Gender effects on outcomes of psychosomatic rehabilitation are reduced

Juliane Burghardt1*, Friedrich Riffer2,3, Manuel Sprung1,2,3

1 Division of Clinical Psychology, Department Psychology and Psychodynamics, Karl Landsteiner University of Health Science, Krems an der Donau, Austria, 2 University Hospital for Psychosomatic Medicine Eggenburg, Psychosomatisches Zentrum Waldviertel, Eggenburg, Austria, 3 Psychiatric Rehabilitation Clinic Gars am Kamp, Psychosomatisches Zentrum Waldviertel, Gars am Kamp, Austria

* Juliane.Burghardt@kl.ac.at

Abstract

Objective
The study examined whether psychiatric/psychosomatic rehabilitation continues to have a better course of treatment for women than men.

Methods
We compared the course of global symptom severity, health-related quality of life and functioning between admission and discharge in patients (848 men, 1412 women) at an Austrian psychiatric/psychosomatic rehabilitation clinic.

Results
Gender-specific differences in the course of treatment were all too small to be clinically relevant. The differences were smallest in the middle-aged cohort. However, at the time of admission, women reported a slightly higher symptom burden.

Conclusion
Overall, the results show a gender-fair effectiveness of the rehabilitation. The new findings could be explained by changes in living conditions, gender roles, or better treatment methods.

Introduction
Psychosomatic rehabilitation focuses on the psychotherapeutic treatment of mental disorders in a stationary context with the goal to reduce symptoms and increase functioning and quality of life. Many studies have shown that psychosomatic rehabilitation shows better treatment effects for women than for men [1–3]. This treatment advantage for women is not limited to psychosomatic rehabilitation interventions, but is reflected in a number of rehabilitation settings (see [4]) e.g. for chronic back pain [5] or the treatment of cardiovascular diseases [6]. The
A meta-analytical MESTA study confirmed the better treatment effects for women in psychosomatic rehabilitation interventions [3]: An increase in the proportion of women in the patient sample was accompanied by an improvement in the treatment outcome between admission and discharge (β = .22). Later studies also replicated this effect of psychosomatic rehabilitation. For example, de Vries and colleagues [1] showed a greater reduction in symptoms (depression, psychological stress, and psychosocial health) for female patients than for male patients with data from 2008 to 2010. A more recent study with data from 2013 could not find any significant differences in the effectiveness of rehabilitation in terms of symptom burden or resilience [7]. Only self-regulatory ability and work motivation showed the effect of gender on treatment outcomes. Multiple reasons for the gender differences were suggested. It was argued that rehabilitation interventions are better tailored to the needs of women than to the needs of men [2]. These different needs are based on gender roles [8,9]. Among other things, seeking help and support contradicts the male gender role, which is why men often show less help seeking behavior than women [10] and communicate less effectively with health care providers. For instance, some men may understate pain or hide emotions [8] or are less accurate about their medical records [11]. The loss of autonomy during treatment is possibly more problematic for men than for women [12]. The patient role is incongruent with the male gender role [13], which is active and agentic. In line with the male gender role, men prefer a higher level of control over the therapeutic process and report a need for action-oriented problem-solving strategies [12]. Accordingly, therapy and rehabilitation should be implemented in a gender-sensitive manner [12,14]. Notwithstanding these recommendations, a study of psychiatric/psychotherapeutic treatments in 2007 concluded that interventions are largely gender-neutral [15].

Gender differences are not only evident in the course of treatment; women and men differ in the severity of symptoms [16], as well as in the frequency [9,17], and in the course of mental disorders [18]. The greater treatment effects in women could therefore be explained by the greater burden of symptoms upon admission [4]. In addition, the living conditions and thus the resources of men and women also differ, e.g., characterized by lower employment of women and a higher burden of childcare [19,20]. Gender roles have been changing significantly for years. As a result, women increasingly describe themselves as more masculine and less feminine than before [21,22]. The living conditions of men and women have also become more and more equal in the last few decades due to the increase in the employment of women and rising incomes [23]. As a consequence of the changed gender roles and the change in living conditions, the question must be asked whether the gender differences can still be replicated. Do women continue to benefit more from psychosomatic rehabilitation programs than men? To answer this question, the present study analyzes gender-specific differences in the effects of inpatient psychosomatic/psychiatric rehabilitation in an Austrian rehabilitation clinic. Since older cohorts often have more traditional living conditions with larger gender differences [9], an additional analysis compares gender differences in different age groups. If the gender differences decrease due to social changes, younger cohorts could show smaller gender differences than older cohorts.

Materials and methods

Participants

The present study is a retrospective analysis of data collected as part of the routine examination. The study analyzes data from 2260 rehabilitation patients, with complete examination results (i.e., all primary outcomes in the admission and discharge surveys) who were treated between July 2011 and January 2015. Depending on the outcome, measurements from 71 to 66% of the total patient sample are available. Missing measurements are mainly due to the
The sample comprised 848 (37.5%) men and 1412 (62.5%) women. The patients were between 18 and 74 years old at the time of admission. Their mean age was 46.1 years (SD = 8.8; median = 47.7). Details are given in Table 1. Male patients were on average somewhat older than female patients, \(t(2258) = 2.251; p < 0.05, 95\% \text{ CI} [0.11; 1.61],\) Cohen’s \(d_s = 0.10.\) The most common diagnoses (main diagnosis) of patients were F30-F39 mood disorders (63.6%) and F40-F48 neurotic, stress and somatoform disorders (28.3%). At the time of admission, 1,116 (65.6%) of the patients were employed, 484 (28.4%) were unemployed and 102 (6.0%) were retired or had applied for a pension or were receiving rehabilitation or sick pay. Gender and age-specific differences with regard to diagnoses and occupational status (employment) are described in Table 1. Male and female patients did not differ

