# Effectiveness of cross-sectoral treatment models for patients with mental disorders - meta-analysis of 13 controlled studies from Germany

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**Research article**

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## Abstract

Background Individuals with mental disorders demand for a continuous and efficient collaboration between different sectors of care. In 2012, a new law in Germany enabled the implementation of cross-sectoral and patient-centered treatment models in psychiatry (FIT64b). These projects have been evaluated by a scientific consortium in controlled cohort studies. We present results of effectiveness based on a meta-analysis from 13 FIT64b hospitals. Methods/Design We undertook a series of claims-data-based controlled cohort studies. Data from over 70 statutory health insurance (SHI) funds in Germany were analyzed. All patients insured by any of the participating SHI funds and treated in one of the FIT64b hospitals for any of 16 pre-defined mental disorders were compared with matched control patients from routine care. The collective was subdivided into hospital-new and hospital-known patients. Primary outcomes were duration of inpatient care and duration of sick leave. Individual treatment effects of the 13 FIT64b hospitals were pooled in a random-effects meta-analysis. Meta-regression analysis was used to explore potential reasons for heterogeneity in model effectiveness. Results Meta-analyses indicated a significant effect of a reduction by over 5 days on the cumulated duration of inpatient care in hospital-new intervention (IG) compared to control patients (CG). This effect was even stronger among FIT64b hospitals with a pre-existing FIT64b-like environment. Regarding the duration of sick leave there was no overall significant effect between the two groups. Further meta-regression for hospital-new patients revealed that sick leave duration was significantly reduced by almost 13 days in intervention hospitals with a pre-existing FIT64b-like contract compared to hospitals without such a contract. Conclusions This meta-analysis suggests positive effects of FIT64b for patients with mental disorders with shorter duration of inpatient treatment. We additionally found a trend towards a reduced duration of sick leave days in FIT64b hospitals with a pre-existing FIT64b–like structure in the pre period. Pre-existing FIT64b-like contracts appear to have facilitated the transition into the new treatment environment. The results should still be interpreted with caution, as this manuscript only covers the first year of the five-year evaluation period in thirteen of eighteen FIT64b hospitals.

## Background

Mental disorders are predominantly characterized by an early onset persisting over long durations. Moreover, utilization of treatment in psychiatric patients is low with a great amount of delay between onset of illness and first adequate treatment (Lambert et al., 2013). Efficient patient-centered treatment of these disorders demands for a continuous and close collaboration between different sectors and professions of care (Brieger, Bode, Urban, & Pfennig, 2012; Wilms, Becker, Lambert, & Deister, 2012).

However, the German healthcare system currently suffers from insufficient interfaces between different health care sectors, particularly in the field of psychiatric care (Schmitt, Petzold, Nellessen-Martens, & Pfaff, 2015). This especially affects the transition from inpatient to outpatient care, joint care of patients involving multiple medical specialists and the transition from rehabilitated patients back into the primary labor market (H. Hoffmann, 2004; Schneider, Falkai, & Maier, 2011). On the other hand, the financing of the German psychiatric health care system is fragmented with separate budgets for inpatient and daycare services strictly divided from a different budget of the psychiatric outpatient department (PIA, for patients in need of particularly intensive and complex near-hospital care due to the nature, severity or duration of their mental disorder). This separation constitutes an additional obstacle towards an efficient trans-sectoral treatment (Deister, 2015) potentially resulting in misguided incentives such as maximizing inpatient occupancies by admitting as many patients as possible with the highest possible retention time (Becker et al., 2008).

In 2012 a German law (§64b Social Code Book (SGB) V) allowed for the realization of models focusing on patient-centered cross-sectoral health care in mentally ill patients. It enabled statutory health insurance funds (SHI) to adopt contracts with hospitals to jointly establish contracts based on the so-called capitation principle (Konig et al., 2013), i.e. an annual overall budget for every patient including inpatient care, day care and outpatient care in the affiliated hospital. Hospitals implementing these new models of care will be further called FIT64b hospitals (Johne et al., 2018; von Peter et al., 2019). FIT64b hospitals are free to tailor specific models of care that suit the regional peculiarities and meet the needs of community members (Berghofer, Hubmann, Birker, Hejnal, & Fischer, 2016).

The supplementary law (§65 SGB V) further requires evaluation on the effectivity and efficiency of all of those projects. The authors are responsible for a standardized evaluation of all model projects based on data from 70 SHI representing more than 300.000 patients (March et al., 2018). In this evaluation patients being treated in FIT64b hospitals are compared to consecutive patients from routine care hospitals

This manuscript describes first results of effectivity measures from the EVA64-study based on meta-analyses and meta-regressions over the first thirteen intermediate evaluative reports. With regard to cumulated duration of inpatient care and cumulated duration of sick leave, we hypothesized a slower increase among hospital-new patients in FIT64b hospitals compared to hospital-new patients in its consecutive control hospitals.

# Methods

Study design

We undertook a series of health insurance data-based controlled cohort studies. Data from over 70 statutory health insurance (SHI) funds in Germany spanning over a time period of seven years are utilized. All patients insured by any of the participating SHI funds and treated in one of the FIT64b hospitals (intervention group, IG) for any of 16 pre-defined mental disorders were compared with control patients from routine care (control group, CG). Details of the study design and methods have already been published (Neumann et al., 2018).

Study population

Main eligibility criteria included patients to be insured by any of the participating SHI funds and to be treated due to any of the 16 pre-defined mental disorders (Neumann et al., 2018). To minimize the likelihood of selection bias on the provider and patient level we applied a two stage matching algorithm. First, control hospitals were allocated to each FIT64b hospital (Petzold et al., 2016) and secondly, FIT64b hospital patients were assigned complementary matches in control hospitals using propensity score matching. For each individual FIT64b hospital, population sub-cohorts of hospital-known and hospital-new patients were defined. Hospital-new describes patients who had no contact to the psychiatric ward or PIA in the corresponding FIT64b or control hospital in the two years before study inclusion. Hospital-known patients had to have at least one such contact in this time period.

Data and outcomes

Primary effectiveness outcomes were *duration of inpatient care* and *sick leave*. The first parameter evaluates the average cumulated length of hospitalization days within the first 12 months after inclusion into the study. We assumed that a potentially reduced inpatient care in the initial treatment phase can be compensated for both in day care or in outpatient treatment. To this end, we also analyzed day care and outpatient utilization in hospital-new patients. To further analyze the association of inpatient and day care treatment duration for the cohort of hospital-new patients, we calculated a Pearson correlation coefficient on the level of FIT64b projects between these two measures. The parameter *sick leave* only applies to subjects of over eighteen years of age describes the average cumulated number of days in sick leave due to inclusion diagnosis among patients with member status (health insurance status = member) within 12 months after inclusion into the study.

Here, we report first results from inception until the end of the first year of the FIT64b intervention in thirteen from the total 18 hospitals. Outcome parameters were compared with the patient-individual pre-time (one year prior to study entrance). Contracts started between January 2013 and December 2014 in all analyzed hospitals. FIT64b hospitals differed with respect to starting conditions. Four hospitals transitioned from standard care into FIT64b. The remaining nine hospitals transitioned from a preexisting contract with similar goals as the §64-contract into FIT64b. These could either include a regional budget for mental health care, a contract for integrated care or both options combined (Schmid, Steinert, & Borbé, 2013).

Analyses were based on a standardized set of anonymized claims data provided by 70 participating statutory health insurance (SHI) funds. The dataset covered inpatient and outpatient care (diagnoses, procedures, cost) including psychiatric outpatients department (PIA), pharmaceutical and non-pharmaceutical treatments and information on sick leave with reasons. As exclusively anonymous data were analyzed the ethical committee of the University of Magdeburg confirmed that no ethical approval was necessary. Data were handled, analyzed and reported according to Good Epidemiological Practice (GEP) (W. Hoffmann et al., 2019), Good Practice of Secondary Data Analysis (GPS) (Swart et al., 2015), and the German Reporting Standard for Secondary Data Analyses, Version 2 (STROSA 2) (E. Swart et al., 2016).

