The Dose-Effect Relationship in Psychotherapy

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ABSTRACT: In order to specify the relationship between length of treatment and patient benefit, probit analysis was applied to 15 diverse sets of data from our own research and from research previously reported in the literature. These data were based on over 2,400 patients, covering a period of over 30 years of research. The probit model resulted in a good fit to these data, and the results were consistent across the various studies, allowing for a meta-analytic pooling that provided estimates of the expected benefits of specific "doses" of psychotherapy. This analysis indicates that by 8 sessions approximately 50% of patients are measurably improved, and approximately 75% are improved by 26 sessions. Further analyses showed differential responsiveness for different diagnostic groups and for different outcome criteria. Implications for research and practice are discussed.

There is a growing consensus in the psychotherapy research literature that psychotherapeutic treatment is generally beneficial to patients (Bergin & Lambert, 1978; Shapiro & Shapiro, 1982; Smith, Glass, & Miller, 1980; VandenBos & Pino, 1980) and that the amount of therapeutic benefit is positively associated with amount of treatment (Kopta, 1983; Orlinsky & Howard, 1978, in press). For example, in an extensive review of the process-outcome literature in psychotherapy (Orlinsky & Howard, in press), we were able to locate 114 estimates of the relationship between amount of treatment and outcome. Of these, 2 were significantly negative, and 74 were significantly positive. Of the remaining 38 estimates that did not attain conventional statistical significance, 36 were positive. Thus, 110 of these 114 estimates support the conclusion that there is a positive relationship between amount of treatment and amount of patient benefit.[1]

Although this positive relationship has been frequently reported, these reports are most often incidental to the main focus of the particular investigation, and the relationship is usually stated in the form of simple measures of association (*r, phi,* etc.) or group comparisons. To date there has been no systematic attempt to specify the mathematical form of this dose-effect relationship or to determine its accuracy. If such a form could be specified, then data could be aggregated across studies, and extrapolation and interpolation could be used to estimate expected benefits for selected doses of psychotherapy. These estimates could be used as a guide for peer or clinical review, for the setting of rational time limits, and for

the definition of "treated" groups in comparative psychotherapy research. The specification of a dose-effect curve could also provide a better understanding of the process of change in psychotherapy.

Specification of the Dose-Effect Relationship

The first problem in determining a dose-effect relationship is the selection of a unit of treatment. Clinical theories, of course, propose active ingredients of treatment (such as interpretations, reinforcements, homework assignments, empathic reflections, etc.), but these are not readily quantifiable and are not consistently employed across therapeutic practice. The session, on the other hand, is a natural quantitative unit of psychotherapy that is roughly comparable across types of treatment. The assumption underlying the choice of the session as a unit of treatment is that the number of sessions is stochastically related to exposure to the active ingredients in any psychotherapy. That is, the more sessions a patient has, the more "therapy" that patient has probably been exposed to. (This is analogous to the use of weight in milligrams as the unit of treatment in drug studies.)

The second problem in specifying a dose-effect relationship is the selection of a mathematical model that would yield a linear function. To this end, we analyzed two sets of data from a Chicago psychiatric outpatient clinic and examined the relationship between number of sessions of individual psychotherapy and percentage of

[1] These findings would seem to be in contradiction to the meta-analysis presented in Smith et al. (1980, p. 101), which yielded a negligible relationship between the average length of treatment and the average "effect size" (amount of benefit) of treatment across studies. Their work, however, was based on a between-study analysis and has no necessary implication for the relationship between duration and benefit within each study. Moreover, there are heterogeneities between these studies that do not resemble and are not parallel to different dosage levels within studies. For example, in their between-study meta-analysis, very brief analogue experiments yielded large effect sizes that masked the dose-effect relationship that we find for nonanalogue studies. Similar caution should be exercised in interpreting other correlations between study characteristics (e.g., the relationship between average level of therapist experience and patient benefit).

patients who improved. The first set consisted of 151 patients whose closed charts were rated by researchers following the termination of treatment (Tovian, 1977). The second set contained 2,448 session-by-session subjective reports (postsession questionnaire—*Therapy Session Report;* Orlinsky & Howard, 1965) concerning their emotional well-being completed by 148 of these patients while they were still in treatment (Howard, Orlinsky, & Hill, 1969). As can be seen in Figure 1, the plots of the actual percentage of patients improved as a function of number of sessions resulted in negatively accelerated curves—relatively more frequent improvement earlier in treatment than later in treatment.[2]