Table 1. Sample characteristics by age cohort and sex.

| Sex   | Frequency  | Age M (SD) | WHO age cohorts |
|-------|------------|------------|-----------------|
|       | male       | female     | <35            | 35–55        | >55        |
|       | 848        | 1412       | 270            | 1628         | 362        |
| Age M (SD) | 46.7 (8.9) | 45.8 (8.8) | 28.8 (4.0)     | 46.5 (5.18)  | 57.3 (2.5) |
| Sex   | 37.5%      | 62.5%      | -              | -            | -          |
|       | male       | female     | 10.7%          | 70.6%        | 18.6%      |
|       | -          | -          | 12.7%          | 72.9%        | 14.4%      |
| Diagnosis |            |            |                |              |            |
| F01-09 | 4 (0.5%)   | 1 (0.1%)   | 0 (0.0%)       | 1 (0.1%)     | 4 (1.1%)   |
| F10-19 | 8 (1.0%)   | 11 (0.8%)  | 5 (1.9%)       | 13 (0.8%)    | 1 (0.3%)   |
| F20-29 | 16 (1.9%)  | 21 (1.5%)  | 10 (3.7%)      | 27 (1.7%)    | 0 (0.0%)   |
| F30-39 | 528 (63.2%)| 892 (63.9%)| 140 (52.4%)    | 1035 (64.5%) | 245 (68.1%)|
| F40-48 | 228 (27.3%)| 403 (28.9%)| 91 (34.1%)     | 447 (27.9%)  | 93 (25.8%) |
| F50-59 | 4 (0.5%)   | 6 (0.4%)   | 1 (0.4%)       | 4 (0.2%)     | 5 (1.4%)   |
| F60-69 | 12 (1.4%)  | 23 (1.6%)  | 15 (5.6%)      | 19 (1.2%)    | 1 (0.3%)   |
| F70-79 | 0 (0.0%)   | 0 (0.0%)   | 0 (0.0%)       | 0 (0.0%)     | 0 (0.0%)   |
| F80-89 | 0 (0.0%)   | 0 (0.0%)   | 0 (0.0%)       | 0 (0.0%)     | 0 (0.0%)   |
| F90-98 | 2 (0.2%)   | 0 (0.0%)   | 2 (0.7%)       | 0 (0.0%)     | 0 (0.0%)   |
| E00-90 | 3 (0.4%)   | 0 (0.0%)   | 0 (0.0%)       | 2 (0.1%)     | 1 (0.3%)   |
| I00-99 | 1 (0.1%)   | 0 (0.0%)   | 0 (0.0%)       | 1 (0.1%)     | 0 (0.0%)   |
| M00-99 | 0 (0.0%)   | 1 (0.1%)   | 0 (0.0%)       | 1 (0.1%)     | 0 (0.0%)   |
| Z73   | 29 (3.5%)  | 38 (2.8%)  | 3 (1.1%)       | 54 (3.4%)    | 10 (2.8%)  |

Employment

| Employment | Frequency  | Age M (SD) | WHO age cohorts |
|------------|------------|------------|-----------------|
|            | male       | female     | <35            | 35–55        | >55        |
|            | 190 (28.9%)| 294 (28.1%)| 75 (36.2%)     | 343 (28.1%)  | 66 (23.9%) |
| retired*   | 33 (5.0%)  | 69 (6.6%)  | 12 (5.8%)      | 63 (5.2%)    | 27 (9.8%)  |
| employed   | 434 (66.1%)| 682 (65.3%)| 120 (58.0%)    | 813 (66.7%)  | 183 (66.3%)|

* F01-F09 Mental disorders due to known physiological conditions, F10-F19 Mental and behavioral disorders due to psychoactive substance use, F20-F29 Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders, F30-F39 Mood disorders, F40-F48 Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders, F50-F59 Behavioral syndromes associated with physiological disturbances and physical factors, F60-F69 Disorders of adult personality and behavior, F70-F79 Intellectual disabilities, F80-F89 Pervasive and specific developmental disorders, F90-F98 Behavioral and emotional disorders with onset usually occurring in childhood and adolescence, F99-F99 Unspecified mental disorder; E00-E90 Endocrine, nutritional and metabolic diseases; I00-I99 Diseases of the Circulatory System; M00-M99 diseases of the musculoskeletal system and connective tissue; Z73 burnout (the information on the main diagnoses of 29 patients is missing in the database).

* Information from 29 patients (1.3% of the sample) was missing.

* Pension, has applied for pension payment, rehabilitation pay or sick pay.

https://doi.org/10.1371/journal.pone.0256916.t001
Materials

Basic socio-demographic and clinical data. Gender, age, diagnoses (i.e. the main diagnoses upon discharge) and information on the professional status (employment) were determined using the basic documentation of the hospital information system. Gender (male, female) was defined in terms of biological sex. Age referred to the chronological age (in years) at the time of admission. Diagnoses were classified using the ICD-10 [27].