Statistical analysis on single hospital level

Estimators for outcomes of interest were estimated using generalized linear poisson models. Models contained regressors for factors *group* (intervention group vs. control group) and *time* (pre vs. 1st year after FIT64b inclusion) as well as an additional regressor for the interaction term *group x time*. As the interaction term denotes the Difference-in-Difference (DiD) estimate (hence, the actual treatment effect) regression coefficients for the interaction term were later used in the meta-analysis. The DiD effect compares the average change over time in the outcome variable for the IG in contrast to the average change over time for the CG. Thus, greater changes over time in the IG compared to the CG are associated with a positive DiD coefficient and vice versa.

Meta-analysis over thirteen evaluated FIT64b hospitals

The DiD-coefficients for every single FIT64b hospital were used in a meta-analysis regarding the primary outcomes *duration of inpatient care* as well as duration of *sick leave.* The meta-analysis was done utilizing the R package metaphor (Viechtbauer, 2010). The heterogeneity measure $I^2$ between the individual entities was expected to be high since hospitals recruited different populations and had varying starting conditions. Taking these considerations into account the pooled estimator was modeled as random effect. The heterogeneity parameter $\tau^2$ was estimated using the *DerSimonian-Laird* estimator. Finally, for every single outcome we additionally carried out a meta-regression to disentangle especially the impact of pre-existing FIT64b–like structures. Therefore, we included a predictor variable in the meta-regression which dummy coded hospitals with a pre-existing contract (0=no existing contract vs. 1= existing contract). The result of the meta-regression would give an estimate on how FIT64b hospitals with pre-existing contracts would contrast against those without such a contract. All statistical analyses were done using statistical software R V. 3.3.2 (R Core Team, 2012).

# Results

Baseline characteristics

The FIT64b and corresponding control patients ranged between 153 and 852 hospital-new, and 164 and 1,207 hospital-known patients, respectively. The overall cohort consisted of 26,398 patients (13,199 each in IG and KG) with 12,468 (6,234 each) being hospital-new and 13,930 (6,965 each) being hospital-known. Mean age and sex was highly comparable between IG and CG (see Table 1). Throughout all hospitals regardless of group, more women were included (56%).

Descriptive data

Outcomes were compared between the first year after study entry (1st yr) and the year prior to study entry (pre) in a Difference-in-Difference analysis.

*Duration of inpatient care*

Hospital-new FIT64b hospitals ranged between 1.0 and 3.8 inpatient days in the pre period, and 6.4 and 30.0 days in the first year, respectively. The corresponding control hospitals ranged between 0.4 and 3.6 inpatient days in the pre period, and 13.9 and 25.9 days in the first year. Among hospital-new patients, the number of days in hospital was low before study inclusion and sharply increased within the first year after study inclusion (see Table 2).  However, over all FIT64b hospitals the sharp increase in hospital stay was lower in the IG (from 2 to 15.6 days) compared to the CG (from 2.2 to 21.3 days; Table 2).

Hospital-known FIT64b hospitals ranged between 5.7 and 20.4 inpatient days in the pre period, and 7.2 and 32.9 days in the first year, respectively. The corresponding control hospitals ranged between 8.9 and 21.8 inpatient days in the pre period, and 12.2 and 26.1 days in the first year. Hospital-known patients had fewer inpatient days in the IG compared to the CG. The increase in inpatient care days was slightly lower in the IG (10.9 to 12.7 days) compared to the CG (from 13.9 to 16.4 days; Table 2).

*Duration of sick leave*

Hospital-new FIT64b hospitals ranged between 15.3 and 33.8 days of sick leave in the pre period, and 57.8 and 83.6 days in the first year, respectively. The corresponding control hospitals ranged between 10.3 and 31.8 sick leave days in the pre period, and 57.4 and 82.6 days in the first year. The number of days in sick leave sharply increased within the first year after study inclusion (Table 3). There was no notable overall difference in increase of sick leave days between the two groups (see Table 3).

Hospital-known FIT64b hospitals ranged between 18.3 and 60.8 days of sick leave in the pre period, and 21.7 and 72.9 days in the first year, respectively. The corresponding control hospitals ranged between 20.4 and 64.0 sick leave days in the pre period, and 18.1 and 71.5 days in the first year. The aggregated average number of days in sick leave was lower in the IG compared to the CG in the first year of the evaluation. Over all, there was a slight increase in the duration of sick leave in both groups with the increase in the IG being slightly lower compared to the CG.

Meta-analysis

*Duration of inpatient care*

In the cohort of hospital-new patients, the pooled effect of the overall difference in cumulative number of inpatient care days per person between IG and CG exceeded significance level ($p<0.001$). The pooled DiD showed an average decrease of 5.4 days (95% CI: -7.41; -3.44) in the IG compared to the CG (see Table 4 and Figure 1). In the meta-regression, we observed that this effect was especially driven by FIT64b hospitals that already had a pre-existing contract. When contrasted against the remaining four FIT64b hospitals without such a contract, hospitals with a pre-existing contract had a significantly reduced DiD of approximately 4.7 days in the meta-regression (see Table 5).

In the cohort of hospital-known patients the pooled estimate displayed a decrease of 0.77 95% CI: -2.5; 0.97) days in the IG compared to the CG (see Table 4 and Figure 2). However, this effect did not exceed significance level. The following meta-regression revealed no significant difference in FIT64b hospitals that already had a pre-existing contract compared to hospitals without a contract (see Table 5). In general, coefficients of individual DiD effects in the cohort of hospital-known patients reveal smaller absolute values compared to the cohort of hospital-new patients, especially in FIT64b hospitals with pre-existing FIT64b–like contracts. This might be mainly due to already existent baseline differences in the pre period between IG and CG. Those baseline differences might lead to possible ceiling effects by leaving not much room of further improvement in the post period. This pre-period difference between the two groups is not that pronounced in FIT64b hospitals without already existing FIT64b–like structure (see Table 2).

*Cumulated number of contacts in outpatient care*

We further differentiated between contacts to the psychiatric outpatient department of the FIT64b or control hospital and contacts to established medical specialists for psychiatry or psychotherapy. Due to insufficient pre-period data of outpatient contacts in the PIA in six of the 13 FIT64b hospitals, this meta-analysis only compared mean differences in the first year after onset of the project. Regarding contacts to medical specialists, we were able to apply the usual procedure of calculating a pooled effect over individual DiD estimates. Both analyses did not yield statistically significant results. Neither the number of contacts in the PIA (pooled Estimate= 0.43; p= 0.402) nor the number of contacts to medical specialists (pooled Estimate= -0.06; p= 0.806) were considerably increased in hospital-new intervention patients compared to patients of the control group (see Table 4).

*Cumulated duration in day care*

In the meta-analysis of cumulated day care duration, the pooled estimate did not exceed significance level as well (p=0.15, see Table 4). However, the IG showed a trend towards a higher utilization (approximately 2 days) compared to the CG (see Figure 3). We identified a coefficient of -0.31. That means that the more inpatient treatment days were reduced in the IG of a specific FIT64b hospital the more the number of day care treatment days was increased compared to the CG and vice versa (see Figure 4). This correlation did not yet exceed significance level (p=0.15) which is mainly due to the lack of statistical power as only data pairs from thirteen FIT64b hospitals were available up to that point.

*Duration of sick leave*

In the cohort of hospital-new patients, there was no visible pooled effect over the overall difference in cumulative number of sick leave days per person between IG and CG (pooled Estimate= -0.02; p= 0.994, see Table 4 and Figure 5). Looking at the individual DiD estimators of each FIT64b hospital contrasted against its control, it is clearly visible that there is a significant effect in almost each of them. However, the direction of these effects is quite divers. When contrasting hospitals who already had a FIT64b-like contract in advance against the remaining hospitals without such a contract as reference in the meta-regression, we found a massive effect of an increased negative DiD (see Table 5). Hence, whether or not a FIT64b hospital already had a pre-existing FIT64b-like structure plays a huge role in explaining the large heterogeneity of the individual DiD effects. Hospitals with a pre-existing contract had a reduced duration of sick leave of almost 13 days compared to hospitals without such a contract. Based on this result, we additionally performed a meta-analysis only including the nine FIT64b hospitals with a pre-existing contract. The pooled estimate did also not exceed significance level, but, however, showed a stronger tendency towards a reduced duration of sick leave of over four days in intervention patients compared to control patients (pooled Estimate= -4.34; p= 0.076).