In order to further ensure that these curves were not a function of an interaction of termination and improvement—such as differential "dropout" due to nonimprovers terminating earlier than improvers—the session-by-session patients' reports were segregated into treatment segments for treatments of various lengths. Table 1 shows that between 29% and 38% of the patients improved within the first three sessions, regardless of the ultimate duration of treatment. Similarly, 48% to 58% improved within four to seven sessions, and so on. This table supports the assertion that the curves shown in Figure 1 were not caused by differential patient attrition.

The form of the curves shown in Figure 1 suggested that a log-normal transformation would produce a linear function. Such a linear function would allow aggregation across studies that used different groupings of cases by number of sessions and would allow interpolation and extrapolation. Because probit analysis has been com-
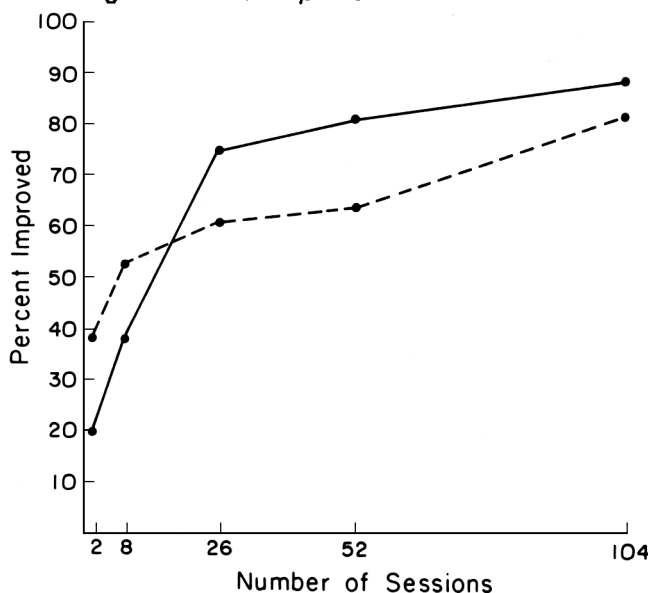
Table 1
Percentages of Patients Improved at Selected Segments of Psychotherapy for Treatments of Different Duration

Total no. of treatment sessions	Segment of ongoing psychotherapy				
	1–3	4–7	8–16	17–52	53–100
1–3	36				
4–7	38	58			
8–16	34	48	68		
17–52	34	48	56	74	
53–100	29	50	56	81	85

Note. N = 148 patients.

Percentages of major diagonal are based on patients who terminated treatment in that segment of psychotherapy.

monly used for evaluating dosage in bioassay research (Cohen & Cohen, 1983, pp. 267–269; Finney, 1971), we selected this approach for combining data from different samples. In the probit model, "dosage" is represented by the log of the number of sessions.[3] This log transformation reflects the fact that, as treatment progresses, more and more sessions are needed to obtain "just noticeable differences" in percentage of patients improved. "Effect" is the unit normal deviate (from the normal distribution) associated with a particular percentage of patients judged to have improved. The use of normalization is a standard psychometric practice and avoids the possibility of extrapolation to values below 0% or above 100%. Thus, these transformations allow for linear (asymptotic) interpolation and extrapolation between 0% and 100% of "patients improved." Probit analysis uses the maximum likelihood estimation of linear regression parameters to predict stochastically the amount of treatment (dose) needed to achieve a specific percentage of patients improved (effect).

Results of the Probit Analyses

In order to utilize the broadest relevant data base, we searched the literature for studies that presented tables showing improvement as a function of varying lengths of treatment.[4] As noted, the vast majority of studies reported only summary statistics, and raw data were no longer available. However, we were able to assemble data for 15 samples covering a period of more than 30 years, reporting data for 2,431 patients in individual outpatient (usually once weekly) psychotherapy. These samples represented a variety of outpatients, therapists, therapeutic

Figure 1
Relation of Number of Sessions of Psychotherapy and Percentage of Patients Improved

Note. Objective ratings at termination are shown by the solid line; subjective ratings during therapy are shown by the broken line.

