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Integrating Focus on Motivation and Actuarial Matching
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Improving Outpatient Alcohol Treatment Systems: Integrating Focus on Motivation and Actuarial Matching

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ABSTRACT

This study investigates the benefit of adding a data-driven actuarial matching system and focus on motivation to routine outpatient alcoholism treatment. The study is a two-cohort quasi-experimental study. One cohort (188 clients) were assigned to treatment based on clinician judgment. Cohort 2 (175 clients) were assigned to treatment based on actuarial matching procedures. Both cohorts were followed for 12 months. A total of 37% of Cohort 2 dropped out of treatment, compared to 52% of Cohort 1. Cohort 2 also showed greater reduction in alcohol consumption and greater improvement. Actuarial matching procedures appear to have improved treatment retention and outcome.

KEYWORDS

Actuarial matching; addiction; guidelines; data-based expert system; adherence

Introduction

Dropout has long been a prominent problem in outpatient alcoholism treatment. Baekeland and Lundwall (1975) reported in an old review of studies that 52% to 75% of clients dropped out before completing treatment. Obviously, dropping out of treatment before planned will be expected to affect the outcome of treatment. Retention in treatment and interventions that decrease dropout from treatment could be expected to improve client outcomes (Lash et al., 2007; Nielsen & Nielsen, 2015; Nielsen, Nielsen, & Wraae, 2000). Prevention of dropout has therefore been a topic for research and quality improvement in the alcohol treatment clinic in Odense, Denmark, for many years, as a part of a general focus on client outcome of treatment (Nielsen & Nielsen, 2015).

Retention in treatment may be increased in various ways. Motivational Interviewing (MI) is one tool designed to enhance client retention and outcome in substance abuse treatment (Miller & Rollnick, 2013). Several
studies have demonstrated that a majority of patients seeking treatment for alcohol problems remain ambivalent toward a change of behavior (DiClemente & Hughes, 1990; Rice, Hagler, & Tonigan, 2014). In early clinical trials in community treatment settings, clients randomly assigned to receive an MI session at intake had increased posttreatment abstinence rates compared to clients receiving the same treatment program without MI (Bien, Miller, & Boroughs, 1993), as well as improved retention and retention (Brown & Miller, 1993), and the findings are consistent (Hettema, Steele, & Miller, 2005; Rubak, Sandbaek, Lauritzen, & Christensen, 2005). In particular, patients with rather low level of motivation seems to benefit from MI sessions (Witkiewitz, Hartzler, & Donovan, 2010).

Retention may be a necessary but not sufficient component of treatment effectiveness. Another advocated strategy is the matching of clients to treatments that are most likely to be effective for them (Hesse, Thyrlstrup, & Nielsen, 2017; Institute of Medicine [IoM], 1990; Miller & Hester, 1986). In practice this is typically done by clinical judgment, in spite that clinical judgment has generally and for long been found to be less accurate than data-based actuarial prediction (Goldberg, 1970; Wiggins, 1973), meaning using data from the past to predict the future. For instance, Project MATCH tested 16 a priori matching hypotheses generated by highly experienced clinical researchers. Relatively modest support was found for only a few, and these matches were not consistent across clinical sites (Longabaugh & Wirtz, 2001), a finding supported in other studies (Mann & Hermann, 2010).

The reason for these results may be that matching is more complex than the simple interaction effect tested in most studies (Hesse et al., 2017). For example, the Project MATCH Research Group (1997, 1998) suggested that more complex formulations of matching may need to be specified and that combinations or profiles of patient characteristics may be more fruitful.

The present study is a quality development study, involving close monitoring of patient profiles, treatment courses and outcome, and systematic collecting information produced during daily clinical work. In the first phase of the study, we developed an algorithm based on the patients’ total profile at initiation of treatment and information about outcome of the treatment course, and this algorithm became the backbone of a matching guideline on how to match client profiles to treatment. Details on how the guideline was developed is described in the Method section. By using the matching guideline, it was possible to determine the patient profiles that benefit most from different types of treatments offered. A process like this is typically called “data-driven” or “actuarial” matching (IoM, 1990). It means that systematically collected information about patient profiles and the outcome of their treatment courses is used for developing an algorithm that can predict outcome for future patients. Such data-based expert systems are commonly used in medicine and engineering to assist in complex decision
making (Ahmadian et al., 2011; Payne, 2000). For instance, a “core-shell” system was designed in Ontario by which patients were centrally assessed and monitored over time to learn who benefitted most from particular programs (Martin, 1995), and likewise a computer-assisted system for patient assessment and referral was developed in Philadelphia, Pennsylvania (Carise, Gurel, McLellan, Dugosh, & Kendig, 2005), in The Netherlands (Merkx et al., 2007), and in Germany (Buchholz et al., 2014) to secure that referrals was systematically based on relevant patients data. Empirical data deriving from such systems may be used and tested in matching subsequent cohorts (IoM, 1990; Weisner, 1995).