In the cohort of hospital-known patients, the pooled estimate displayed a decrease in days of sick leave of 1.27 days in the IG compared to the CG (see Table 4 and Figure 6). This effect did not exceed significance level. The meta-regression revealed no significant difference in FIT64b hospitals that already had a pre-existing contract compared to hospitals without a contract (see Table 5).

# Discussion

Already in the 1970s, the German Bundestag Study Commission urged for new approaches to care particularly aiming at a preference of outpatient over inpatient treatment whenever possible and a regionalized health care (Kunze H, 1999). Since then various health care models that aim to change misguided incentives in the current system and use resources more efficiently in order to improve treatment in psychiatric patients have been investigated (Deister, 2015; Schmid et al., 2013). The project EVA64 evaluates eighteen different nationwide model projects according to §64b SGB V which aim to optimize the health care of patients with mental disorders in Germany. The study was, as requested by prior research (Nolting & Hackmann, 2012; Wilms et al., 2012), designed to provide a standardized evaluation procedure on a common basis of SHI funds. The manuscript presents results of the EVA64-study based on a meta-analysis over the first intermediate evaluative reports of thirteen of these FIT64b projects.

Our reasoning behind the sub-division of the cohort into hospital-new and hospital-known patients was that potential intervention effects would show differently in patients who already have a treatment history at a FIT64b-/control hospital compared to patients whose initial treatment after the onset of §64b SGB V also represents their initial treatment in the FIT64b-/control hospital. This differentiation gains even more importance considering that 9 out of 13 FIT64b hospitals already had specific contracts which to a certain extent already exhibited FIT64b-like structures in advance of the intervention onset. These already pre-existing contracts are likely to have facilitated the transition into the new §64b SGB V environment and in fact even could have already forestalled some of the intended FIT64b effects in the pre-intervention period (Coleman et al., 2005; Konig et al., 2010; C Roick, S, & A, 2008; Schmid et al., 2013). Hence, we expected more unbiased intervention effects in the sub cohort of hospital-new patients.

The meta-analysis showed a significantly lower increase in the cumulated duration of inpatient care in hospital-new intervention patients (IG) compared to control patients (CG) indicating positive effects on one of the primary goals of FIT64b (Neumann et al., 2018). This effect was even stronger when only considering FIT64b hospitals that transitioned from an already existing FIT64b-like contract into §64b SGB V. The overall sharp increase in inpatient care from pre period to the end of the first year in both groups was expected as hospital-new patient's inclusion diagnosis is likely to be an incident diagnosis. In hospital-known patients there was already a substantial baseline difference between IG and CG in those FIT64b hospitals. This was not the case when only considering FIT64b hospitals without any pre-existing contract in the pre period. These results may lead to various conclusions with high impact for the organization of clinical care in mental health settings. First, the FIT64b intervention is effective in terms of reducing inpatient care. Secondly, FIT64b–like contracts in the pre-period may have already forestalled some of the intended effects (hospital-known patients). This presumption is supported by findings from other authors who explicitly examined the effects of some of these contracts in various hospitals (C. Roick et al., 2005; Sander & Albus, 2010; Schmid et al., 2013). On the other hand, those contracts possibly facilitated a faster and smoother implementation of FIT64b (hospital-new patients). Hospitals starting from scratch are likely to undergo a longer transition and implementation period. Thus, potential FIT64b effects are not likely to be already present in the first year after onset. Interestingly, we found tendencies of overall increased day care duration but not an increase in outpatient contacts in hospital-new patients. Moreover, there seems to be a correlation between the reduction of inpatient care and day care; the more inpatient care is reduced in a FIT64b hospital the more day care treatment is increased. This may give rise to the interpretation that reduced inpatient days in FIT64b hospitals are rerouted into day care treatment but not necessarily into outpatient treatment per se.

Analogously to inpatient treatment utilization, there was a sharp increase in sick leave duration from pre period to the end of the first year in both groups. As hospital-new patient's inclusion diagnosis is likely to be an incident diagnosis, it may also give rise to an increased number of sick leave days. On first sight there seemed to be no considerable difference regarding trends in sick leave duration between FIT64b patients and control patients. The pooled estimator showed no significant difference in the average cumulated number of sick leave days between IG and CG in both hospital-new as well as hospital-known patients. With the individual effects being very heterogeneous, a further meta-regression for hospital-new patients revealed that sick leave duration was significantly lower by almost 13 days in FIT64b hospitals with an already existing FIT64b-like contract in the pre-period compared to FIT64b hospitals without such a contract. A concluding meta-analysis containing only FIT64b hospitals with a FIT64b-like contract in the pre-period showed a clear tendency of reduced sick leave duration in intervention patients compared to control patients, although not significant.

The scientific use of claims data from SHI funds for the evaluation of new health care concepts has been established during the last years including analysis and reporting standards (E Swart et al., 2016; Swart et al., 2015). Due to the assessment of anonymous data, it is not necessary to explicitly inform about the study and informed consent is not obtained, giving these data the great advantage of being less prone to bias (Swart, 2017). While claims data offer essential information, preference-based and patient-centered information cannot be obtained. To this end, the complementary evaluation project PsychCare, which is conducted in ten FIT64b hospitals and consecutive controls, will give access to patient-reported outcomes and patient-reported experience measures by means of questionnaires and qualitative surveys. First results by another research group implementing a mixed methods design suggest that changes caused in FIT64b hospitals are rated mostly positive by patients while relatives stated to fear certain extra effort caused by increased outpatient treatment. Employees in FIT64b hospitals described to have a higher work load, especially present in nursing professions (von Peter, Ignatyev, & Heinze, 2017). One major handicap of this study is that results cannot be directly compared to conditions in routine care due to the lack of a control group.

As a limiting factor, this manuscript only reviews the first year of the all in all five-year evaluation period. Thus, it can only cover potential short-term effects leaving out effects that occur only over a longer time period. Further reports with data spanning over a longer observation period will reveal if positive intervention effects will be present or strengthened in FIT64b hospitals, particularly in those without any pre-existing contract. Additionally so far only 13 of a total of 18 FIT64b hospitals have been analyzed. For a final assessment, more data of all FIT64b hospitals over the entire evaluation period are necessary.

# Conclusions

The indirect aim of the FIT64b is to evolve a system where the treatment can be adjusted flexibly to the patient and not the patient to the treatment. In accordance with our hypothesis, this meta-analysis suggests positive effects of cross-sectoral models of care for patients with mental disorders with shorter duration of inpatient treatment and a trend towards a reduced duration of sick leave days in FIT64b hospitals with a pre-existing FIT64b–like structure in the pre period. Moreover the results suggest that a) pre-existing contracts are likely to have facilitated the transition into the new §64b-environment and b) implementation of §64b-contracts in hospitals without such a pre-contract demands for a certain transition period until positive effects will be visible. Further reports will answer the question if already observed positive intervention effects will persist also on a long-term perspective. If FIT64b hospitals in psychiatric care continue to be efficient compared to routine care, this evaluation will provide arguments for a new structuring of routine care for patients with mental disorders in Germany.

# Abbreviations

CG Control group

DiD Difference in Difference

ICD-10 International Classification of Disease, 10th revision

IG Intervention Group

PIA psychiatric outpatients department

SGB Social Security Code (Sozialgesetzbuch)

SHI Statutory Health insurance funds

# Declarations

### Ethics approval and consent to participate

The ethical committee of the University of Magdeburg has been notified. The ethical committee stated in April 2016 that no vote is necessary, as EVA64 is an analysis of anonymous data.

### Availability of data and materials

The data supporting the findings of the study is provided by the 70 participating SHIs. These data is not publicly available and were used under license for the current study. Data are however available from the authors upon reasonable request and with permission of the participating SHIs.

### Consent for publication

“Not applicable”

### Competing interests

The Technische Universität Dresden, the University of Magdeburg and WIG2 received funding for this study. This funding did not have any influence on the design, methods and evaluation of the study.

