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Problem severity, treatment duration, and the outcome of psychotherapy: The benefits keep growing with time spent in treatment for longer than previously known

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Abstract

Findings from previous psychotherapy research suggest that the majority of improvement takes place in the initial phase of treatment with the relative effectiveness dropping at a negatively accelerating rate. However, the evidence for this pattern of change comes from investigations of short-term treatments and it is unclear whether this also holds for more flexible and long-term psychotherapy. We provided open-ended treatments under routine-care conditions for a representative sample of 370 patients, including a large proportion characterized by severe psychopathology. Patients attended 52 sessions on average ($SD = 59$, range = 1 - 364, Median = 36). Our results indicated that the degree of improvement was linearly associated with time spent in psychotherapy and contingent upon the severity of psychological problems at intake. The least severely afflicted received the shortest treatments, experienced the most rapid change but demonstrated smaller overall magnitudes of improvement. More severely suffering patients received longer treatments, had slower rates of change but received greater overall benefits. Among the patients who experienced clinically significant symptomatic improvement (47 %), a dose-response survival analysis indicated a median survival time of 57 sessions. We argue that previous suggestions of psychotherapy dosage have been inappropriate for patients suffering from moderate to severe psychopathology.

Keywords: *Psychotherapy, Rate of change, Effectiveness, Open-ended, Long-term*

The question of how much therapy is needed for psychotherapy to produce optimal effects has been hotly debated since the inception of psychotherapy itself. Early empirical investigators likened the dosage of psychotherapy to a pharmaceutical drug and found a log-linear dose-effect relationship (Howard et al., 1986). Data from psychotherapy trials indicated that the majority of improvements were seen in the early phase of therapy, usually within the first 4-8 sessions. If a patient failed to achieve early improvement, then the likelihood of establishing it later was thought to decrease at a log-linear, or negatively accelerating rate. An optimal dosage, in this view, is a theoretical point of rapidly diminishing returns. This can be evaluated in terms of a plateau effect on a continuous scale and dichotomized into a treatment response – no treatment response outcome. Treatment response is usually defined using Jacobson & Truax's (1992) definition of Reliable Change (RC) or Clinically Significant change (CS). Achieving RC or CS can be statistically modeled as an *event*, using survival analysis methods. A recent review by Robinson, Delgadillo & Kellett (2019) concluded that psychotherapy treatment data from low threshold intervention and university counseling centers show lower optimal dosages when compared to traditional outpatient psychiatric clinics. The former ranging between 4-12 sessions while the latter ranging from 8-52. The authors found that most investigations utilized a definition of optimal dosage as the median survival time for achieving RC or CS. The studies that demonstrated large optimal doses were related to the treatment of more severe conditions such as severe characterological pathology (Asay et al., 2002; Stephen Mark Kopta et al., 1994) or psychosis (Lincoln et al., 2016). Robinson et al.'s (2019) review also revealed that 95 % of the included patients in the dose-response literature are from either university counseling clinics or low-threshold interventions delivered elsewhere. These investigations indicate that there is little evidence to support long-term therapies beyond 30 sessions with the majority of studies reporting optimal dosages between 4 – 15 sessions.

Another dosage perspective was provided by Barkham et al. (2006) who replaced the pharmaceutical analogy of dosage with a focus on the psychotherapeutic process. The good-enough level (GEL) model suggests that patients differ in their response to psychotherapy, with some patients rapidly improving, while others needing more therapy to achieve similar results. The GEL model posits that each patient attends psychotherapy for as long as it is required to achieve a good enough level of functioning. Once this level is achieved, the patient or therapist terminate the treatment. Thus, the GEL model predicts that the rate of change is related to the individual's time in therapy. It can also explain the previously established log-linear pattern of improvement, as the majority of patients improve quickly and then terminate treatment. Those who do not benefit from short treatments are censored from the analysis, thereby producing a diminishing survival curve. Several empirical investigations support the main tenets of the GEL model (Michael Barkham et al., 2006; Falkenström et al., 2016; Stiles et al., 2003, 2008, 2015; Stulz et al., 2013).