A systematic and consequent matching strategy only makes sense, if different treatment approaches is available within the treatment system. In this study, four manual-guided interventions were offered throughout by the treatment institution throughout the course of the study.

With these issues in mind, we tested implementation of two changes in the outpatient alcoholism treatment system in Odense, Denmark: (1) increased focus on patient motivation during the first session at intake and (2) data-driven matching of clients to the four treatments interventions.

**Method**

**Patients and study design**

The two study cohorts were derived from the outpatient alcohol clinic in Odense, Denmark. The clinic has been working closely together with the Unit of Clinical Alcohol Research, University of Southern Denmark, for many years, and though it is a common and traditional public outpatient treatment institution, it also has a tradition for functioning as a laboratory for development and research. Throughout the study period a central assessment unit was in place to monitor patient progress for 12 months after treatment intake, essentially replicating a core-shell model with a central referral system, referring patients to different treatment offers. We used minimal exclusion criteria so that the study cohorts would be as representative as possible of the community treatment population. We excluded only patients with dementia, psychosis, or terminal illness. During the 14-month recruitment period for Cohort 1 (routine care), a total of 375 consecutive patients sought psychosocial treatment, of whom a random representative sample of 188 were enrolled in the study and followed up one year after initiation of treatment. Hereafter system changes were implemented within the treatment institution. The changes are described in details below.

After implementation of the system changes, another 180 consecutive patients initiating psychosocial treatment were recruited for Cohort 2 (Integrated intervention program), of whom 175 agreed to participate in
the study and be followed up one year after treatment start. At 12-month follow-up we were able to interview 136 (72%) of Cohort 1 and 140 (80%) of Cohort 2, for an overall follow-up rate of 76%.

**Assessment procedures**

The same intake and follow-up assessment procedures were used for both cohorts. An Addiction Severity Index (ASI; (McLellan, Luborsky, Woody, & O’Brien, 1980)) interview was routinely completed with all clients by clinical staff of the outpatient clinic. The ASI provides a multidimensional picture of the patient’s life functioning related to medical health, employment, alcohol use, drug use, legal, family and social conditions, and psychiatric status. ASI contains an interviewer score as well as a composite score. The interviewer score has been developed to describe the patient’s problems at the initiation of treatment for use in treatment planning, whereas changes in the composite score can be used to evaluate the results in the follow-up period.

The ASI interviewer score is based on the prevalence of symptoms within the 30 days preceding the contact to the outpatient clinic. The more days the patient has had problems, the higher the score. The scoring is based on objective data as well as the patient’s subjective description of problems and need for treatment. The following is a general guideline for the ratings:

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–1</td>
<td>No real problem, treatment not indicated</td>
</tr>
<tr>
<td>2–3</td>
<td>Slight problem, treatment probably not necessary</td>
</tr>
<tr>
<td>4–5</td>
<td>Moderate problem, some treatment indicated</td>
</tr>
<tr>
<td>6–7</td>
<td>Considerable problem, treatment necessary</td>
</tr>
<tr>
<td>8–9</td>
<td>Extreme problem, treatment absolutely necessary</td>
</tr>
</tbody>
</table>

In the development of the matching criteria, patients were divided into two categories: Patients with no or moderate problems scoring 0 to 5 and patients with more severe problems scoring 6 to 9.

The composite ASI score is based on the overall prevalence of symptoms within the 30 days preceding the interview. We added to the ASI some quantity/frequency questions to obtain more specific data regarding patients’ alcohol consumption during the same 30-day period. A thorough psychiatric interview was completed to make any relevant psychiatric diagnoses in accordance with ICD 10 R (WHO 1993). ICD-10 is the 10th revision of WHO’s International Statistical Classification of Diseases and Related Health Problems, and we used the research criteria. We also administered the Beck Hopelessness Scale to all patients (Beck, Weissman, Lester, & Trexler, 1974).