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actimonda krankenkasse;

AOK Nordost – Die Gesundheitskasse für Berlin, Brandenburg und Mecklenburg-Vorpommen;

AOK Rheinland/Hamburg – Die Gesundheitskasse;

AOK PLUS – Die Gesundheitskasse für Sachsen und Thüringen;

AOK NORDWEST – Die Gesundheitskasse;

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Kaufmännische Krankenkasse – KKH;

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Wieland BKK;

WMF Betriebskrankenkasse

## Authors' contributions

FB wrote the manuscript; conceptualized and conducted the statistical analyses.

OS conceptualized the statistical analyses.

AN coordinates the study and defined the outcome parameters.

MS contributed substantially to data handling, selection of control hospitals and evaluation of outcome parameters.

RK contributed substantially to the economic outcomes and patient-individual matching.

SM contributed substantially to the data management.

FC evaluated the economic outcomes.

ES is responsible for data management.

DH is responsible for economic outcomes.

AP advised substantially in regard to psychiatric care and outcome parameters.

JS is principle investigator and responsible for the description of the study design and effectivity estimation.

All authors have read and commented on the manuscript. All authors read and approved the final version of the manuscript.

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# Tables

**Table 1: Characteristics of patients of all hospitals at the time of study inclusion**

| | N | | Mean Age (Years) | | Percentage Women | |
|---|---|---|---|---|---|---|
| | IG | CG | IG | CG | IG | CG |
| **Cohort of hospital-new patients** | **6,234** | **6,234** | **50.6** | **50.6** | **56%** | **56%** |
| A | 770 | 770 | 41.9 | 41.9 | 62% | 62% |
| B | 153 | 153 | 49.9 | 50 | 69% | 61% |
| C | 748 | 748 | 47.7 | 48.3 | 58% | 57% |
| D | 637 | 637 | 50 | 49.4 | 58% | 60% |
| E | 426 | 426 | 52.3 | 53.8 | 55% | 54% |
| F | 594 | 594 | 50.9 | 50.6 | 55% | 53% |
| G | 375 | 375 | 52.3 | 51.9 | 52% | 54% |
| H | 507 | 507 | 50.6 | 49.8 | 58% | 59% |
| I | 221 | 221 | 54.4 | 52.8 | 44% | 45% |
| J | 852 | 852 | 53.3 | 52.3 | 56% | 57% |
| K | 204 | 204 | 50 | 50.8 | 55% | 57% |
| L | 289 | 289 | 52.8 | 52 | 51% | 54% |
| M | 458 | 458 | 51.4 | 53.6 | 58% | 52% |
| **Cohort of hospital-known patients** | **6,965** | **6,965** | **51.5** | **51.4** | **56%** | **56%** |
| A | 663 | 663 | 45.7 | 47.4 | 56% | 58% |
| B | 245 | 245 | 53.6 | 51.2 | 68% | 67% |
| C | 1,207 | 1,207 | 49.2 | 50.3 | 55% | 58% |
| D | 705 | 705 | 48.4 | 49 | 63% | 59% |
| E | 496 | 496 | 52.2 | 52.6 | 52% | 55% |
| F | 469 | 469 | 49.6 | 51.6 | 51% | 54% |
| G | 318 | 318 | 52.6 | 53 | 42% | 46% |
| H | 486 | 486 | 50.8 | 49.6 | 55% | 53% |
| I | 259 | 259 | 53.6 | 53.6 | 49% | 48% |
| J | 981 | 981 | 56.7 | 56.8 | 58% | 59% |
| K | 337 | 337 | 55.5 | 53.7 | 63% | 60% |
| L | 164 | 164 | 49.3 | 46 | 61% | 51% |
| M | 635 | 635 | 51.8 | 53.3 | 54% | 55% |

[1] IG = intervention group (FIT64b hospital); CG = control group (control hospitals)

Table 2: Duration of inpatient care

| | IG | | CG | |
|---|---|---|---|---|
| | **pre** | **1st yr** | **pre** | **1st yr** |
| **Cohort of hospital-new patients (n)** | **6,234** | | **6,234** | |
| Cumulated duration (days) of inpatient care per patient | mean (sd) | | | |
| A | 3.9 (17.3) | 13.3 (27.0) | 3.8 (16.9) | 20.0 (31.1) |
| B | 1.4 (6.6) | 12.4 (24.0) | 3.6 (19.6) | 24.9 (39.8) |
| C | 2.2 (14.4) | 9.4 (22.1) | 1.8 (9.7) | 13.9 (30.3) |
| D | 2.7 (15.5) | 16.6 (25.9) | 1.6 (10.3) | 23.7 (34.3) |
| E | 2.0 (12.7) | 6.4 (15.0) | 3.2 (21.0) | 17.3 (27.0) |
| F | 1.4 (10.5) | 18.1 (24.0) | 1.9 (12.5) | 23.4 (36.4) |
| G | 2.2 (14.8) | 17.2 (32.9) | 2.3 (13.0) | 21.0 (32.3) |
| H | 1.1 (8.3) | 11.3 (28.4) | 1.5 (9.4) | 23.9 (36.5) |
| I | 1.0 (4.6) | 20.0 (23.2) | 0.4 (2.7) | 20.6 (25.6) |
| J | 1.7 (12.9) | 10.7 (25.8) | 2.0 (10.5) | 19.6 (30.6) |
| K | 1.8 (11.3) | 18.6 (34.2) | 1.2 (8.3) | 17.6 (29.5) |
| L | 2.6 (14.2) | 30.0 (43.8) | 2.9 (14.5) | 25.9 (34.6) |
| M | 1.6 (13.3) | 19.4 (26.3) | 2.7 (16.3) | 25.2 (34.9) |
| **Grand mean over all hospitals** | **2.0** | **15.6** | **2.2** | **21.3** |
| **Grand mean of only FIT64b hospitals with pre-existing FIT64b-like contract** | **2.0** | **13.9** | **2.2** | **20.9** |
| **Grand mean of only FIT64b hospitals without pre-existing FIT64b-like contract** | **1.9** | **19.7** | **2.2** | **22.1** |
| **Cohort of hospital-known patients (n)** | **6,965** | | **6,965** | |
| Cumulated mean duration (days) of inpatient care per patient | mean (sd) | | | |
| A | 8.3 (21.8) | 9.8 (27.2) | 9.2 (24.7) | 17.9 (33.6) |
| B | 11.0 (25.5) | 10.1 (21.6) | 13.5 (33.2) | 13.7 (27.7) |
| C | 8.9 (27.7) | 7.2 (24.5) | 15.8 (38.4) | 12.4 (32.4) |
| D | 7.5 (22.3) | 10.4 (24.8) | 13.4 (31.5) | 15.2 (31.3) |
| E | 5.7 (16.4) | 7.4 (21.4) | 11.6 (31.2) | 14.3 (30.4) |
| F | 14.9 (27.1) | 18.0 (31.3) | 20.4 (39.7) | 26.1 (43.2) |
| G | 11.1 (31.9) | 14.1 (31.1) | 13.1 (30.0) | 19.3 (34.1) |
| H | 8.8 (25.3) | 8.8 (23.2) | 14.3 (33.1) | 17.0 (34.5) |
| I | 8.2 (21.7) | 10.5 (22.3) | 9.3 (24.5) | 13.4 (32.0) |
| J | 12.4 (34.2) | 10.2 (30.9) | 11.4 (29.8) | 12.5 (28.0) |
| K | 11.2 (29.6) | 11.8 (32.1) | 9.9 (26.8) | 12.2 (28.8) |
| L | 20.4 (37.0) | 32.9 (46.6) | 21.8 (32.9) | 24.7 (39.9) |
| M | 13.2 (31.2) | 14.1 (35.0) | 16.6 (32.7) | 15.0 (30.5) |
| **Grand mean over all hospitals** | **10.9** | **12.7** | **13.9** | **16.4** |
| **Grand mean of only FIT64b hospitals with pre-existing FIT64b-like contract** | **9.4** | **10.7** | **13.4** | **16.6** |
| **Grand mean of only FIT64b hospitals without pre-existing FIT64b-like contract** | **13.6** | **16.3** | **14.7** | **16.2** |