Recently, there have been several attempts at applying modern statistical tools to estimate the pattern of change observed in psychotherapy trials. For instance, Owen et al., (2015, N = 10.854) analyzed data from university counseling centers using Latent Growth Curve Models (LGCM). Treatment length ranged from 1 to 14 sessions (mean = 9.4). The best-fitting model was comprised of a three-class solution: Class 1 was typified by an initial rapid positive change followed by a plateau. Class 2 saw an initial negative trend, followed by a larger positive development, followed by a plateau. Class 3 had a steady linear positive development. Owen et al. (2016, N = 13.664) applied Multi-Level Models (MLM) to another university counseling center dataset with treatment length ranging from 2 to 100 sessions (mean = 9). When analyzing well-being measures, the authors found that a log-linear development parameter produced the best model fit. Both studies concluded that the rate of change was related to treatment length, as suggested by the GEL model. Similarly, Erikson,

Lambert & Eggett (2015) applied investigated symptomatic changes from a university counseling center ($N = 21.488$) using MLM's. Treatment length spanned 1 - 21 sessions (mean = 5.8). The authors concluded that a linear pattern of development provided the best model fit. A cox regression found that around 80 % of the sample was predicted to achieve a clinically significant change at session 30. In a recent study, Sembill, Vocks, Kosfelder, Schöttke (2019) used data ($N = 351$) from a German university counseling clinic that provide long term treatment for patients with mild to moderate levels of psychopathology. The average treatment length was 52 sessions. Using MLM, the authors found that a log-linear curve provided the best fit for overall symptoms, well-being, and a global measure of psychopathology. This was not the case for measurements of interpersonal problems which was optimally modeled using a linear rate of change.

In contrast to the previously cited studies that are mostly comprised of data from university counseling centers, Falkenström et al. (2016) applied MLM analyses to community-based primary care ($N = 640$) and psychiatric care ($N = 284$) sample. The mean session number was 6 and 9.1, respectively. They found that a cubic polynomial with both time and treatment length in interaction, as well as random effects of both patient and therapist intercepts and slope, provided the best model fit. When comparing the two samples, they found that the primary care patients demonstrated a faster rate and larger magnitude of change compared to the psychiatric care sample. However, these results could not generalize beyond the 12 sessions due to a lack of data for longer treatments.

In summary, evidence from short treatments focusing on mild psychopathology cohorts indicate that the majority of change during psychotherapy takes place early in treatment. Unfortunately, investigations of longer treatments with severely afflicted cohorts are few and far between. The few that exist tend to recommend a higher dosage compared to the university counseling treatment centers and low threshold interventions. This paper aims

to supplement this literature with outcome data that includes treatments that are far longer and includes a more heterogeneous patient cohort, compared with previous investigations. Our main goal is to investigate the pattern of change associated with therapy under naturalistic conditions and examine the relationship between dose and outcome.

Methods

Study Overview

The Norwegian Multisite Study of Process and Outcome in Psychotherapy – NMSPOP, includes patients that are selected from routine outpatient care. Taken as a whole the sample is characterized by severe levels of mental health problems, as more than half of the patients (54 %) satisfy the DSM-4 (American Psychiatric Association, 1994) criteria for at least one personality disorder at treatment start. The patients also have a high degree of comorbidity and the majority have been afflicted with psychopathology for several years. Treatments provided in the NMSPOP trial are predominantly open-ended, i.e. therapist and patient are instructed to come to an agreement about when to terminate treatment. The NMSPOP includes patients ($N = 370$) from seven sites; five psychiatric outpatient clinics, one university student training clinic, and one clinic specializing in somatoform disorders. One of the outpatient clinics, treating 45 (13 %) patients, had a predetermined max duration of 40 sessions. Overall, patients attended an average of 52 sessions ($SD = 59$, range = 1 - 364, Median = 36). The following exclusion criteria were applied: Age less than 20 years, active psychosis, drug/alcohol abuse as the primary problem, need for emergency treatment or hospitalization, and mental retardation ($IQ < 70$). These criteria are in line with commonly used criteria in the evaluation of patients for individual psychotherapy at outpatient clinics. The current study excludes patients who only completed the pretreatment assessments ($n = 8$). The Regional Committee for Medical Research Ethics in Eastern Norway approved the study.