Follow-up ASI interviews were conducted by two independent research interviewers who had no involvement with the patients’ pretreatment
assessment or treatment. Because of the cohort design it was impossible for interviewers to be unaware of experimental condition. Whether patients completed an ASI interview, medical records were used to document interruption of the planned treatment. *Interruption* was defined as the patient stayed away from the agreed treatment in spite of calls and mail.

**Treatments**

The study site was the alcohol outpatient clinic of Odense. In Denmark, outpatient treatment is the primary public treatment available for people with alcohol problems (Schwarz, Nielsen, & Nielsen, 2017). Only a minority of the patients are referred from the outpatient clinics to inpatient treatment, and only in case of repeatedly problems with compliance in outpatient treatment. The treatment is free of charge, and patients may receive outpatient treatment promptly and without referral. All outpatient treatment consists of individual therapy. The length of treatment in the alcohol treatment clinic in Odense is about 9 months. The therapists were largely the same clinicians for both cohorts and included nurses, social workers, and psychiatrists. All had been thoroughly trained in the method of treatment that they preferred and practiced. Before the period of Cohort 1 began, local manualized treatment guidelines were developed in Danish for each of the four treatments by consensus among the therapists delivering it, and these guidelines were followed throughout both cohort periods. Weekly supervision was provided by highly experienced therapists to enhance adherence to treatment guidelines. The content of the four interventions is not particularly pertinent to the purpose of this study that focused on treatment delivery system changes, but they are described briefly below:

Cognitive-Behavior Therapy focused on helping patients learn problem-solving and coping skills to use in their daily lives in the community to not to drink excessively. In this treatment, as in the other three types of treatments, it was up to the patient whether to pursue a goal of total abstinence or to reduce drinking to sensible consumption (defined as drinking no more than 21 standard drinks per week, i.e., below the national recommendations). In vivo exposure was a commonly recommended technique for patients to gradually confront difficult situations in real life using the practiced coping skills. Homework assignments were used all through the treatment.

Behavior contracting consisted of developing structured contracts between therapist and patient specifying the treatment goals being pursued and a clear description of the behavior to be expected of both parties during the course of treatment. The contract could be modified along the way, and cognitive-behavioral methods were also included to help patients pursue their goals.

Supportive psychotherapy was strongly patient centered. The therapist focused on listening and reflecting, and it was the patient’s responsibility to
define the aims of counselling. There was also a psychodynamic quality to this treatment, exploring developmental antecedents of the patient’s current experience.

In systemic family therapy the patient and family members worked with a therapeutic team consisting of one or two therapists and two observers who followed the sessions via a one-way mirror. All sessions were videotaped. The starting point of the family therapy was to reduce alcohol abuse of one or more family members and implement structural/systemic changes in family dynamics to support this goal.

**Routine care (Cohort 1)**

During routine care (Cohort 1), a clinician used findings from the patient assessment at baseline and a clinical interview to decide which of the four types of psychosocial intervention would be best for the patient. The referral was based purely on clinical judgment from prior experience.

**Development of the actuarial matching criteria (for Cohort 2)**

The Actuarial Matching Criteria (AMC) was developed on the basis of data collected at the initiation of treatment for the 136 patients reinterviewed in Cohort 1 and data from a previous study including 63 patients in behavior contract treatment (Nielsen et al., 1998). Data included baseline data from the seven ASI problem areas, sociodemographic data, psychiatric diagnoses, and hopelessness score. Selection of AMC took place in the following way: Firstly, the patients in the four individual treatment options were divided into two groups according to whether they had a sensible alcohol use one year after start of treatment. Secondly, the variables that were associated with a sensible consumption were analyzed for each treatment option. Based on these analyses 16 variables were selected as they had a significance level of \( p \leq 0.1 \) for sensible consumption at just one of the treatment methods.