[1] IG = intervention group (FIT64b hospital); CG = control group (control hospitals)

 pre = one year before study inclusion; 1st yr = one year after study inclusion

Table 3: Duration of sick leave due to inclusion diagnosis

| | IG | | CG | |
|---|---|---|---|---|
| | pre | 1st yr | pre | 1st yr |
| **Number of <u>hospital-new</u> patients capaple of working (n)** | **3,433** | | **3,430** | |
| cumulated number of days in sick leave | mean (sd) | | | |
| A | 33.8 (75.3) | 70.8 (106.8) | 29.5 (69.7) | 75.3 (104.1) |
| B | 27.5 (74.4) | 83.6 (108.3) | 16.1 (41.1) | 75.3 (85.2) |
| C | 15.9 (45.4) | 57.8 (96.9) | 13.2 (32.5) | 59.9 (92.4) |
| D | 25.9 (62.9) | 58.2 (86.2) | 18.5 (49.3) | 67.9 (93.2) |
| E | 19.6 (64.2) | 58.6 (92.8) | 13.6 (42.5) | 57.4 (85.3) |
| F | 20.3 (50.0) | 67.0 (89.6) | 16.1 (42.9) | 63.5 (91.7) |
| G | 19.1 (47.2) | 78.8 (102.1) | 20.0 (56.0) | 63.8 (100.4) |
| H | 16.6 (40.6) | 58.5 (78.1) | 13.1 (43.4) | 61.1 (91.2) |
| I | 15.6 (39.4) | 66.2 (91.5) | 10.3 (28.9) | 67.2 (90.1) |
| J | 17.7 (49.1) | 61.5 (96.6) | 16.7 (45.7) | 57.8 (83.2) |
| K | 19.7 (54.5) | 75.2 (103.0) | 18.4 (57.7) | 57.4 (86.1) |
| L | 15.3 (40.3) | 70.0 (74.9) | 31.8 (70.0) | 62.6 (80.8) |
| M | 22.8 (56.8) | 72.5 (92.6) | 25.5 (56.4) | 82.6 (96.3) |
| **Grand mean over all hospitals** | **20.8** | **67.6** | **18.7** | **65.5** |
| **Grand mean of only FIT64b hospitals with pre-existing FIT64b-like contract** | **21.6** | **66.6** | **16.7** | **65.7** |
| **Grand mean of only FIT64b hospitals without pre-existing FIT64b-like contract** | **18.9** | **69.8** | **23.1** | **65.1** |
| **Number of <u>hospital-known</u> patients capaple of working (n)** | **3,183** | | **3,116** | |
| cumulated number of days in sick leave | mean (sd) | | | |
| A | 36.4 (75.2) | 36.5 (74.5) | 37.5 (77.0) | 49.7 (86.3) |
| B | 60.8 (82.3) | 67.8 (102.7) | 59.5 (93.0) | 62.3 (90.2) |
| C | 28.5 (63.5) | 28.2 (63.7) | 29.9 (62.8) | 30.2 (61.9) |
| D | 28.6 (63.7) | 31.0 (65.8) | 32.9 (64.7) | 31.2 (64.1) |
| E | 31.6 (67.9) | 30.7 (57.4) | 30.8 (59.2) | 42.0 (79.2) |
| F | 29.7 (51.9) | 39.3 (72.5) | 40.0 (66.5) | 42.1 (59.4) |

| | | | | |
|---|---|---|---|---|
| G | 35.8 (74.5) | 35.7 (71.0) | 27.3 (50.7) | 40.1 (72.4) |
| H | 30.4 (55.8) | 28.6 (61.9) | 32.9 (67.1) | 30.8 (57.8) |
| I | 18.3 (46.1) | 21.7 (35.5) | 27.0 (54.2) | 29.9 (61.2) |
| J | 28.7 (58.6) | 29.8 (66.7) | 31.2 (60.2) | 40.3 (75.5) |
| K | 39.4 (73.9) | 45.4 (90.7) | 20.4 (50.8) | 18.1 (44.0) |
| L | 58.3 (75.5) | 72.9 (83.8) | 64.0 (85.1) | 71.5 (92.3) |
| M | 46.2 (78.2) | 37.2 (70.5) | 44.3 (73.7) | 37.7 (69.2) |
| **Grand mean over all hospitals** | **36.3** | **38.8** | **36.7** | **40.5** |
| **Grand mean of only FIT64b hospitals with pre-existing FIT64b-like contract** | **33.3** | **35.5** | **35.3** | **39.8** |
| **Grand mean of only FIT64b hospitals without pre-existing FIT64b-like contract** | **43.1** | **46.3** | **40.0** | **41.9** |

[1] IG = intervention group (FIT64b hospital); CG = control group (control hospitals)

 pre = one year before study inclusion; 1st yr = one year after study inclusion

 capable of working: health insurance status = member (own insurance and not through family member, no pensioner)

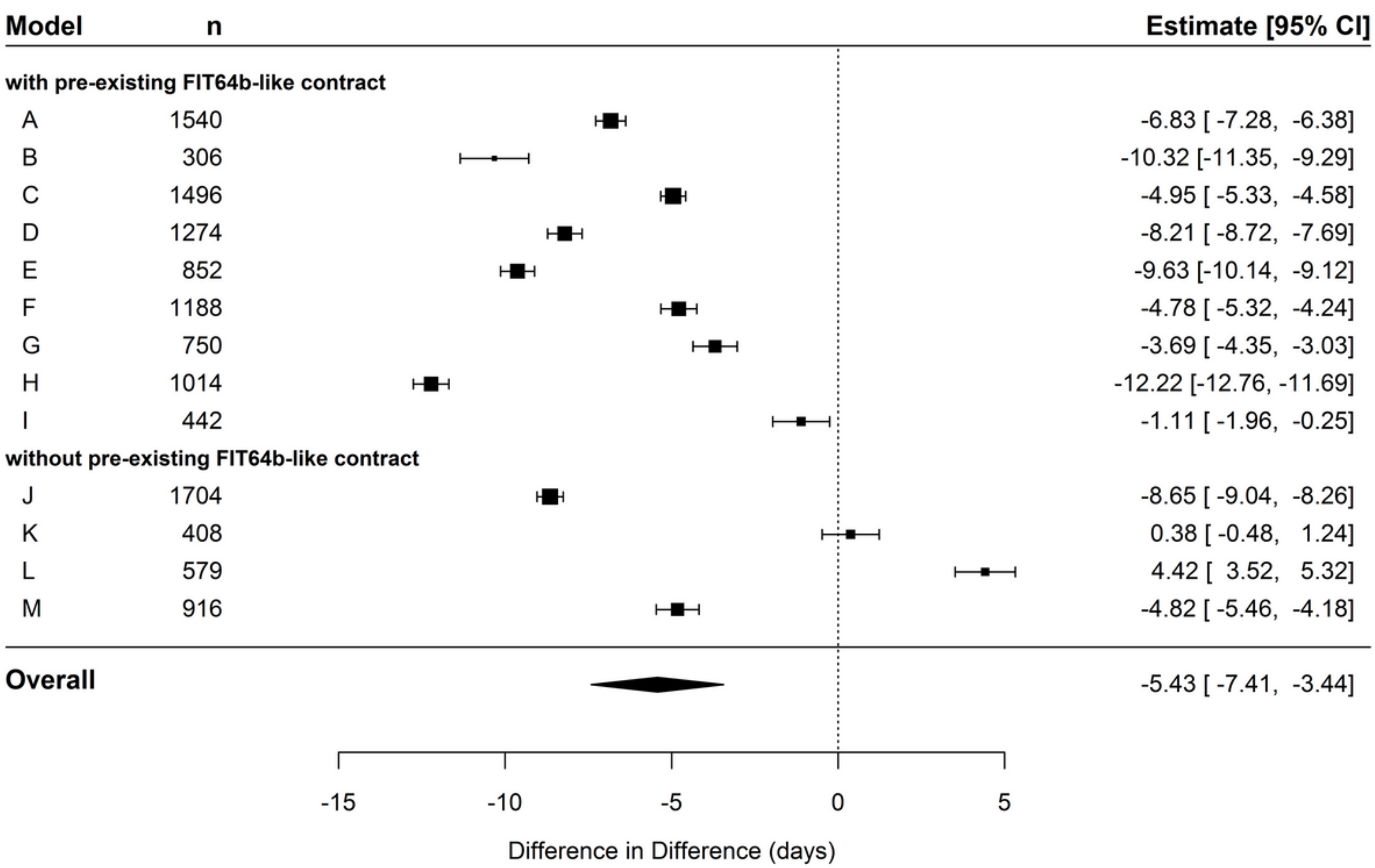
Table 4: Pooled estimates of meta-analysis for different outcomes

