	0.11
Long-term day hospital	0.05	0.17	0.20	0.20	0.20
Short-term inpatient	0.07	0.13	0.27	0.09	0.18
Long-term inpatient	0.16	0.09	0.12	0.09	0.10

From Unchanged to Improved

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.06	0.07	0.11	0.03	0.07
Short-term day hospital	0.07	0.07	0.05	0.11	0.08
Long-term day hospital	0.10	0.08	0.09	0.09	0.09
Short-term inpatient	0.07	0.13	0.10	0.10	0.10
Long-term inpatient	0.09	0.11	0.08	0.06	0.07

From Unchanged to Relapsed/Deteriorated

	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.03	0.05	0.05	0.10	0.08
Short-term day hospital	0.04	0.05	0.06	0.10	0.08
Long-term day hospital	0.05	0.07	0.04	0.05	0.04
Short-term inpatient	0.07	0.10	0.12	0.09	0.10
Long-term inpatient	0.03	0.03	0.06	0.03	0.04

(continued)

doi:10.4088/JCP.09m05228blu
© Copyright 2010 Physicians Postgraduate Press, Inc.

eAppendix 1 (continued). Mean 6-Month Probabilities of Transitioning From One State to Another in Each Time Period, After Propensity Score Adjustment

From Improved to Improved	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.70	0.63	0.52	0.59	0.55
Short-term day hospital	0.48	0.67	0.54	0.67	0.60
Long-term day hospital	0.57	0.52	0.63	0.57	0.60
Short-term inpatient	0.39	0.35	0.53	0.49	0.51
Long-term inpatient	0.60	0.67	0.66	0.42	0.54

From Relapsed/Deteriorated to Relapsed/Deteriorated	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.45	0.25	0.42	0.56	0.49
Short-term day hospital	0.44	0.44	0.45	0.24	0.34
Long-term day hospital	0.56	0.48	0.35	0.20	0.28
Short-term inpatient	0.50	0.36	0.39	0.54	0.47
Long-term inpatient	0.54	0.25	0.50	0.34	0.42

From Improved to Recovered	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.10	0.18	0.16	0.20	0.18
Short-term day hospital	0.29	0.14	0.23	0.11	0.17
Long-term day hospital	0.21	0.31	0.20	0.12	0.16
Short-term inpatient	0.27	0.45	0.25	0.15	0.20
Long-term inpatient	0.07	0.16	0.12	0.25	0.19

From Relapsed/Deteriorated to Recovered	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.07	0.25	0.17	0.14	0.16
Short-term day hospital	0.08	0.18	0.23	0.10	0.16
Long-term day hospital	0.05	0.10	0.16	0.17	0.17
Short-term inpatient	0.17	0.17	0.25	0.13	0.19
Long-term inpatient	0.06	0.25	0.17	0.11	0.14

From Improved to Unchanged	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.10	0.09	0.24	0.14	0.19
Short-term day hospital	0.11	0.09	0.16	0.11	0.14
Long-term day hospital	0.15	0.10	0.10	0.24	0.17
Short-term inpatient	0.21	0.10	0.14	0.27	0.21
Long-term inpatient	0.26	0.10	0.16	0.28	0.22

From Relapsed/Deteriorated to Improved	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.07	0.25	0.17	0.14	0.16
Short-term day hospital	0.08	0.11	0.13	0.10	0.11
Long-term day hospital	0.05	0.14	0.13	0.17	0.15
Short-term inpatient	0.17	0.18	0.17	0.13	0.15
Long-term inpatient	0.06	0.25	0.13	0.11	0.12

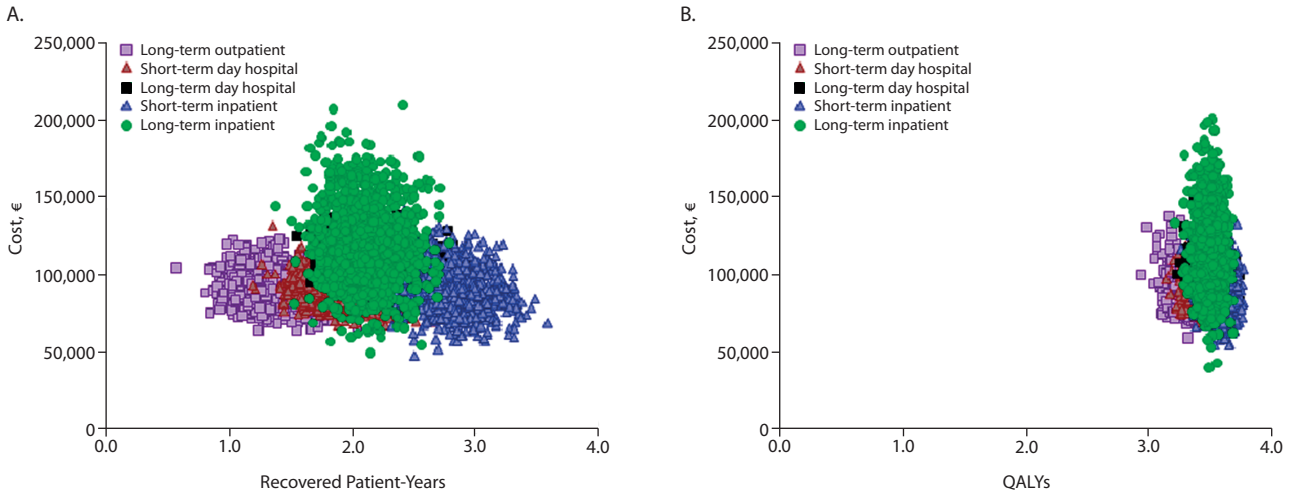
From Improved to Relapsed/Deteriorated	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.10	0.09	0.08	0.07	0.08
Short-term day hospital	0.11	0.10	0.06	0.11	0.09
Long-term day hospital	0.08	0.07	0.07	0.07	0.07
Short-term inpatient	0.13	0.10	0.07	0.08	0.08
Long-term inpatient	0.07	0.06	0.05	0.05	0.05

From Relapsed/Deteriorated to Unchanged	6–12 mo	12–24 mo	24–36 mo	36–42 mo	42–60 mo
Long-term outpatient	0.40	0.25	0.24	0.16	0.20
Short-term day hospital	0.40	0.27	0.20	0.56	0.38
Long-term day hospital	0.33	0.29	0.36	0.46	0.41
Short-term inpatient	0.17	0.30	0.19	0.21	0.20
Long-term inpatient	0.34	0.25	0.21	0.44	0.32

[a]In the reported transition probabilities, the risk of death was not taken into account. In our model, however, we used a probability of death obtained from standard life tables, which varies according to time in model (ie, age-specific background mortality). Moreover, we assumed patients in the improved, unchanged, and relapsed or deteriorated health states faced an elevated risk of death of 0.00127 due to suicide. [b]In the first 6 months patients enter the model. The percentage of patients in each of the 5 health states is displayed. We assumed no probability of death.
Symbol: … = not applicable.

doi:10.4088/JCP.09m05228blu
© Copyright 2010 Physicians Postgraduate Press, Inc.

eAppendix 2. Scatter Plots Showing the Costs and Health Outcomes of the Treatment Strategies From 1,000 Monte Carlo Simulations (A) for Recovered Patient-Years and (B) for QALYs



Abbreviation: QALYs = quality-adjusted life-years.

doi:10.4088/JCP.09m05228blu
© Copyright 2010 Physicians Postgraduate Press, Inc.