Symptom burden, quality of life and functional ability. The routine examination survey assessed the general symptom burden, quality of life and functional ability (primary outcomes). General symptom severity was determined using the Symptom Checklist (SCL-90) [28] or the Brief Symptom Checklist (BSCL) [29]. The checklists measure the subjectively perceived impairments caused by physical and psychological symptoms in a total of nine symptom areas with 90, respectively 53 items on a 5-point response scale. The BSCL had been derived from the SCL-90 by selecting the items with the highest item loading. Previous data showed that the BSCL and SCL-90 are highly correlated \( r = .92 \) to \( .99 \), [30]. Both instruments provide a Global Severity Index (GSI), which is a commonly used measure of general psychological distress. Items were averaged to form the index. Higher values imply higher symptom severity. The quality of life was determined with the WHO Quality of Life questionnaire (WHOQOL-BREF) [31]. It assesses the subjective health-related quality of life in four subareas as well as globally using 26 items (with a 5-point response scale). The quality of life was determined by adding values for each area. This provided measures for physical, psychological, social, and environmental quality of life as well as a global value. Higher scores denote better quality of life. Functional ability was determined using the Global Assessment of Functioning (GAF) scale of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) [32]. Based on external assessments by the attending physician, the GAF is used to determine a single value for the current general functional level of the patient (graded into 10 levels). Higher scores imply better functioning. Relevant comparative values of other Austrian psychiatric rehabilitation patients can be found in a current meta-analysis [33].

Procedure

The study used a naturalistic one-group pre-post design without a control group. The analysis used data of patients who were treated at the psychiatric rehabilitation clinic Gars am Kamp in Austria. Patients answered the questionnaires in a computer assessment room in the presence of a trained professional. The self-report measures were assessed using the Hogrefe test system. This system provides a platform that administers standardized questionnaires licensed by Hogrefe. It provides a user-friendly surface and assures data integrity. The GAF was assessed during individual medical examinations.

The analyses were approved by the ethics commission of the Karl Landsteiner University of Health Sciences (Nr: 1006/2021). We complied with the requirements of the current version of the Declaration of Helsinki [34]. The patients agreed to the data collection and usage when they started treatment, all analyses were conducted on pseudonymized data.

Treatment

All patients in the study sample took part in a standard multidisciplinary therapy program of 22½ hours per week during a planned 6-week inpatient stay at a psychiatric/psychosomatic rehabilitation clinic in Austria. The therapy, which largely takes place in open groups that are

significantly with regard to diagnosis or occupational status. Further information on the total sample can be found in Riffer and colleagues [24–26].
not specific to the disorder, was carried out by a multidisciplinary treatment team in accordance with the treatment plan of the pension insurance institution (Pensionsversicherungsanstalt; www.pv.at) responsible for psychiatric/psychosomatic rehabilitation in Austria. Psychosomatic rehabilitation in Germany and psychiatric rehabilitation in Austria are very similar approaches to treat mental disorders. Both emphasize psychotherapeutic interventions, but also include psychopharmacological and various other complementary interventions, for instance exercise and physical therapy. Both mainly treat patients with depressive or anxiety-related disorders. Further details on the treatment program can be found elsewhere [25]. Due to the legal requirements applied to all psychiatric rehabilitation clinics in Austria the treatment program is comparable to that of other Austrian rehabilitation clinics [33]. The length of stay of the patients in the study sample was between 39 and 62 days (M = 42.1; SD = 3.5; Modus = 41.0). There were no significant gender- or age-specific differences in the length of stay.

Analyses

The data was extracted from the Hogrefe test system and the clinic information system. To simplify analysis, only complete data sets were evaluated. The analyzes tested for gender-specific differences at the beginning of treatment (admission survey) and for gender-specific differences in the changes in the examination results (primary outcomes) between admission and discharge. The final sample had a power of over .99 to find small effects for this interaction between gender and measurement time (G’Power Version 3.1.9.2., [35]). The gender-specific pre-post and baseline values at admission were compared with t-tests and repeated-measure ANOVAs using SPSS 26. These treatment effects were tested both in the overall sample and separately for three age cohorts. The level of significance was set at α < 0.05 (two-sided). Cohen’s d values above 0.8 are interpreted as large effects, between 0.5 and 0.2 as medium effects and effects below 0.2 are interpreted as small effects [36]. Corresponding values for η² recommend that values from 0.14 should be interpreted as large, from 0.06 as medium and from 0.01 as small effects [37].

Results

Results at pre- (T1) and posttest (T2), separately for each gender

To test the effectiveness of the treatment, we compared the outcomes of T1 (pretest) and T2 (posttest) separately by gender. The analyzes in Table 2 show that all outcomes at T2 improved compared to T1, for both men and women. The changes show small to large effects. The biggest effects were found for functional ability (GAF), the smallest in the areas of social and environmental quality of life (QOLsocial and QOLenvironment).