| Outcome | Estimate | Lower CI | Upper CI | p | $I^2$ |
|---|---|---|---|---|---|
| **hospital-new patients** | | | | | |
| number of days in inpatient care | **-5.43** | **-7.41** | **-3.44** | **0.000*** ** | **99.39** |
| number of days in day care | 2.12 | -0.76 | 5.00 | 0.15 | 99.89 |
| number of days in sick leave | -0.02 | -5.51 | 5.47 | 0.994 | 99.36 |
| Number of outpatient contacts (PIA) | 0.43 | -0.57 | 1.43 | 0.40 | 99.56 |
| Number of outpatient contacts (established practitioner) | -0.06 | -0.54 | 0.43 | 0.81 | 96.17 |
| **hospital-known patients** | | | | | |
| number of days in inpatient care | -0.77 | -2.5 | 0.97 | 0.386 | 99.08 |
| number of days in sick leave | -1.27 | -5.18 | 2.63 | 0.523 | 98.86 |

Table 5: Meta-regression effect sizes of FIT64b-like pre-contracts (existing vs. non-existing) in different outcomes

| Outcome | Slope coefficient | p |
|---|---|---|
| **hospital-new patients** | | |
| number of days in inpatient care | **-4.67** | **0.041*** |
| number of days in day care | 1.56 | 0.647 |
| number of days in sick leave | **-12.89** | **0.022**** |
| **hospital-known patients** | | |
| number of days in inpatient care | -3.58 | 0.079 |
| number of days in sick leave | -5.51 | 0.442 |

# Figures




## Figure 1

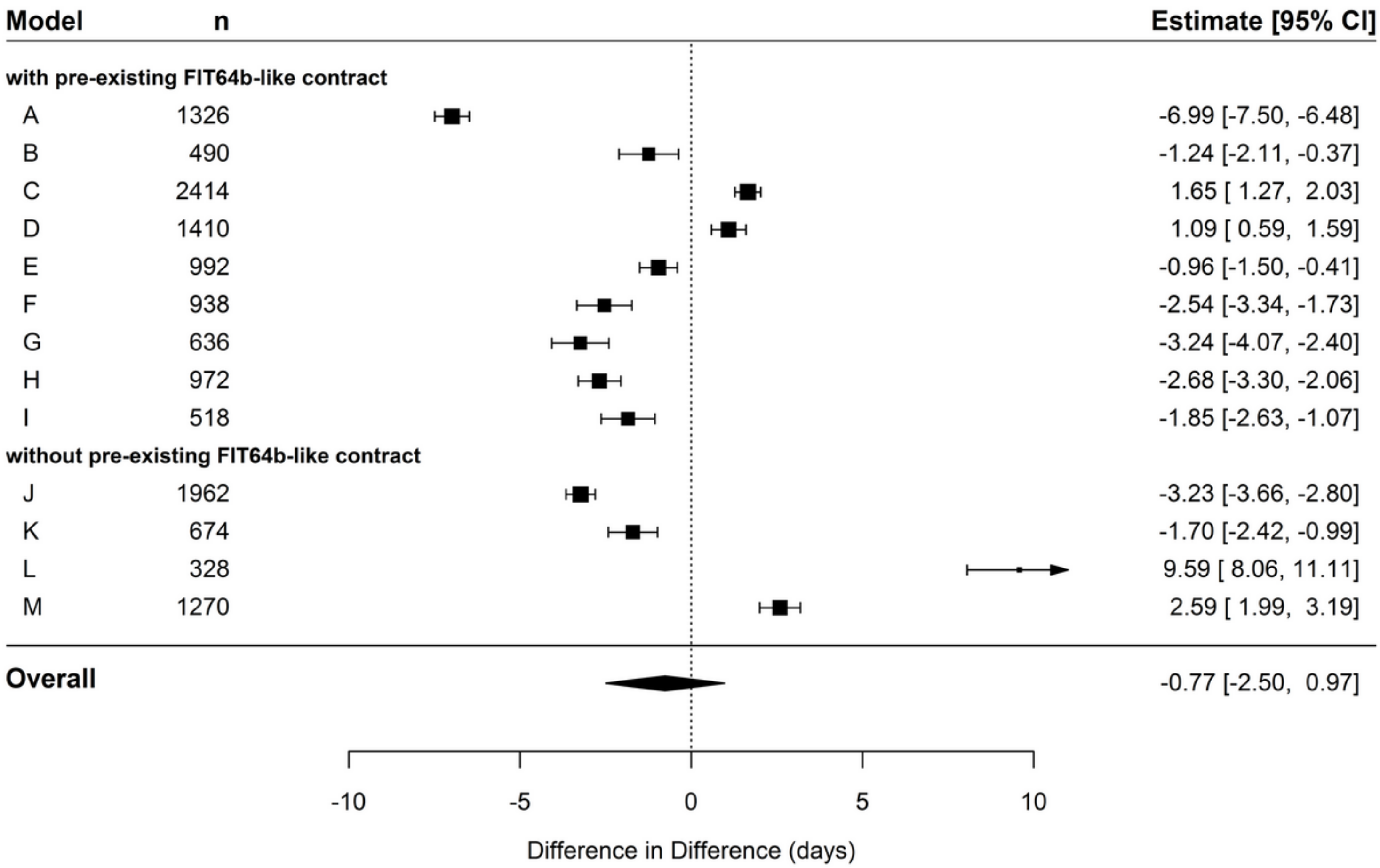

Model
n
Estimate [95% CI]
with pre-existing FIT64b-like contract
A 1326 -6.99 [-7.50, -6.48]
B 490 -1.24 [-2.11, -0.37]
C 2414 1.65 [ 1.27, 2.03]
D 1410 1.09 [ 0.59, 1.59]
E 992 -0.96 [-1.50, -0.41]
F 938 -2.54 [-3.34, -1.73]
G 636 -3.24 [-4.07, -2.40]
H 972 -2.68 [-3.30, -2.06]
I 518 -1.85 [-2.63, -1.07]
without pre-existing FIT64b-like contract
J 1962 -3.23 [-3.66, -2.80]
K 674 -1.70 [-2.42, -0.99]
L 328 9.59 [ 8.06, 11.11]
M 1270 2.59 [ 1.99, 3.19]
Overall -0.77 [-2.50, 0.97]
-10
-5
0
5
10
Difference in Difference (days)