[2] Schlesinger, Mumford, Glass, Patrick, & Sharfstein (1983) have shown a similar relationship between the number of psychotherapy sessions and lower costs of subsequent medical utilization.

[3] Though using a different response metric, Standal and van der Veen (1957) anticipated our recourse to log-of-number-of-sessions.

[4] Two panels of data (Garfield & Kurz, 1952; Weitz et al., 1975) were not included because evaluations of outcome were not available for such large fractions of their patient samples, 75% and 65%, respectively.

orientations, treatment settings, and outcome criteria. In general, the patients in these samples were diagnosed as "neurotic" (depressive or anxiety neurotic) with relatively small proportions diagnosed as personality disordered or psychotic. As can be seen in Table 2, the patients were quite diverse with regard to age and social class. Therapists were practitioners of each of the major mental health professions, and their orientations were generally psy-chodynamic or interpersonal. None of the therapies were primarily behavioral or psychopharmacological. Settings included private practice, university counseling centers, university-based psychiatric clinics, and community clinics. Outcome criteria included therapist ratings of patient improvement at termination of psychotherapy, patient ratings of well-being at various points during therapy, and researcher ratings based upon clinical chart infor-

Table 2
Sample Characteristics of Data Panels Used in Probit Analyses

Author	Therapists	Patients	Setting	Population	Range of sessions	Median session	Outcome criterion
Brown & Kosterlitz (1964)	NR	61	University psychiatric clinic	Adults, 36% male, low socioeco-nomic status	1–134	4	Rating of clinical charts by researchers
Cappon (1964)	1	133	Private psychiatric practice	Adults, Great Britain	1–217	8	Therapist rating at termination
Cartwright (1955)	17	78	University counseling center	62% students, 58% male	1–77+	16	Therapist rating at termination
Cole, Hardin Branch, & Allison (1962)	NR	134	University psychiatric clinic	Adults, low socioeconomic status	1–30+	15	Therapist or staff rating at termination
Garfield & Affleck (1959)	NR	76	University psychiatric clinic	Adults, 27% with some college education	1–22+	12	Therapist rating at termination
Graham (1958)	NR	65	Community outpatient clinic	Adults, all neurotic	4–135	28	Patient rating during therapy
Howard, Orlinsky, & Hill (1969)	27	148[a]	Private psychiatric clinic	Adult women	1–134	28	Patient ratings after each session
Jacobs & Warner (1981)	22	161	Private psychiatric clinic	Adults, 33% male, 9% college graduates	1–98	10	Therapist and researcher ratings
Jones (1980)	158	188	Community clinics	Adults, 42% male, 56% with 2 or more years of college	7–200	24	Therapist rating at termination
Kopta (1983)	13	119[b]	Community mental health clinic	Adults, 45% with some college education	1–98	19	Patient rating after each session
Kopta, Howard, & Orlinsky, (1981)	NR	212	Community mental health clinic	Adults	1–113	7	Therapist rating at termination minus intake rating
Mensh & Golden (1951)	NR	575	VA mental hygiene contract clinic	Male veterans	1–20+	4	Therapist rating at termination
Rosenthal & Frank (1958)	NR	216	University psychiatric clinic	Adults, 38% male, 11% with some college education	1–21+	6	Therapist rating at termination
Strassberg, Anchor, Cuningham, & Elkins (1977)	60	262	University counseling center	Students, 37% male	2–21+	8	Therapist rating at termination
Tovian (1977)	27	151[c]	Private psychiatric clinic	Adult women	1–189	33	Rating of clinical charts by researchers

Note. NR = not reported.
[a] Reports for 2,448 sessions. [b] Reports for 176 sessions. [c] Includes the patients in the Howard et al. (1969) study.

Table 3

Interpolated and Extrapolated Estimates of Percentage of Patients Improved for Selected Amounts of Psychotherapy