After selection of the 16 variables, the values of the AMC were derived by logistic regression (Fleiss et al., 1986). For all variables, an “odds” statistic was calculated, where the effect of the other patient characteristics was controlled for, meaning calculating the predictive value for each variable independently of the others. The predictive value of each patient characteristic in relation to a specific treatment method was thereby calculated. To make it simpler for clinician to calculate the AMC the “odds” was then rounded up to a whole number representing the “odds score” or AMC. The “odds scores” for each variable can be seen in Table 1. The odds score for “other treatment” was calculated based on the patient characteristics predicting a negative drinking outcome when treated in the outpatient clinics. It can be seen from the table how the variable female, for instance, has the odds score 2 for family therapy, 2 for CBT, and −1 for counselling.
The patient characteristics are marked with a circle in Table 1 if the patient possesses the characteristic, implying that the stated odds scores should be multiplied by 1. No circle around the odds score indicates that the patient does not possess the characteristic mentioned and the odds score is therefore multiplied by 0. Hereafter, the calculations will be as follows:

\[ Z (\text{total odds score}) = \text{Odds}_0 + \text{Odds}_1 \cdot X_1 + \text{Odds}_2 \cdot X_2 + \text{Odds}_3 \cdot X_3 \ldots \ldots \cdot \text{Odds}_{16} \cdot X_{16}. \]

In other words: the clinician calculates the sum of the values that have been circled in each column to calculate the total odds score for each treatment option.

### Table 1. Data-driven matching guideline

<table>
<thead>
<tr>
<th>Data</th>
<th>Family Therapy Odds Score</th>
<th>Cognitive Behavioral Therapy Odds Score</th>
<th>Counselling Odds Score</th>
<th>Contract Treatment Odds Score</th>
<th>Other Treatment Odds Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (Odds(_1))</td>
<td>2</td>
<td>2</td>
<td>−1</td>
<td>1</td>
<td>−1</td>
</tr>
<tr>
<td>40 years or older (Odds(_2))</td>
<td>1</td>
<td>−5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASI Interviewer score &gt; 6 (Odds(_3))</td>
<td>1</td>
<td>3</td>
<td>−1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed min. 20 days in the past month (Odds(_4))</td>
<td>1</td>
<td>2</td>
<td>−1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASI interviewer score &gt; 6 (Odds(_5))</td>
<td>−2</td>
<td>−2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abuse lasted &gt;5 years (Odds(_6))</td>
<td>2</td>
<td>−4</td>
<td>−1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASI interviewer score &gt; 6(Odds(_7))</td>
<td></td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family/social</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASI Interviewer score &gt; 6 (Odds(_8))</td>
<td>−8</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohabiting (Odds(_9))</td>
<td>4</td>
<td>−3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has network (close friends and/or family) (Odds(_10))</td>
<td>13</td>
<td>−3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychiatric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASI Interviewer score &gt; 6 (Odds(_11))</td>
<td>23</td>
<td>2</td>
<td>−1</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>Hopelessness score &gt; 6 (Odds(_12))</td>
<td>−2</td>
<td>−4</td>
<td>−1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Depression (Odds(_13))</td>
<td>3</td>
<td>−2</td>
<td>2</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>Generalized anxiety (Odds(_14))</td>
<td>−4</td>
<td>−36</td>
<td>−6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Panic attacks/phobias (Odds(_15))</td>
<td>−2</td>
<td>−1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality disorder (Odds(_16))</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum (odds score)</td>
<td>4</td>
<td>−23</td>
<td>0</td>
<td>1</td>
<td>−1</td>
</tr>
<tr>
<td>Basis point (are always added) (odds(_5))</td>
<td>−1</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>−1</td>
</tr>
<tr>
<td>Total odds score</td>
<td>3</td>
<td>−3</td>
<td>1</td>
<td>1</td>
<td>−1</td>
</tr>
</tbody>
</table>

Note. ASI = Addiction Severity Index.

The values under each therapy heading are added up separately, and the patient is referred to the therapy type, which has obtained the highest score. In case of family therapy, however, it is a condition that the patient is currently cohabiting and wishes to improve the relations with his/her partner. If two therapy types have equal scores, the choice is made based on the following: Outpatient treatment = other treatment, choose outpatient treatment. Family therapy = individual therapy, choose family therapy. Cognitive-Behavioral Therapy = supportive counselling or contract treatment, choose cognitive behavioral therapy. Contract treatment = supportive counselling, choose contract treatment.
The matching guidelines with the AMC are showed in Table 1 and on the basis of the total odds score the clinician referred the patients to the treatment option that obtained the highest score. Programmed into a computer, the instrument requires less than one minute to calculate the score and refer the individual patient.

**Integrated intervention program (Cohort 2)**

The integrated intervention approach offered to Cohort 2 differed in two ways from prior routine care. First, all patients in Cohort 2 received a single motivational session after assessment and before treatment assignment. Second, patients were allocated to one of the four treatments by the actuarial matching system described above, without discretion for clinical judgment.