After receiving information and signing a written consent, the patients completed self-report questionnaires, as well as Structured Clinical Interview (SCID) based on the DSM 4 criteria for Axis I and II disorders. Patients completed self-report questionnaires during treatment after the 3rd, 12th, and 20th session, as well every subsequent 20th session, for as long as they received therapy. Patients also completed self-report questionnaires at a posttreatment assessment as well as SCID interviews. The mean number of self-report treatment assessment was 5.87 including the pre- and posttreatment assessment. The therapists ($n = 88$) were mainly experienced clinicians with a mean of 10 years ($SD = 6.5$) of psychotherapy experience. The majority of therapists had postgraduate professional training, including a mean of 5.9 years ($SD = 4.3$) of clinical supervision. Notable exceptions were a group of clinical physiotherapists ($n = 8$) specially trained in psychodynamic body therapy (K. Monsen & Monsen, 2000) and a group of student therapists ($n = 27$) who received supervision. The mean number of patients per therapist was 4.2. When asked to rate themselves on a scale from 0 (no influence) to 5 (maximum influence), the overall mean therapist ratings of self-identified theoretical orientations were: Analytic/Psychodynamic (3.4), Behavioral (1.5), Cognitive (2.4), Humanistic (2.4), System Theory (1.9) and Other (2.4). Therapists were instructed to provide their usual therapeutic practice including their preferred treatment methodology. Patients were offered weekly therapy sessions, but this was not a requirement.

Sample Characteristics

The mean age was 35.2 years ($SD = 9.4$) with a majority of female patients (69.5 %). Patients were referred to the clinics through regular pathways, mainly from primary care services. Axis I disorders were distributed as follows: Affective, 50%; anxiety, 64%; somatoform, 24%; eating-disorder, 9%; substance-related, 3%; other, 5%. In total, 86.8 % of patients had one or more Axis I disorders. In total, 54 % of patients had at least one personality disorder at pretreatment. Distribution of Axis II disorders were as follows: Cluster

A, 22%; Cluster B, 19%; Cluster C, 46%; Not Otherwise Specified, 2%. The mean number of pretreatment SCID II criteria of personality disorder was 12.7 (SD = 5.8).

The Symptom Checklist 90 Revised (SLC-90-R)

We used the SLC-90-R to assess overall symptom presence and severity. It contains 90 questions asking patients to rate, on a Likert scale from 0 (not at all) to 4 (very much), the intensity of a given symptom during the last week. We used the Global Severity Index (GSI) as an overall symptom severity measure, which is the mean rating across the entire checklist. The SCL-90-R demonstrated high internal consistency in our sample with a pretreatment Cronbach's alpha of .97.

The Inventory of Interpersonal Problems 64 (IIP-64)

We applied the IIP-64 to assess levels of interpersonal problems. It consists of 64 questions rated on a five-point Likert scale from 0 (*not at all*) to 4 (*very much*). The first 39 questions begin with the phrase "*It is hard for me to...*" while the remaining 25 questions ask about "*Things that I do too much.*" We used the IIP global, which is the mean scores across the entire inventory. This global score has been shown to adequately capture a wide range of interpersonal problems and pathology (Tracey, Rounds, & Gurtman, 1996). The IIP-64 demonstrated high internal validity with a pretreatment Cronbach's alpha of .93.

Statistical Analysis

We carried out all statistical analyses using R version 3.6.2 (R Core Team, 2018) using the lme4 package (Bates et al., 2014) to fit MLM's. We usedggeffects (Lüdtke, 2018) to estimate marginal effects and survival (Therneau, 2020) for survival analyses. We analyzed SCL-90-R using the Global Severity Index (GSI) and IIP-64 with the IIP Global, which is the mean score across all questions. As seen in Table 1, the GSI and IIP Global scores were fitted to a range of different MLM's fitted with Maximum Likelihood to prioritize precise estimation of fixed effects. MLM allows for nesting measurements within individuals,

sidestepping the violation of the independence assumption that arises when analyzing longitudinal data. MLM has been shown to outperform traditional methods (e.g., last observation carried forward method) when handling missing data and accounting for potential dropout bias (Hamer & Simpson, 2009).