Sample	Number of sessions[a]								
	0	1	2	4	8	13	26	52	104
Brown & Kosterlitz (1964)	10	20	27	38	52	62	76	86	93
Cappon (1964)	27	40	48	59	70	78	86	93	96
Cartwright (1955)	5	11	16	25	37	47	63	77	87
Cole, Hardin Branch, & Allison (1962)	8	16	22	33	47	57	72	84	92
Garfield & Affleck (1959)	8	20	30	46	65	77	90	97	99
Graham (1958)	13	21	27	36	47	56	68	79	87
Howard, Orlinsky, & Hill (1969)[b]	24	32	36	43	50	56	64	72	79
Jacobs & Warner (1981)[b]	10	19	26	37	51	61	76	86	93
Jones (1980)[b]	17	27	33	42	53	61	71	81	88
Kopta (1983)[b]	26	34	39	46	54	60	68	76	82
Kopta, Howard, & Orlinsky (1981)[b]	12	19	25	33	43	51	63	74	83
Mensh & Golden (1951)	24	39	49	62	75	83	91	96	99
Rosenthal & Frank (1958)	18	25	30	35	42	48	57	65	72
Strassberg, Anchor, Cuningham, & Elkins (1977)	7	17	27	42	61	74	88	96	99
Tovian (1977)[b]	7	15	22	33	47	58	74	86	93
Means	14	24	30	41	53	62	74	83	90
95% confidence band (+/−) for estimate of mean	4	4	5	5	5	6	6	5	4

[a] Doses were selected that would roughly correspond to fractions of years in weeks of treatment, based on one session per week. A denser sampling of dosage was used at the lower levels in order to discriminate the more rapid changes in response that take place early in treatment.

[b] Raw data supplied by authors.

mation. These ratings tended to be "global," and none involved the use of psychological test data or covariance-adjusted change scores.

The data from each sample were submitted to a probit analysis. The input for these analyses comprised (a) the session numbers at which improvement was assessed, (b) the number of patients assessed at each of these points in treatment, and (c) the number of these patients judged improved at each point (Helwig & Council, 1979). The results shown in Table 3 are estimates (not the reported results of each study), in that they are extrapolated or interpolated values of the expected percentage improved for the selected number of sessions. These estimates are based on the best-fit lines produced by the probit analysis of each set of raw data. In Table 3 (and Table 4), "0" sessions is the extrapolated estimate of the percentage of patients who would have improved after making an appointment for a first session but before attending that session (there were no actual observations in any sample at 0 sessions).[5] The confidence bands shown at the bottom of Table 3 were based on an *N* of 15 (the number of samples). Inspection of Table 3 indicates that the response functions are quite consistent despite the diversity of patients, therapists, therapies, settings, and outcome criteria.

[5] In order to estimate the effect of entering treatment, one was added to the number of sessions in each analysis. Thus, "0" in Tables 3 and 4 is the result of subtracting one from the number of sessions indicated in each probit analysis.

Table 3 indicates that 10% to 18% of patients could be expected to have shown some improvement before the first session of psychotherapy, simply as a function of initiating contact with the therapist or clinic, and that by eight sessions, 48% to 58% of patients would be expected to have measurably improved. About 75% of patients should have shown measurable improvement by the end of six months of once-weekly psychotherapy (26 sessions) and about 85% by the end of a year of treatment.

In order to begin to refine our estimate of the dose-effect relationship for differences among patients and types of outcome data, we grouped the patients shown in Figure 1 into three diagnostic categories—depression, anxiety, and borderline-psychotic. We analyzed the percentage who improved on the basis of two outcome criteria: researchers' clinical chart ratings after termination of treatment (Tovian, 1977) and patients' self-ratings during treatment (Howard et al., 1969). The results of these probit analyses are shown in Table 4. As can be seen, depressive patients began responding at the lowest dosages of psychotherapy, anxiety neurotics at a somewhat higher dosage, and borderline-psychotics at a still higher dosage. We found that 50% of the patients improved in about 8 to 13 sessions of treatment for anxiety and depression with both types of outcome criteria. However, for borderline cases, this level of improvement occurred later, at 13 to 26 sessions, according to the patients' self-ratings and still later, at 26 to 52 sessions, according to clinical chart ratings. Some initial lagging of researchers'

Table 4

Results of Probit Analyses of Three Diagnostic Groups for Two Outcome Criteria

Diagnostic groups	N	Number of sessions								
		0	1	2	4	8	13	26	52	104
		Criterion: Research ratings of closed clinical charts[a]								
Depression	69	6	13	20	31	46	57	73	86	94
Anxiety	21	0	0	0	5	25	53	87	99	99
Borderline-psychotic	23	0	0	0	0	3	11	38	74	95
		Criterion: Patient ratings after each session[b]								
Depression	974	22	31	37	44	53	60	69	77	84
Anxiety	425	15	22	28	36	46	54	64	74	82
Borderline-psychotic	402	3	8	13	21	33	42	60	75	87