The motivational session at intake was based on the principles of Motivational Interviewing (MI) (Miller & Rollnick, 2013), in which the therapists had had 2 days of training. No supervision in the method was delivered during the period under study.

**Actuarial matching**

As described above, patients were assigned to the treatment option with the highest odds score. If—and only if—the total scores were equally large for two therapies, the following pragmatic decision rules were consistently used: (1) outpatient treatment is chosen before other treatment settings, because it is cheaper for society; (2) family therapy is chosen before individual therapy, because not only the patient but also the significant others may benefit as well; (3) CBT is chosen before consultations and contract treatment, because the evidence of CBT is more supported than the evidence of consultations.

**Data analysis**

In the data analyses, all follow-up patients were included, irrespective of whether they had completed or interrupted treatment. Regarding statistical analyses, Student’s t-test was used for comparison of two means of the various groups. The chi-squared test was used for bivariate data. Time to interruption of treatment was shown in survival curves constructed according to the Kaplan-Meier method. Wilcoxon’s nonparametric test for variance in interruption rates was used in analyses of these survival curves.

**Results**

Patient pretreatment characteristics are reported in Table 2. Patients in Cohort 1 were slightly younger (18.7% younger than age 30 in Cohort 1 vs. 6.2% in Cohort 2; chi-squared test, $p = .017$). ASI-documented severity was
similar in the two groups, except that legal problems were somewhat higher
in Cohort 2 due to a few outliers.

Figure 1 is a survival curve showing time to interruption of planned
treatment for the two patient groups. With routine care (Cohort 1) 65
(47.8%) patients completed treatment as compared with 88 (62.8%) in the
integrated program (Cohort 2) (chi-squared test, \( p = .011 \)). This analysis
included the entire intent-to-treat sample.

At 12-month follow-up, as shown in Table 3, the ASI interviews reflected
significantly greater improvement in Cohort 2 on alcohol and psychiatric
problems, yielding a marginally significant difference in composite score.
Other drug and legal problems were relatively rare in both cohorts. Drinking
outcomes also differed, with 105 (75%) of Cohort 2 reporting moderate
consumption during the month preceding follow-up, as compared to 87
(64%) of patients in Cohort 1 (chi-squared test, \( p = .025 \)). With regard to
daily drinking, 44 (32%) patients in Cohort 1 reported they had never drunk
more than three units on any day in the preceding month (including total
abstainers), compared to 71 (51%) in Cohort 2 (chi-squared test, \( p = .002 \)).

**Discussion**

This study demonstrates that a treatment system change integrating routine
care with focus on motivation and data-driven matching was associated with
a significant improvement in patient adherence, retention and outcome.
Patients treated in Cohort 2 after these system changes were significantly more likely to complete treatment and showed greater reduction in drinking and in alcohol-related and psychiatric problems. The rate of treatment completion in a 12-month program with the integrated approach was quite good (63%) in an intent-to-treat sample, compared to previously reported dropout rates (Baekeland & Lundwall, 1975).

Our quasi-experimental design does not permit analysis of the separate contributions of the two system changes. Improved retention could have been a response to the motivational session, or due to being placed in a more appropriate treatment. We, however, consider the impact of the AMC to be the most significant, since research consistently demonstrates that a 2-day training course rarely has an impact on the treatment delivered (among others: Lucilla-Palacios & C. Castellano-Tejedor, 2015; Moyers et al., 2008).

Removing clinical judgment as a factor in treatment assignment was a significant and somewhat controversial change in system procedures. It has long been known that clinicians tend to place greater credence in their

Figure 1. Time to interruption of the planned treatment of patients in the routine group \((n = 136)\) and patients in the integrated group \((n = 140)\); \(p = .037\).
guesses than would be warranted by the evidence (Goldberg, 1970; Wiggins, 1973). Yet even the best guesses of well-established experts yielded disappointing results (Finney, 2008; Mann & Hermann, 2010; Project MATCH Research Group, 1997; Ukatt Research Team, 2008). An actuarial matching system yields data-based criteria for matching that can be applied with perfect reliability, and ongoing outcome monitoring can yield continuous improvement in matching (Martin, 1995; Nielsen & Nielsen, 2015).

Compared to other studies (Merkx et al., 2007; Project MATCH Research Group, 1997; Ukatt Research Team, 2008), it has the advantage of confidence that the criteria being used are relevant to the particular population being treated, rather than generalizing from findings in other populations and or hypothesis.