We centered treatment start at zero and coded the posttreatment assessment as the last session registered for each patient. Patients were further categorized in terms of their treatment length, that is, how many psychotherapy sessions they attended. This variable was added as an interaction term to assess whether sessions attended would moderate change following psychotherapy. We use the terms *GEL model* and *dose-effect model* when referring to models with and without treatment length as an interaction term, respectively. None of our models' nests observations within therapist due to the high number of therapists seeing only one patient. The mean patient treatment per therapist was 4.1. Only 3 % and 1 % of the variance could be attributed to the therapist-effect on the GSI and IIP-Global respectively. We applied months following treatment completion as our main follow-up time measure with the posttreatment measurement coded as zero. Follow-up analysis was completed on the 296 patients who had at least one follow-up measure. To account for this missing data we applied multiple imputation following the MICE methodology (Buuren & Groothuis-Oudshoorn, 2011). Missing data was imputed based on symptom severity, interpersonal problems, and the number of positive SCID 2 Personality Disorder items, all measured at pretreatment. Analysis of the complete imputed dataset did not differ significantly from the results presented below.

We also computed marginal effects for the GEL model on both GSI and IIP Global. The marginal effect demonstrates how the predicted level of the dependent variable changes at different levels of the independent variables (time and treatment length). We chose to highlight the interaction term between treatment length and development across different

sessions up to 220. This upper restriction came about as standard error expanded due to the low number of patients receiving very long treatments.

Survival Analysis

We calculated CS change on the GSI and IIP Global as a dichotomous score based on Jacobson & Truax's (1992) definition. To be classified as CS, a patient's score needs to achieve both a RC and pass the half-way cut-off to a functional population as compared to a dysfunctional population. Based on the Norwegian norms from Carrozzino et al. (2016) and Monsen et al. (2006), we calculated this cut-off to be .73 and 1.22 for the GSI and IIP Global respectively. RC was calculated by $SD_{Pretreat} * (\sqrt{1} * \sqrt{1 - a})$ where a is Cronbach's alpha which was .97 for GSI and .93 for IIP Global. For the Kaplan Meyer analysis, we categorized each case dichotomously (achieved CS or not) as well as the number of attended sessions before achieving reliable change. For cases that do not achieve CS (censored cases), the total number of sessions is included in analyses. The cumulative proportion was calculated by $\frac{nEvents}{nAtRisk}$ at each timepoint. We did not perform survival analyses on the IIP-64 due to the scarcity of patients achieving CS.

Results

For both main outcome measures, we found that a linear model of symptomatic change (Level 1), and random intercept and slope parameters (Level 2) provided superior fit when compared to Quadratic and Cubic growth curve models (Level 1) equipped with a random intercept, as shown in table 1. None of our polynomial models could be equipped with an additional random slope parameter as this led to non-convergence. This is most likely due to overfitting and the following singular fit (Cheng et al., 2009) as the polynomial effects do not add variance that is not accounted for by the random effects. Linear models were also superior to their corresponding log10 transformed model, as measured by model fit indexes.

All models fitted with random intercept and slope parameters also included a correlation parameter between random effects.

Table 1: GSI and IIP Global Model Fit

Fixed Effect	Random Effect(s)	GSI			IIP Global		
		AIC	BIC	RMSE	AIC	BIC	RMSE
Linear session	Intercept	2737	2759	.36	2015	2038	0.29
Linear session*length	Intercept	2600	2633	.34	1925	1959	0.28
Log10 session	Intercept	2648	2670	.35	1946	1968	0.28
Log10 session *length	Intercept	2614	2648	.35	1900	1934	0.28
Quadratic session growth curves	Intercept	2668	2696	.35	1990	2019	0.29
Quadratic session growth curves*length	Intercept	2583	2628	.34	1903	1948	0.28
Cubic session growth curves	Intercept	2582	2628	.34	1962	1996	0.28
Cubic session growth curves*length	Intercept	2582	2638	.34	1884	1940	0.28
Log10 session	Intercept & Slope	2521	2554	.29	1795	1829	0.24
Log10 session *length	Intercept & Slope	2499	2543	.29	1762	1807	0.24
Linear session	Intercept & Slope	2487	2520	.28	1731	1765	0.23
Linear session *length	Intercept & Slope	2433	2478	.28	1680	1725	0.23

Note.

GSI: Global Severity Index = Mean scores across all 90 items.