Outcome comparisons at admission (T1)

The level of distress at the time of admission (T1) was then compared between men and women. Table 3 contains the corresponding t-tests for independent samples at admission (T1). In line with earlier findings, women were more distressed than men at admission. This difference was most pronounced in the psychological area of quality of life (QOLmental) and general symptom burden (GSI). Significant differences were also found in the areas of environment (QOLenvironment), physical (QOLphysical), and global quality of life (QOLglobal).
Gender differences in changes between T1—T2

The course of treatment for men and women was compared with the help of a repeated measures ANOVAs, controlling for the differences in symptom burden at the time of admission (T1). Table 4 reports the results of the 2 (time) × 2 (gender) ANOVAs per outcome variable. Treatment effects were gender-specific (= significant interaction between the factors time × gender) for general symptom burden (GSI) and quality of life in the physical and psychological domain (QOLphysical, QOLpsychological), as well as functional ability (GAF). Functional ability showed a more pronounced improvement in men; the other two measures showed

Table 2. Treatment outcomes for men and women.

| Outcomes | M    | SD   | M    | SD   | t    | df  | p     | r    | dav  |
|----------|------|------|------|------|------|-----|-------|------|------|
| GSI      |      |      |      |      |      |     |       |      |      |
| men      | 1.10 | 0.67 | 0.80 | 0.68 | 13.78| 847 | < .001| 0.55 | 0.44 |
| women    | 1.31 | 0.66 | 0.87 | 0.70 | 24.0 | 1411| < .001| 0.52 | 0.65 |
| QOLphysical |      |      |      |      |      |     |       |      |      |
| men      | 55.52| 18.31| 64.40| 20.95| -17.073| 847| < .001| 0.71 | 0.45 |
| women    | 51.80| 18.77| 62.62| 19.91| -26.51| 1411| < .001| 0.69 | 0.56 |
| QOLpsychological |      |      |      |      |      |     |       |      |      |
| men      | 48.91| 19.18| 58.48| 21.01| -17.589| 847| < .001| 0.69 | 0.48 |
| women    | 41.18| 18.83| 53.36| 20.32| -28.125| 1411| < .001| 0.66 | 0.63 |
| QOLsocial |      |      |      |      |      |     |       |      |      |
| men      | 55.33| 22.83| 61.32| 23.09| -9.55 | 847| < .001| 0.68 | 0.26 |
| women    | 55.99| 23.12| 61.77| 22.79| -11.14| 1411| < .001| 0.64 | 0.25 |
| QOLenvironment |      |      |      |      |      |     |       |      |      |
| men      | 69.44| 15.93| 71.32| 17.14| -4.54 | 847| < .001| 0.74 | 0.11 |
| women    | 65.42| 16.15| 67.75| 16.72| -7.10 | 1411| < .001| 0.72 | 0.14 |
| QOLglobal |      |      |      |      |      |     |       |      |      |
| men      | 45.71| 21.11| 58.13| 22.66| -17.68| 847| < .001| 0.57 | 0.57 |
| women    | 42.69| 21.46| 56.70| 22.31| -24.48| 1411| < .001| 0.52 | 0.64 |
| GAF      |      |      |      |      |      |     |       |      |      |
| men      | 59.68| 7.12 | 66.51| 8.46 | -38.461| 847| < .001| 0.79 | 0.88 |
| women    | 59.45| 6.67 | 65.81| 7.82 | -45.72| 1411| < .001| 0.75 | 0.88 |

lower value = positive; higher value = positive.
Corr = correlation between T1 and T2.

https://doi.org/10.1371/journal.pone.0256916.t002

Table 3. Group comparison of outcomes at admission (time T1).

| Outcomes | sex (male vs. female) | t    | df  | p     | d_s  |
|----------|-----------------------|------|-----|-------|------|
| GSI      |                       | -7.059| 2258| < .001| 0.32 |
| QOLphysical |                    | 4.605| 2258| < .001| 0.20 |
| QOLpsychological |              | 9.377| 2258| < .001| 0.41 |
| QOLsocial |                      | -0.665| 2258| .506  | < 0.001|
| QOLenvironment |                | 5.748| 2258| < .001| 0.25 |
| QOLglobal |                       | 3.260| 2258| < .01 | 0.14 |
| GAF      |                       | 0.781| 2258| .435  | < 0.005|

https://doi.org/10.1371/journal.pone.0256916.t003
greater effects in women. At the same time, all effect sizes were so small that the differences should be viewed as clinically insignificant.

Gender-specific differences in the change between T1—T2 per age cohort

For further exploration, we tested whether the gender effects differed between age cohorts. As the living conditions of men and women become increasingly similar, it would be possible that older cohorts show greater gender differences than younger ones. To test this, we repeated the repeated measures ANOVAs for the three age groups. The age groups were formed in accordance with the WHO age limits and corresponded to the ranges 18–35 years = young adults, 35–55 years = middle-aged adults, over 55 years = older adults. If the low gender effects were based on cohort effects, the oldest cohort should show the largest gender-specific treatment effects. The results did not match these expectations. Gender differences in treatment effects were slightly larger in both the youngest and oldest age groups than for the entire sample. The results are shown in Table 4. The youngest age group showed gender differences in the course of treatment, with at least a small effect size ($\eta^2 > 0.01$) in the general symptom burden, the quality of life in the psychological, social and environmental domains as well as in the global evaluation (QOL_mental, QOL_social, QOL_environment, QOL_global). These measurements showed a better course of treatment in women. Functional ability (GAF) also showed a small gender difference, however, men showed the better course in this measure. The oldest cohort also reported a more positive course of treatment for women of at least small size in terms of general symptom burden and quality of life in the physical, mental and global domains.