Figure 2

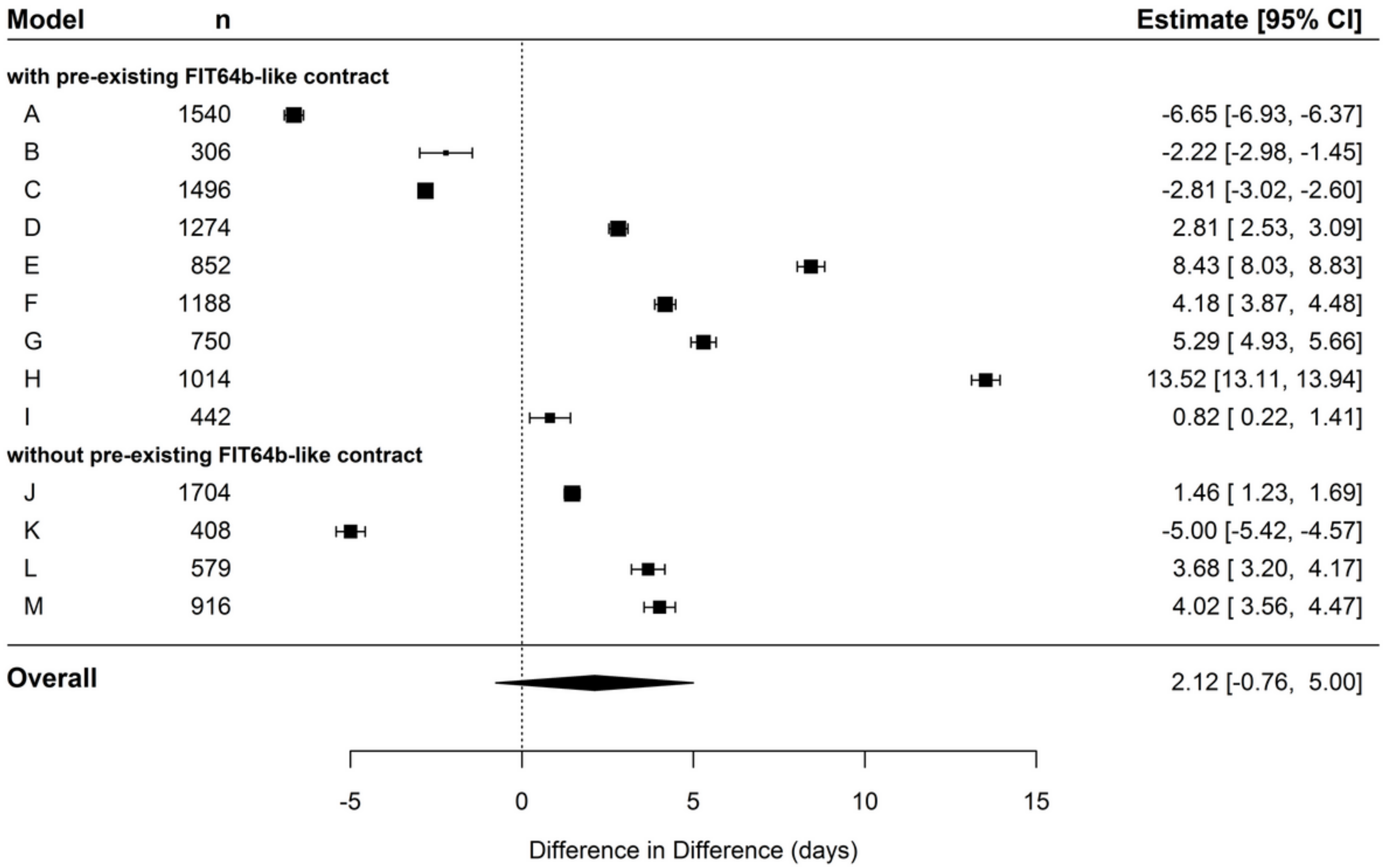
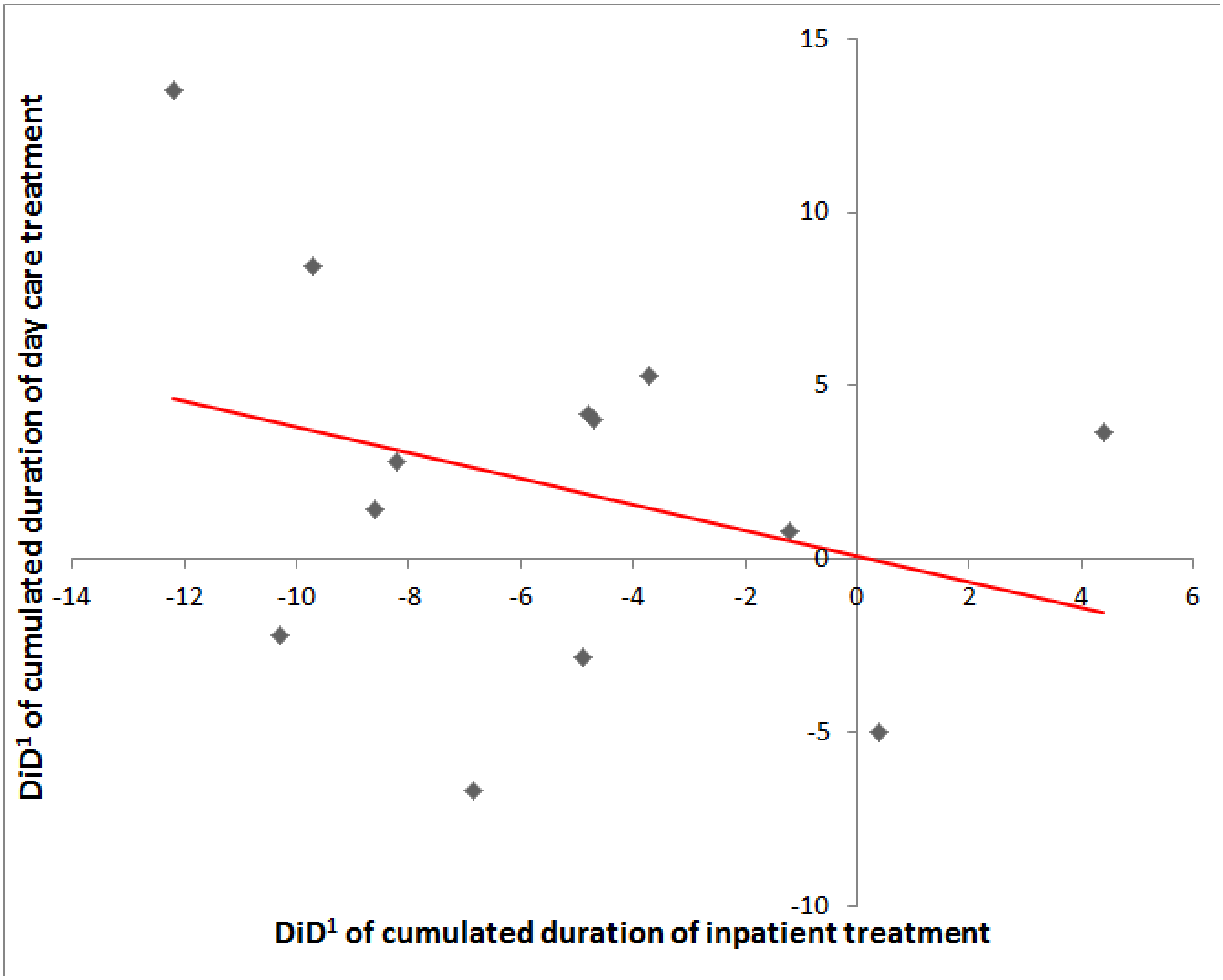

Model
n
Estimate [95% CI]
with pre-existing FIT64b-like contract
A 1540 -6.65 [-6.93, -6.37]
B 306 -2.22 [-2.98, -1.45]
C 1496 -2.81 [-3.02, -2.60]
D 1274 2.81 [ 2.53, 3.09]
E 852 8.43 [ 8.03, 8.83]
F 1188 4.18 [ 3.87, 4.48]
G 750 5.29 [ 4.93, 5.66]
H 1014 13.52 [13.11, 13.94]
I 442 0.82 [ 0.22, 1.41]
without pre-existing FIT64b-like contract
J 1704 1.46 [ 1.23, 1.69]
K 408 -5.00 [-5.42, -4.57]
L 579 3.68 [ 3.20, 4.17]
M 916 4.02 [ 3.56, 4.47]
Overall 2.12 [-0.76, 5.00]
-5
0
5
10
15
Difference in Difference (days)

Figure 3



15
10
5
0
-5
-10
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
DiD1 of cumulated duration of day care treatment
DiD1 of cumulated duration of inpatient treatment