IIP Global: Inventory of Interpersonal Problems Global: Mean Scores across all 64 items

AIC: Akaike Information Criteria

BIC: Bayesian Information Criteria

RMSE: Root Mean Square Error

Estimation = Maximum Likelihood

Table 2: GSI & IIP Global Follow-Up Model Fit

Fixed Effect	Random Effect(s)	GSI			IIP Global		
		AIC	BIC	RMSE	AIC	BIC	RMSE
Linear months	Intercept	1121	1141	.24	925	945	.22
Linear months*length	Intercept	1120	1150	.24	917	947	.22
Log10 months	Intercept	1121	1141	.24	925	945	.22
Log10 months *length	Intercept	1121	1150	.24	919	948	.22
Quadratic months growth curves	Intercept	1123	1147	.24	926	951	.22
Quadratic months growth curves*length	Intercept	1124	1163	.34	921	961	.22
Cubic months growth curves	Intercept	1127	1178	.34	928	957	.22
Cubic months growth curves*length	Intercept	1127	1176	.34	924	973	.22
Log10 months	Intercept & Slope	1104	1133	.20	915	944	.19
Log10 months *length	Intercept & Slope	1101	1143	.20	908	947	.18
Linear months	Intercept & Slope	1121	1182	.21	923	953	.20
Linear months *length	Intercept & Slope	1159	1198	.21	916	955	.20

Note.

GSI: Global Severity Index = Mean scores across all 90 items.

IIP Global: Inventory of Interpersonal Problems Global: Mean Scores across all 64 items

AIC: Akaike Information Criteria

BIC: Bayesian Information Criteria

RMSE: Root Mean Square Error

Estimation = Maximum Likelihood

Figure 1: Predicted GSI and IIP Global Outcome Scores at Various Treatment Lengths

The result from the marginal models revealed that patients who received 80 – 120 sessions of psychotherapy derived the largest total predicted magnitude of change in both

outcome domains, as shown in Figure 1. These estimates also indicated that change during psychotherapy gradually diminishes as treatment length increases. This trend was slightly more pronounced on the GSI as compared to the IIP Global. The calculation of estimated effects originates from the models with the best fit which were models equipped with linear session, in interaction with treatment length, supplemented by patient-level random slope and intercept parameters.

A likelihood ratio test confirmed the superiority of GEL model compared to dose-effect for both GSI, $\chi^2(2) = 57.7$, $p < .001$ and IIP Global, $\chi^2(2) = 10.9$, $p = .004$. The significant negative correlation between intercept and slope (Level 2) in both outcome measures indicate that more severely disturbed patients experienced greater improvement on the within-patient level. Similarly, we found a significant fixed effect of treatment length for both outcome measures, indicating that between-patient variability (Level 1) could be explained by adding treatment length. See Table 3 for additional information.

Table 3: Linear Time (Session) and Treatment Length Treatment Outcomes

	GSI		IIP Global	
	Dose-Response Model	Gel Model	Dose-Response Model	Gel Model
Fixed Effects				
Intercept	1.26***	1.17***	1.41***	1.30***
Session	-.01***	-.02***	-.005***	-.008***
Length		.002**		.002***
Session*Length		<.0001***		<.0001***
	Estimate	Estimate	Estimate	Estimate
Random Effects				
Patient Intercept	.6	.59	0.51	.49
Patient Slope	.01	.009	.007	.006
Intercept – Slope Covariance	-.21	-.29	-.12	-.22
Model Fit				
-2 Log Likelihood	2475	2417	1720	1664
Akaike Information Criteria	2487	2433	1731	1680
Bayesian Information Criteria	2520	2478	1765	1725

Note.

GSI: Global Severity Index = Mean scores across all 90 items.

IIP Global: Inventory of Interpersonal Problems Global: Mean Scores across all 64 items

** $p < .01$. *** $p < .001$

Model comparison of the follow-up phase is shown in Table 2. Overall, there was a small model fit differences between these models. Our results demonstrated that patients on average maintained their symptomatic and interpersonal improvements for at least 2.5 years after treatment. The duration of treatment was not significantly associated with development during follow-up as indicated by the non-significant interaction term on both follow-up outcome measures.

The therapists were prompted to evaluate the nature of treatment termination, as shown in Table 4. The results demonstrate that the majority of terminations were due to mutual agreement between therapist and patient. Patients were more likely to drop-out or end treatment compared to therapist-initiated termination.

Table 3: Linear Time (Months) and Treatment Length Follow-Up Outcomes

	GSI		IIP Global	
	Dose-Response Model	Gel Model	Dose-Response Model	Gel Model
Fixed Effects				
Intercept	0.81***	0.75***	1.18***	1.08***
Months	-.0003	- .001	-.002***	-.002*
Length	NA	.001*	NA	.002**
Months*Length	NA	< .0001	NA	<.0001
	Estimate	Estimate	Estimate	Estimate
Random Effects				
Patient Intercept	.33	.33	.28	.27
Model Fit				
-2 Log Likelihood	1113	1108	916	906
Akaike Information Criteria	1121	1120	924	918
Bayesian Information Criteria	1141	1150	945	947

Note.