### Table 4. Group comparison in the improvement of the outcomes of admission and discharge surveys (T1—T2).

| Outcomes          | 2 (time) × 2 (sex) ANOVA | 2 (time) × 2 (sex) ANOVA by age cohort |
|-------------------|--------------------------|----------------------------------------|
|                   | Factor | F | df | p    | $\eta^2$ | Age cohorts | F | df | p    | $\eta^2$ |
| GSI               | time   | 650.28 | 1 | < .001 | 0.22 | <35 | 4.17 | 1 | .042 | 0.015 |
|                   | sex    | 30.44 | 1 | < .001 | 0.013 | 35–55 | 9.34 | 1 | .002 | 0.006 |
|                   | time × sex | 20.76 | 1 | < .001 | 0.009 | >55 | 10.63 | 1 | .001 | 0.029 |
| QOL_physical      | time   | 882.19 | 1 | < .001 | 0.28 | <35 | 1.82 | 1 | .179 | 0.007 |
|                   | sex    | 12.48 | 1 | < .001 | 0.005 | 35–55 | 2.88 | 1 | .090 | 0.002 |
|                   | time × sex | 8.59 | 1 | < .001 | 0.004 | >55 | 6.22 | 1 | .013 | 0.017 |
| QOL_psychological | time   | 965.40 | 1 | < .001 | 0.30 | <35 | 10.70 | 1 | .001 | 0.038 |
|                   | sex    | 66.93 | 1 | < .001 | 0.03 | 35–55 | 2.02 | 1 | .156 | 0.001 |
|                   | time × sex | 13.81 | 1 | < .001 | 0.006 | >55 | 10.86 | 1 | .001 | 0.029 |
| QOL_social        | time   | 202.51 | 1 | < .001 | 0.08 | <35 | 3.48 | 1 | .063 | 0.013 |
|                   | sex    | 0.37 | 1 | n.s. | - | 35–55 | 1.50 | 1 | .221 | 0.001 |
|                   | time × sex | 0.07 | 1 | n.s. | - | >55 | 0.36 | 1 | .548 | 0.001 |
| QOL_envir.        | time   | 62.82 | 1 | < .001 | 0.03 | <35 | 7.65 | 1 | .006 | 0.028 |
|                   | sex    | 32.47 | 1 | < .001 | 0.01 | 35–55 | 0.18 | 1 | .675 | < 0.001 |
|                   | time × sex | 0.72 | 1 | n.s. | - | >55 | 0.69 | 1 | .407 | 0.002 |
| QOL_global        | time   | 829.75 | 1 | < .001 | 0.27 | <35 | 3.64 | 1 | .058 | 0.013 |
|                   | sex    | 7.14 | 1 | < .001 | 0.003 | 35–55 | < 0.01 | 1 | .959 | < 0.001 |
|                   | time × sex | 2.99 | 1 | n.s. | - | >55 | 8.26 | 1 | .004 | 0.022 |
| GAF               | time   | 3400.07 | 1 | < .001 | 0.60 | <35 | 5.16 | 1 | .024 | 0.019 |
|                   | sex    | 2.34 | 1 | n.s. | - | 35–55 | 4.13 | 1 | .042 | 0.003 |
|                   | time × sex | 4.25 | 1 | < .001 | 0.002 | >55 | 1.04 | 1 | .309 | 0.003 |

$F$-values for interaction time by sex.

https://doi.org/10.1371/journal.pone.0256916.t004

108
The middle age group showed no (clinically relevant) gender differences over the course of treatment.

**Discussion**

Both men and women showed substantial improvements in all examined outcome areas (general symptom burden, quality of life and functional ability). Although some of these improvements showed significant gender-specific differences, the effect sizes of these differences were so small that they can be regarded as clinically negligible. Older findings that showed moderate gender differences in the course of treatment could therefore not be replicated. Substantial gender differences were neither evident in externally rated functional ability (GAF) nor in self-report measures. At the time of admission, women showed greater symptom burden than men. The gender differences in treatment outcomes were most pronounced in the oldest and youngest age group, but remained small in these groups too. Accordingly, all age groups, both men and women, showed broad treatment success. The age group patterns did not match a linear decrease in the gender difference in the sense of a cohort effect. If the equalization of living conditions between men and women were the reason for the decrease in gender differences, it should be least pronounced in the youngest age group. The interpretation is complicated, however, by the fact that the analysis confounded age and cohort effects. The data pattern fits an explanation of gender differences through gender roles. The relatively low gender effect in the middle age group could be based on the gender differences being driven by masculine gender role orientations. These show the smallest differences between men and women in middle adulthood [38,39]. However, to test this explanation a direct measure of gender role orientation would be necessary. Since most patients in this study fall within the middle age group the very small overall gender effect is driven by this age group. However, previous meta-analyses of psychosomatic rehabilitation interventions show that this age distribution is representative of psychiatric rehabilitation clinics in Austria and psychosomatic rehabilitation clinics Germany [3,33].