Note. The two criteria were applied to the same sample of female outpatients.
[a] Data from Tovian (1977). N indicates number of patients in each diagnostic group.
[b] Data from Howard, Orlinsky, and Hill (1969). N indicates number of observations for each diagnostic group.

ratings of improvement compared to patients' subjective ratings of well-being also occurred for the anxiety and depressive cases, but after 26 sessions a greater percentage of patients were seen by researchers as improved than the percentage of patients who felt they had improved. It seems that early in treatment patients begin to feel better before they appear better. Later on, subjective change seems to lag behind improvement in their clinical condition.

Implications

In all of the studies included in our meta-analysis, there was a natural combination of the passage of time and the number of sessions of psychotherapy. Thus, each of the treatment response curves is necessarily a function of the effects of psychotherapy as these are confounded with and interact with the processes of "spontaneous" recovery (e.g., see Frank, 1973). Although we have not directly addressed the issue of what elapsed-time control groups would show if subjected to a similar analysis, it should be noted that the vast majority of controlled studies have shown psychotherapy to be more beneficial than the processes of "spontaneous" recovery, alone, as these are manifest in no-treatment control groups (e.g., see Bergin & Lambert, 1978). In this context, we employed probit analysis to describe what happens to patients who are actually engaged in psychotherapy, rather than to test the comparative effectiveness of psychotherapies. The strength of probit analysis is that it has allowed us to aggregate data from diverse studies. These aggregated results suggest some guidelines for approaching several important issues in psychotherapy research and practice.

One of the issues in psychotherapy research is how to decide when a patient should be included in a "treated" group. Investigators have had to make idiosyncratic decisions (e.g., whether attending one session constitutes treatment). A common criterion of effective exposure to treatment in pharmacological studies is the dosage at

which 50% of patients show some response. If this criterion were adopted for psychotherapy research, the present results indicate that the dosage for establishing a treatment group would generally be six to eight sessions (this could be modified to fit the particular diagnostic categories and outcome criteria included in a specific study). Subjects (patients) who have had less than six to eight sessions should be considered, for purposes of research, as not having been effectively exposed to treatment and should be analyzed separately (as should dropouts, refusers, etc.).

Another issue in psychotherapy research has to do with estimating the benefit derived from the act of entering psychotherapy—the amount of "spontaneous remission" associated with making an initial appointment. Our meta-analysis suggests that about 15% of patients will feel and/ or show measurable improvement before attending the first session of psychotherapy. This may very well be due to the lessening of distress that is attendant on the fact that the patient knows that help is near at hand.

Finally, we note that although there has been much recent emphasis on the use of time-limited psychotherapy, the selection of actual time limits has been somewhat arbitrary. The present meta-analysis indicates that by 26 sessions, about 75% of patients have shown some improvement. This, of course, does not mean that such patients have achieved maximum treatment benefits. However, in clinics that serve a large population with limited resources, 26 sessions might be used as a rational time-limit.[6] It would remain to be shown that the effects of a time-unlimited therapy terminated at 26 sessions would be the same as those of a 26-session time-limited therapy. In any case, 26 sessions could sensibly be used to mark

[6] As can be seen from Table 2, the median of the median dosages of treatment (for these 15 studies of psychotherapy of unlimited dosage) is 12 sessions. It seems that the number of sessions of time-limited psychotherapy, which usually has a limit of 16 to 20 sessions, tends to be greater than the median dosage for unlimited therapy!

a point in treatment at which cases that have not shown any measurable improvement should be subjected to clinical review.

Analyses such as these hold some promise for establishing empirical guidelines for peer review and third-party financial support of psychotherapy. No treatment is 100% effective in alleviating any disorder. It seems safe to assume that a single course of psychotherapy would result in measurable improvement for at most about 85% of the patients that enter this form of treatment. From our analysis, it would appear that for the average patient sample, the maximum percentage improved would be reached in approximately 52 once-weekly sessions. Of course, as indicated in Table 4, some patients may feel or show improvement in fewer sessions, and others may require more treatment. Further analyses of patient characteristics and specific outcome criteria will certainly be required before firm and fair standards can be set.

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