GSI: Global Severity Index = Mean scores across all 90 items.

IIP Global: Inventory of Interpersonal Problems Global: Mean Scores across all 64 items

Models above fitted with random intercept only

* $p < .05$ ** $p < .01$. *** $p < .001$

Table 4: Cause of Treatment Termination

Mutual agreement	59 %
Mainly the patient's decision while the therapist was uncertain	12 %
Mainly the therapist's decision while the patient was uncertain	4 %
Extraneous circumstances (Illness, Relocation, etc.)	11 %
Patient non-attendance without reason	12 %
Patient referred to other treatment	2 %

As rated by therapists at posttreatment

The results from the GSI survival analyses are presented in Figures 2, 3, and Table 5. These results indicate that the majority of patients either experience CS improvement or terminate therapy, within the first fifty sessions. A total of 236 (65.2 %) achieved RC while 169 (46.7 %) achieved a CS improvement. The median survival time for CS improvement was 57 sessions. A complete survival table is available in the appendix. Only 39 % of the sample experiences CS improvement when assessed by the IIP-64, while 58 % achieved RC.

Table 5: Survival Analysis

Session	10	20	30	40	50	100	150	200	250	300	350
Events	41	107	119	140	143	163	165	166	166	168	169
Censored	32	65	94	132	143	170	180	186	192	192	192
At-Risk	293	216	159	131	77	33	18	11	5	4	2

Event is demonstrating CS improvement. Censored patients disengage therapy without establishing CS improvement.

Figure 2: Kaplan Meier Survival Curve of GSI

Kaplan Meier curve with 95 % confidence interval

Figure 3: Bar Chart of Length of Therapy and Achievement of CS in GSI

Discussion

These results indicate that patients in open-ended psychotherapy differ substantially in their needs for psychotherapy, as indicated by the great variability in treatment dosage. Also, patients with relatively mild levels of psychopathology show the quickest rates of improvement, while more severely afflicted patients demonstrate a slower but larger overall change. A similar observation has been noted by other investigators (Brown et al., 2001; Hansen et al., 2002, 2006; Hansen & Lambert, 2003). In the present sample, the largest magnitudes of change, in terms of both improvement of overall psychiatric symptoms and interpersonal problems, were found in patients receiving dosages that have limited

documentation in the treatment-response literature, which rarely includes treatments longer than 30 sessions (Robinson et al., 2019). Our results indicate that the conclusions and recommendations from this literature do not appear to be generalizable to public outpatient clinics, as dosage requirements correspond to the severity of psychopathology. The high severity of the NMSPOP sample is evident when comparing different pretreatment study-populations to non-clinical population utilizing Z-scores¹. While the NMSPOP sample was both severely afflicted and demonstrated a high median time-to-recovery (SCL-90, Z: 2.5, Median: 57), other studies demonstrate lower severity and lower median time-to-recovery. See the following for comparison; Erekson et al. (2015, OQ-45, Z: 1.1, Median: 8), Falkenström et al. (2016, Core-OM, Z: 1.6, Median: 8-13), Kopta et al. (2014, BHM, Z: 1.5, Median: 7-10), Owen et al. (2015, BHM: Z:1.9, Median: 11), or Wolgast et al. (2004, OQ-45, Z: 1.3, Median: 14-16).

When modeling treatment data using MLM's, we found that the rate of change during treatment was best accounted for by utilizing linear models. This pattern of change indicates that the impact of each session does not diminish as treatment length increases, as posited by earlier dose-effect investigations (Hansen et al., 2006). This finding is in contrast to other studies demonstrating that many patients show a large and rapid change early in treatment followed by a treatment plateau effect (Haas et al., 2002; Rubel et al., 2015; Sembill et al., 2019; Stiles et al., 2003; Tang & DeRubeis, 1999). However, the plateau effect was evident when analyzing GSI utilizing survival statistics, aimed at identifying CS improvement. In