Earlier studies faced the question of whether women only benefited more from rehabilitation interventions because they were more distressed than men when they were admitted [4]. In lieu of the current data, this interpretation appears to be less likely, since there are no longer any gender differences in treatment outcomes, but women are still more distressed at admission. This suggests that the earlier gender difference in treatment outcomes was more likely due to an earlier lack of fit between needs and services; as previously suggested [2,4]. The most positive interpretation of the results would be that treatment methods are now more optimally aimed at both men and women. However, this interpretation is less in line with the larger gender differences in the youngest and oldest cohort. Alternatively, the gender differences that influenced the course of therapy differently, such as differences in gender roles or living conditions, could have decreased sufficiently in the population in certain age groups. The results may be surprising in view of the amount of evidence that has highlighted the extent of the differences in disease rates between men and women. Gender-specific differences in psychopathology are favored by a number of biological, cultural, cognitive, and affective factors and manifest themselves in a variety of ways [40]. For example, depression in men is more often characterized by a mixture of internalization (anxiety, depression) and externalization disorders (substance abuse, aggression) [41] while women report more somatic symptoms [42]. The gender-specific differences in the symptoms of depression have been neurobiologically [43] and neuroendocrinologically confirmed [44]. The depression pattern typical for men was more strongly characterized by alcohol abuse and suicide than that of women. These gender differences could be missing in the present study, since patients represent a selective sample.
Previous work has noted that the gender differences could be partly attributed to biases within measures [18]. Since men and women often report different symptoms questionnaires can be biased towards capturing traditionally ‘feminine’ symptoms of a disorder. Therefore, it is notable that our study used the SCL-90 lists, which is the most common instrument used in studies within the MESTA-meta-analysis, which did find a gender effect $\beta = .22$ [3]. It is therefore unlikely that our results hinge on measurement biases.

Even though, the absence of pronounced gender effects on efficacy may seem surprising, the present results only superficially contradict more recent findings. Although earlier studies continued to confirm the existence of gender differences in psychosomatic rehabilitation interventions, the corresponding effects were small for data from 2008 to 2010 [1] or limited to a few variables for data from 2013 [7]. The greatest effect was found in work motivation, although this effect also remained small. Work motivation and related procedures could show greater effects than, for example, symptom burden, because there are gender-typical differences in working environments. Accordingly, it would make sense to investigate further treatment outcomes in future studies. It should also be examined whether other rehabilitation measures continue to show gender effects.

The strengths of the present study are the sample size and the inclusion of heterogeneous patient groups. An important extension of the present study would be the examination of post-treatment follow-up data. Previous findings showed that gender differences at follow-up assessment compared to the discharge assessment disappeared [3]. Although men benefit more from rehabilitation at discharge assessment, men may show poorer results at the follow-up assessment. Since men show more health risk behavior such as substance abuse or sleep deprivation [45], therapeutic effects could decrease especially strongly after rehabilitation. One of the limitations of the present study is that gender role orientation was not studied. The division into age groups was done post hoc and confounded age and cohort effects. Additionally, the data was collected between 2011 and 2015. It is thus, plausible that new changes have occurred. This and the fact that the data was only gathered in one clinic makes it necessary to replicate our findings. Another limitation is that no control group was included in the study. Therefore, it cannot be ruled out that without treatment the effects would be lower and that the observed gender-specific differences in the change in T1—T2 could also be found in a control group without treatment. However, a controlled study on psychiatric/psychosomatic rehabilitation in Austria confirmed that the improvements in psychiatric/psychosomatic rehabilitation are systematically greater than in an untreated control group [46]. Unfortunately, gender differences were not investigated in this study. In the future, more controlled studies should be carried out that also take gender-specific differences into account.

In contrast to earlier studies, gender-specific differences in the outcomes of psychiatric/psychosomatic rehabilitation were scarcely detectable. The present findings confirm that rehabilitation interventions can be equally effective among men and women, even though women remain more distressed upon admission than men. Thus, the higher symptom burden of women at admission does not necessarily lead to a difference in treatment effectiveness. It remains unclear whether the decline in gender differences on treatment effectiveness was caused by changes in society as a whole or by specific characteristics of the present treatment. The extent of the gender differences in rehabilitation outcomes was particularly small in the middle age group, which is consistent with the typical course of changes in gender roles over the lifespan. This would correspond to an explanation by changes in society as a whole. If the finding of comparatively bigger gender effects among older or younger patients replicates, this might imply a need for gender and age-sensitive treatments instead of a gender-sensitive treatment that ignores age.
Supporting information
S1 File. Evaluation data.
(SAV)

Acknowledgments
The results of the present study were in part presented during a poster presentation at the 18th annual conference of the Austrian Society for Psychiatry, Psychotherapy and Psychosomatics.

This article is distributed under the terms of the Creative Commons Attribution 4.0 International License https://creativecommons.org/licenses/by/4.0/deed.en), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

Author Contributions
Conceptualization: Juliane Burghardt, Friedrich Riffer, Manuel Sprung.
Data curation: Manuel Sprung.
Formal analysis: Juliane Burghardt, Manuel Sprung.
Funding acquisition: Friedrich Riffer, Manuel Sprung.
Methodology: Manuel Sprung.
Project administration: Manuel Sprung.
Resources: Friedrich Riffer, Manuel Sprung.
Supervision: Manuel Sprung.
Validation: Juliane Burghardt.
Writing – original draft: Manuel Sprung.
Writing – review & editing: Juliane Burghardt, Friedrich Riffer, Manuel Sprung.