This study has several strengths. It was conducted with 363 patients in real-life public treatment settings using minimal exclusion criteria. The analyses were conducted on all patients followed up rather than selecting treatment completers. Follow-up was conducted by independent interviewers with widely used assessment procedures, and was completed with 76% of patients at 12 months. The 15 percentage-point difference in treatment completion rates clearly meets criteria for clinical as well as statistical significance (Miller & Manuel, 2008). As for limitations, the design was a quasi-experimental cohort study rather than a randomized trial. Although the two cohorts were quite similar in pretreatment characteristics, unknown confounders may have affected findings. It was

Table 3. Patients in the routine care group and the integrated care group distributed according to health, substance use, and psychosocial problems, 12 months after initiation of treatment (Analyzed by intent to treat)

<table>
<thead>
<tr>
<th>Problem areas(\textsuperscript{b} (M))</th>
<th>Routine Care Group ((n = 136))</th>
<th>Integrated Care Group ((n = 140))</th>
<th>Difference (95 CI)(\textsuperscript{a})</th>
<th>(\rho) Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>.274</td>
<td>.274</td>
<td>.000 (−.077 to .077)</td>
<td>.998</td>
</tr>
<tr>
<td>Employment</td>
<td>.615</td>
<td>.612</td>
<td>−.003 (−.071 to .065)</td>
<td>.926</td>
</tr>
<tr>
<td>Alcohol</td>
<td>.300</td>
<td>.232</td>
<td>−.068 (−.123 to −.013)</td>
<td>.016</td>
</tr>
<tr>
<td>Drug</td>
<td>.099</td>
<td>.008</td>
<td>−.001 (−.010 to −.008)</td>
<td>.090</td>
</tr>
<tr>
<td>Legal</td>
<td>.013</td>
<td>.004</td>
<td>−.009 (−.020 to −.002)</td>
<td>.095</td>
</tr>
<tr>
<td>Family/social</td>
<td>.170</td>
<td>.131</td>
<td>−.039 (−.080 to −.002)</td>
<td>.064</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>.170</td>
<td>.108</td>
<td>−.062 (−.103 to −.021)</td>
<td>.004</td>
</tr>
<tr>
<td>Global function (total score)</td>
<td>.221</td>
<td>.196</td>
<td>−.025 (−.050 to −.001)</td>
<td>.046</td>
</tr>
<tr>
<td>Self-reported drinking(\textsuperscript{c})</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensible consumption in the preceding 30 days ((N, %))</td>
<td>64.0</td>
<td>75.0</td>
<td>+11.0 (4.3 to −25.2)</td>
<td>.025</td>
</tr>
<tr>
<td>Abstinent or maximum 3 drinks per day in the preceding 30 days ((%))</td>
<td>32.4</td>
<td>50.7</td>
<td>+18.3 (6.0 to 36.9)</td>
<td>.002</td>
</tr>
</tbody>
</table>

Note. CI = confidence intervals.

\(\text{\textsuperscript{a}}\) Difference between routine care group and integrated group; 95% confidence intervals in parenthesis.

\(\text{\textsuperscript{b}}\) Based on Addiction Severity Index composite scores. Scores vary from 0 (no problem) to 1 (extreme problem) in the preceding 30 days.

\(\text{\textsuperscript{c}}\) Adjusted for age.

\(\text{\textsuperscript{d}}\) Estimated at 21 units per week.
impossible for follow-up interviewers to be naïve to experimental condition. Time effects might also have played a role; for example, therapists may have acquired greater skills in the therapy they provided. On the other hand, a few therapists did leave their jobs between the two periods, with the effect that Cohort 2 was treated by somewhat less experienced therapists. Finally, it would be worthwhile to evaluate the separate impact of the two system changes that we made. The current study speaks only to their combined impact.

Our conclusion is that data-driven matching improves patient adherence, retention, and outcome, compared to clinical judgement. But is the patient himself or herself an even better judge of what treatment offer that may be most effective and suitable to him or her? This question still needs to be answered, and hopefully it will, when we in a few years have the findings from the Self-Match Study, an ongoing randomized study that compares the outcomes of self-match versus data-driven matching.

**Ethical considerations**

The study was presented to the ethic committees but did not need approval because it was considered to be a quality assurance project. The study was approved by the Danish Data Protection Agency. The study applies to the Declaration of Helsinki.

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**References**