¹ Z-Score calculated by counting the number of standard deviations required to move from non-clinical sample mean to study population pretreatment mean. Derogatis & Unger (2010) Non-Clinical Mean (SD) SCL-90-R GSI = 0.34 (0.38): $0.34 + (0.38 * 2.5) = 1.30$ (pretreatment GSI NMSPOP). Lambert et al. (1996) Non-Clinical Mean (SD) OQ-45 Total Score: 48.2 (18.2). Barkham et al. (2005) Non-Clinical Mean (SD) CORE-OM Total Score: 0.76 (0.59). Green et al. (2003) Non-Clinical Mean (SD) BHM Global Mental Health: 3.29 (0.47)

contrast to previous investigations, we found a median time-to-event of 57 sessions. This is the largest recommended dosage observed in the dosage-literature. Comparing our sample and methodology with this literature reveals important distinctions that can explain the diverging results. Firstly, the majority of our sample received explicitly open-ended treatments. This might shift therapists and patients towards long-term goals and therapeutic processes that require longer treatments. In their phase-model of psychotherapy outcome, Howard, Lueger, Maling & Martinovich (1993) proposes that the early response effect is due to the relative ease for patients with mild severity to achieve remoralization. This stands in contrast to treatments that seek the remediation of a symptomatic problem or rehabilitation of a maladaptive pattern of behavior which the model posits takes longer to achieve. Low dosage recommendations can arise due to not offering enough sessions for more extensive therapeutic processes to take place, or by providing adequate short treatments for patients afflicted with mild levels of psychopathology. These are possible reasons why university counseling studies demonstrate a very fast treatment response. This is illustrated by Draper et al. (2002) who concluded that the optimal dosage for a sample of university counseling sites was between 4-10 sessions ($N = 1698$). The authors also found that the mean length of therapy was 3.3 sessions indicating that this cohort has little in common with the patients treated in our study. In contrast, Asay et al. (2002) and Kopta et al. (1994) are the only studies with comparable dosage recommendations. Both these studies include patients with moderate-to-severe personality disorders and offer open-ended treatments. Both studies find a median time-to-recovery between 40-60 sessions when measuring symptoms related to characterological functioning.

There are reasons to believe that therapists in the NMSPOP trial engaged patients in psychotherapeutic processes that went beyond remoralization. The patients' overall high levels of psychopathology, large magnitudes of changes, and the linear effect of time in

treatment all support this assumption. As it is hypothesized (Connor & Walton, 2011), the remoralization effect should be prominent early in treatment but gradually diminish in potency. Given the overall linear effects, it seems likely that other processes are influencing patients undergoing long treatments. It is also worth noting that we found no relationship between treatment duration and changes during follow-up. This indicates that even the short treatments in our study showed lasting effects. The duration of these treatments was a choice made by patients and therapists in collaboration, in contrast to a fixed dosage scenario.

Although our two main outcome measures largely mirror each other, there are slight differences between them. Specifically, improvements in interpersonal problems require a slightly larger dosage compared with improvements of overall psychiatric symptoms, as shown by the relatively larger interaction effect between dosage and time in the IIP Global compared to the GSI scores. This was evident when Z standardizing and centering both GSI and IIP-Global, as well as both independent variables. The interaction term in our MLM analyses was .39 and .26 for the GSI and IIP-Global respectively. The finding that interpersonal problems require longer treatment parallels other investigations that seek to disentangle the relationship between dosage and presenting problem. Maling et al. (1995) found that problems relating to interpersonal detachment required more sessions to alleviate when compared to problems relating to the experience of interpersonal control, as measured by the IIP – 64. Also, Lutz et al. (2001) found that patients required the lowest dosage for recovery in terms of subjective well-being scores while overall psychiatric symptoms required a larger dosage for recovery. The largest required dosage was found when modeling overall life functioning. A similar finding was reported by Sembill et al. (2019) who found that the rate of change corresponded to the prediction made by Howard et al's. (1993) phase model of change. The authors concluded that a log-linear curve best explained the change trajectories of well-being, general psychiatric symptoms, and a global score of psychopathology, whereas

interpersonal functioning was best modeled using a linear trajectory. The outcome data was collected from an outpatient clinic with a mean amount of sessions of 51.9 (SD = 23, Median = 50). One prominent difference between this investigation and ours is that only 5.1 % of Sembill et al. (2019) patient sample had a personality disorder, indicating overall less severe levels of psychopathology.