References
1. de Vries U, Lange M, Franke W, Petermann F (2011) Differenzielle Effekte stationärer psychosomatischer Rehabilitation. Phys Med Rehabil Kurortmed 21:290–295. https://doi.org/10.1055/s-0031-1291369
2. Dinger-Broda A, Broda M (1997) Geschlechtspezifische Unterschiede in der psychosomatischen Rehabilitation. Prax Klin Verhal Rehabil 7–12.
3. Steffanowski A, Löschna C, Schmidt J, Wittmann WW, Nübling N (2005) Meta-Analyse der Effekte stationärer psychosomatischer Rehabilitation—MESTA-Studie. http://forschung.deutsche-rentenversicherung.de/ForschPortalWeb/rehaDoc.pdf?rehaId=C8009F9A95868E3EC1256E99004424E7. Accessed 25 Jun 2020.
4. Schröder A (2000) Männer und Frauen in der Rehabilitation. Z Für Med Psychol 9:37–42.
5. Mohr B, Gräf T, Forster M, Krohn-Grimberge B, Kurzeja R, Mantel F, et al (2008) Der Einfluss von Depressivität und Geschlecht auf den Rehabilitationserfolg bei chronischem Rückenschmerz: Eine Pilotstudie. Rehabil 47:284–298. https://doi.org/10.1055/s-2008-1076708 PMID: 18937161
6. Adams KF, Sueta CA, Gheorgiade M, O’Connor CM, Schwartz TA, Koch GG, et al (1999) Gender differences in survival in advanced heart failure. Insights from the FIRST study. Circulation 99:1816–1821. https://doi.org/10.1161/01.cir.99.14.1816 PMID: 10199767
7. von Hösten N, Schulz W, Gissendanner SS, Schmid-Ott G (2019) Geschlechterunterschiede im Verlauf und Erfolg psychosomatischer Rehabilitation. Phys Med Rehab Kuror 29:190–198. https://doi.org/10.1055/a-0852-3471
8. O’Neil JM (2008) Summarizing 25 Years of Research on Men’s Gender Role Conflict Using the Gender Role Conflict Scale: New Research Paradigms and Clinical Implications. Couns Psychol 36:358–445. https://doi.org/10.1177/001100008317057
9. Seedat S, Scott K, Angermeyer MC, et al (2009) Cross-national associations between gender and mental disorders in the world health organization world mental health surveys. Arch Gen Psychiatry 66:785–795. https://doi.org/10.1001/archgenpsychiatry.2009.36 PMID: 19581570
10. Yousaf O, Arbogast AL, Zintel S, von Wagner C (2020) Gender differences in self-reported family history of cancer: A review and secondary data analysis. Cancer Med 53:405–415. https://doi.org/10.1002/cam4.3405 PMID: 32835456
11. Courtenay WH (2000) Constructions of masculinity and their influence on men’s well-being: a theory of gender and health. Soc Sci Med 50:1385–1401. https://doi.org/10.1016/s0277-9536(99)00390-1 PMID: 10741575
12. Stengler K, Glaesmer H, Dietrich S (2011) Gender- and geschlechtsspezifische Aspekte in der psychiatrischen und psychotherapeutischen Forschung: eine bibliometrische Analyse. Z Für Psychiatr Psychotherapeut Psychother 59:305–310. https://doi.org/10.1024/1661-4747/a000086
13. Bekker MHJ, van Mens-Verhulst J (2007) Anxiety Disorders: Sex Differences in Prevalence, Degree, and Background, But Gender-Neutral Treatment. Gend Med 4:S178–S193. https://doi.org/10.1016/s1550-8579 (07)80057-x PMID: 18156102
14. Cavanagh A, Wilson CJ, Kavanagh DJ, Caputi P (2017) Differences in the Expression of Symptoms in Men Versus Women with Depression: A Systematic Review and Meta-analysis. Harv Rev Psychiatry 25:29–38. https://doi.org/10.1097/HRP.0000000000000128 PMID: 28059934
15. Boyd A, Van de Velde S, Vilagut G, de Graaf R, O’Neill S, Florescu S, et al (2015) Gender differences in mental disorders and suicidality in Europe: Results from a large cross-sectional population-based study. J Affect Disord 173:245–254. https://doi.org/10.1016/j.jad.2014.11.002 PMID: 25462424
16. Piccinelli M, Wilkinson G (2000) Gender differences in depression. Critical review. Br J Psychiatry 177:486–92. https://doi.org/10.1192/bjp.177.6.486 PMID: 11102321
17. Worringen U, Zwingmann C (2001) Zur Einführung: Geschlechtsspezifische Rehabilitationsforschung in Deutschland. In: Worringen U, Zwingmann C (eds) Rehabilitation weiblich- männlich Geschlechtspezifische Rehabilitationsforschung. Juventa.
18. Donnelly K, Twenge JM (2017) Masculine and feminine traits on the Bem Sex-Role Inventory, 1993–2012: A cross-temporal meta-analysis. Sex Roles J Res 76:556–565. https://doi.org/10.1007/s11199-016-0625-y
19. Twenge JM (1997) Changes in masculine and feminine traits over time: A meta-analysis. Sex Roles 36:305–325. https://doi.org/10.1007/BF02766650
20. Statistik Austria (2020) Internationale Frauentag 2020: Frauen holen bezüglich Bildungsniveau und Erwerbstätigkeit auf; Teilzeit und niedrigere Erwerbsseinkommen führen zu größeren sozialen Risiken. In: Stat. Austria. http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/soziales/gender-statistik/erwerbstaeltigkeit/122737.html. Accessed 2 Jul 2020.
21. Riffer F, Sprung M, Kaiser E (2017) Evaluationsergebnisse der Rehabilitationsklinik Gars am Kamp. Spez Psychiatri 3:34–37.
22. Riffer F, Sprung M, Streibl L, Kaiser E (2018) Stationäre medizinische Rehabilitation von Patienten mit psychiatrischen oder psychosomatischen Erkrankungen: erste Evaluationsergebnisse der Rehabilitationsklinik Gars am Kamp. In: Riffer F, Kaiser E, Sprung M, Streibl L (eds) Das Fremde: Flucht — Trauma — Resilienz: Aktuelle traumapsychische Konzepte in der Psychosomatik. Springer Berlin Heidelberg, Berlin, Heidelberg, pp 227–241.
23. Riffer F, Sprung M, Streibl L, Kaiser E (2018) Relevanz von Erkrankungsart und beruflichem Status für die Ergebnisse psychiatrischer Rehabilitation. neuropsychiatrie 32:33–43. https://doi.org/10.1007/s40211-017-0254-x PMID: 29236245
24. Dilling H, Mombour W, Schmidt MH, World-Health-Organization (2011) Internationale Klassifikation psychischer Störungen: ICD-10, Kapitel V (F, klinisch-diagnostische Leitlinien). Hans Huber, Bern.
25. Franke GH, Derogatis LR (1995) Die Symptom-Checkliste von Derogatis-Deutsche Version. Beltz, Göttingen.
29. Franke GH (2000) BSI brief symptom inventory von LR Derogatis (Kurzform der SCL-90-R). Dtsch Version-Man Gött Ger Beltz Test GmbH.