Figure 4

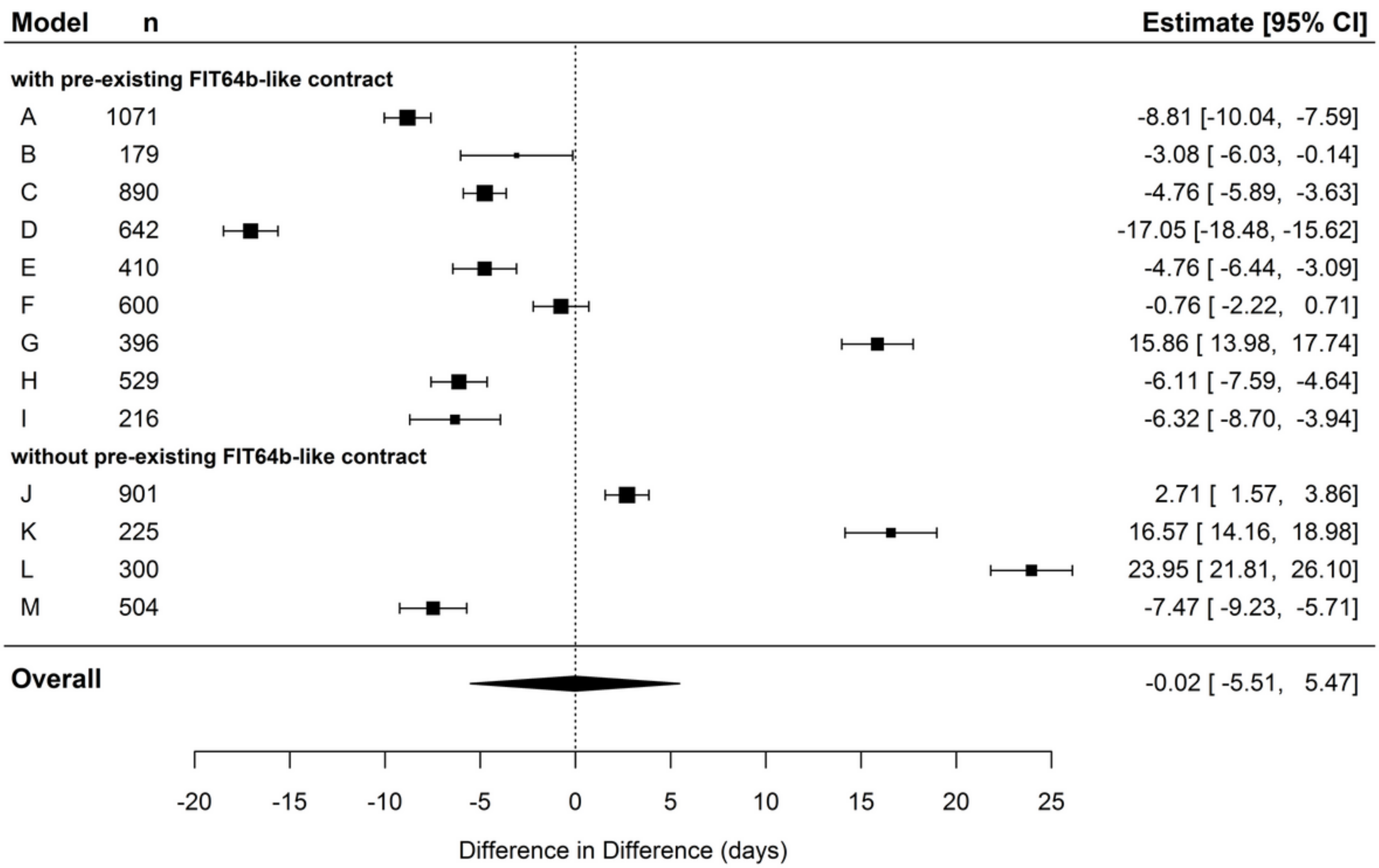

Model
n
Estimate [95% CI]
with pre-existing FIT64b-like contract
A 1071 -8.81 [-10.04, -7.59]
B 179 -3.08 [ -6.03, -0.14]
C 890 -4.76 [ -5.89, -3.63]
D 642 -17.05 [-18.48, -15.62]
E 410 -4.76 [ -6.44, -3.09]
F 600 -0.76 [ -2.22, 0.71]
G 396 15.86 [ 13.98, 17.74]
H 529 -6.11 [ -7.59, -4.64]
I 216 -6.32 [ -8.70, -3.94]
without pre-existing FIT64b-like contract
J 901 2.71 [ 1.57, 3.86]
K 225 16.57 [ 14.16, 18.98]
L 300 23.95 [ 21.81, 26.10]
M 504 -7.47 [ -9.23, -5.71]
Overall -0.02 [ -5.51, 5.47]
-20
-15
-10
-5
0
5
10
15
20
25
Difference in Difference (days)

Figure 5

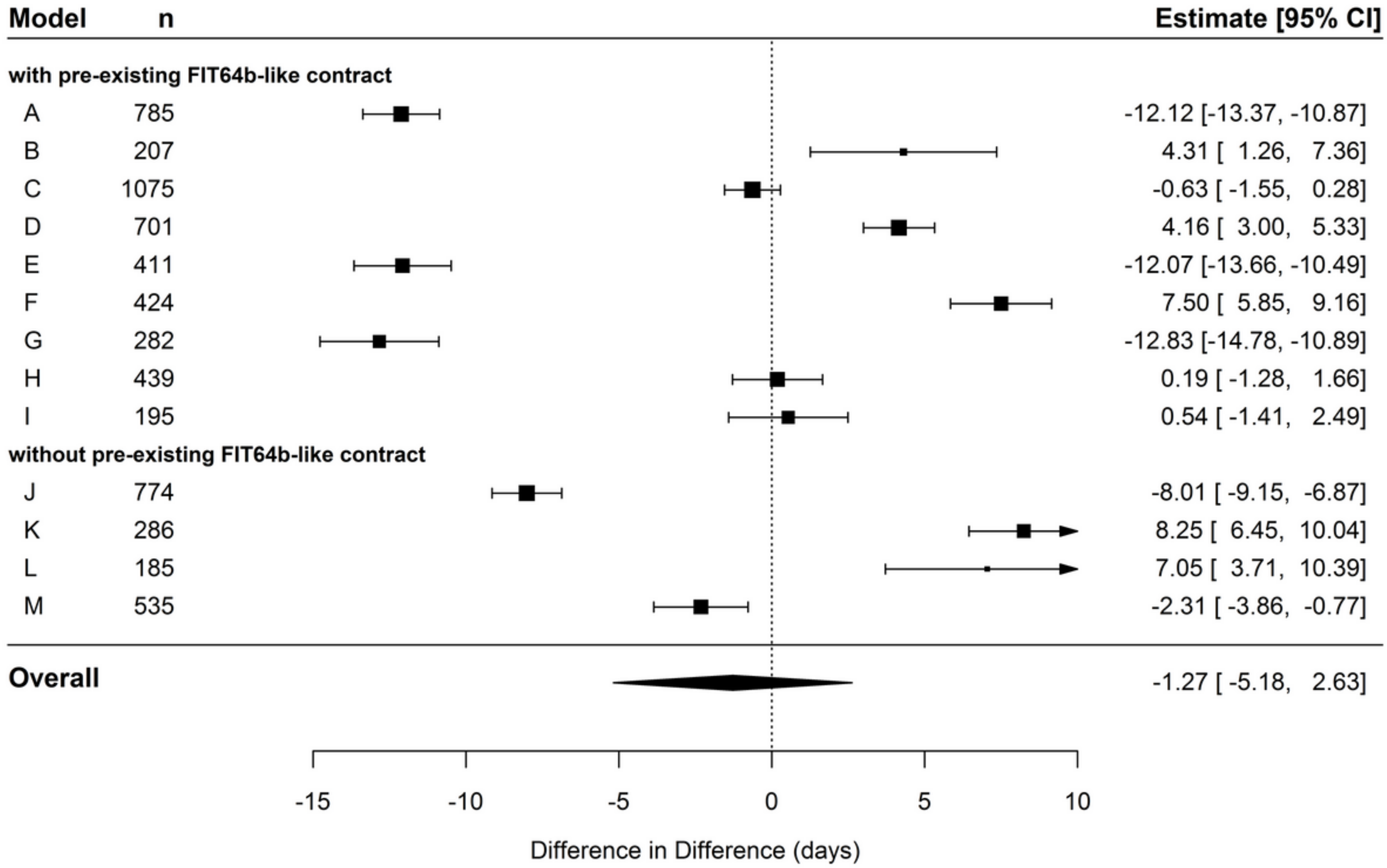



Figure 6

# Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- supplement1.doc