The results of our analyses also demonstrate how the choice of methodology can influence the takeaway message from dose-response investigations. When modeling outcomes as continuous measures we find no plateau effect, while this is prominent in the survival analysis. We believe that survival analysis tools should be cautiously interpreted for several reasons. Firstly, reducing the continuous nature of clinical recovery into a dichotomy entails deliberately discarding valuable information (Altman & Royston, 2006). Secondly, dichotomizing outcomes entail an unwarranted normative evaluation of the nature of recovery itself. Most psychotherapy investigations report that a minority of patients achieve CS and the majority of patients are censored from the survival analysis. This practice effectively neglects the potentially large positive improvements made by severely afflicted patients. The CS dichotomization favors patients with mild to moderate psychopathology as they are more likely to cross the cut-off point into normality. Future research could ameliorate this by identifying and implementing cohort-specific recovery thresholds, differentiating between mild, moderate, and severe psychopathology.

Some methodological limitations should be noted. Firstly, we do not have an adequate sample size to generalize our findings across every possible treatment length. Most of our sample clusters around 30 – 50 sessions with a minority of patients receiving very long treatments. We believe that our overall findings are robust but caution against a broad interpretation of the results from very long treatments. Secondly, although selected from naturalistic outpatient clinics, patients were not randomized into participation. Instead, a local

coordinator at each treatment site recruited and evaluated patients. We cannot rule out that this introduced an unwanted selection bias. Thirdly, our treatment effects are intertwined with a time effect that we cannot disentangle without a control condition (Blease & Kirsch, 2016). However, given the patients' overall level of psychopathology severity and chronicity, we conclude that the improvements are most likely attributable to the treatment processes. Lastly, we did not measure outcomes at each session which limits our ability to pinpoint the time of recovery. This limitation should be weighed against the observation that a large proportion of recoveries was seen at the posttreatment assessment (30 %), which was precisely captured. A similar concern is the possibility of relapse in previously recovered patients. This scenario would not be captured by the survival analysis as patients are removed after achieving recovery. However, the follow-up data suggest that the improvements made during therapy are stable.

Clinical Implications

Our results are in line with a large body of evidence indicating that patients' rate and magnitude of change are related to the length of treatment. This observation contradicts a static dosage-effect perspective, which presupposes an optimal dosage common across patients. This conclusion is an argument against "one-size fits all" policies for treatment length. In contrast to previous investigations, our results indicate the patients continuously improve throughout therapy with appropriate dosage estimates far exceeding what is generally found. Therapists treating patients with moderate to severe levels of psychopathology should appraise the dosage literature cautiously as it underrepresents this cohort. Our results demonstrate that, given flexible treatment settings, patients with high levels of psychopathology can demonstrate the largest therapeutic gains.

The question of when to end an unsuccessful psychotherapeutic relationship is a major unanswered question (M.J. Lambert & Ogles, 2013). There is currently a meager empirical

literature that can advise clinicians and policymakers, simply because psychotherapy trials seldom offer long-term or open-ended treatment. Our analyses reveal that a minority of the very long treatments do not provide symptomatic or interpersonal relief. A visual inspection of individual raw change trajectories (see Appendix A) for patients ($n = 26$) with over 150 sessions confirms this assertion.

Appendix A

Figure 4: Patients with Over 150 Sessions Fitted with Linear Regression

Generic ID numbers applied for comparison

There are two main competing hypotheses for why patients continue in unsuccessful treatment. Firstly, following the GEL model predictions (Michael Barkham et al., 2006), these patients continue with therapy because they never reach the theoretical "good-enough" point. Support for this notion is found in the observation that these patients experience significant symptomatic and interpersonal problems at the end of therapy. Secondly, it may be that the therapy promotes some other positive aspect that is not reducible to symptomatic and interpersonal functioning. Lastly, we should note that our main results describe a statistical

trend that attempts to describe development across very different individual patient trajectories. The visual assessment of raw scores also demonstrates that many patients with very long treatment do indeed benefit from treatment.

Conclusion

Previous estimates on psychotherapy dosages have emphasized patients with mild levels of psychopathology, leading to small estimates. When including patients with moderate to severe levels of psychopathology, the recommended dosage is greatly increased. Short treatments for mild psychopathology produce the most rapid change but moderate to severely afflicted patients demonstrate the greatest magnitude.

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