30. Derogatis LR (1993) BSI Brief Symptom Inventory. Administration, Scoring, and Procedures Manual, 4th ed. National Computer Systems, Minneapolis, MN, US.

31. Angermeyer MC, Kilian R, Matschinger H (2000) WHOQOL-100 und WHOQOL-BREF (WHO-QOL): deutschsprachigen Version der WHO Instrumente zur Erfassung von Lebensqualität. Hogrefe, Göttingen.

32. American-Psychiatric-Association (1996) Diagnostisches und statistisches Manual psychischer Störungen DSM-IV. Hogrefe, Göttingen.

33. Sprung M, Münch HM, Kaiser E, Streibl L, Riffer F (2018) Meta-Analyse der Evaluationsergebnisse psychiatrischer-psychosomatischer Rehabilitation in Österreich. neuropsychiatrie. https://doi.org/10.1007/s40211-018-0290-1 PMID: 30328582

34. World-Medical-Association (2013) World medical association declaration of helsinki: Ethical principles for medical research involving human subjects. JAMA 310:2191–2194. https://doi.org/10.1001/jama.2013.281053 PMID: 24141714

35. Faul F, Erdfelder E, Lang A-G, Buchner A (2007) G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods 39:175–191. https://doi.org/10.3758/bf03193146 PMID: 17695344

36. Cohen J (1988) Statistical power analysis for the behavioral sciences, 2. ed. Erlbaum, Hillsdale, NJ.

37. Lakens D (2013) Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. Front Psychol 4:863. https://doi.org/10.3389/fpsyg.2013.00863 PMID: 24324449

38. Pinquart M, Sörensen S (2001) Gender Differences in Self-Concept and Psychological Well-Being in Old Age A Meta-Analysis. J Gerontol Ser B 56:P195–P213. https://doi.org/10.1093/gerontb/56.4.p195 PMID: 11445606

39. Puglisi JT, Jackson DW (1981) Sex Role Identity and Self Esteem in Adulthood. Int J Aging Hum Dev 12:129–138. https://doi.org/10.2190/4EPU-UK3E-X7KA-QBDK PMID: 7203674

40. Hyde JS, Meuzlis AH (2020) Gender Differences in Depression: Biological, Affective, Cognitive, and Sociocultural Factors. Harv Rev Psychiatry 28:4–13. https://doi.org/10.1097/HRP.0000000000000230 PMID: 31913978

41. Rice SM, Fallon BJ, Aucote HM, Moller-Leimkuhler AM (2013) Development and preliminary validation of the male depression risk scale: Furthering the assessment of depression in men. J Affect Disord 151:950–958. https://doi.org/10.1016/j.jad.2013.08.013 PMID: 24051100

42. Silverstein B, Ajdacic-Gross V, Rossler W, Angst J (2017) The gender difference in depressive prevalence is due to high prevalence of somatic depression among women who do not have depressed relatives. J Affect Disord 210:269–272. https://doi.org/10.1016/j.jad.2017.01.006 PMID: 28068614

43. Knott V, Mahoney C, Kennedy S, Evans K (2001) EEG power, frequency, asymmetry and coherence in male depression. Psychiatry Res Neuroimaging 106:123–140. https://doi.org/10.1016/s0925-4927(00)00089-0 PMID: 11306251

44. Walther A, Rice T, Kufert Y, Ehlert U (2017) Neuroendocrinology of a Male-Specific Pattern for Depression Linked to Alcohol Use Disorder and Suicidal Behavior. Front Psychiatry 7:206. https://doi.org/10.3389/fpsyg.2016.00206 PMID: 28096796

45. Courtenay WH (2000) Behavioral Factors Associated with Disease, Injury, and Death among Men: Evidence and Implications for Prevention. J Men's Stud 9:81–142. https://doi.org/10.3149/jms.0901.81

46. Rabenstein R, Pintzing N, Knogler V, Kirnbauer V, Lenz G, Schossler A (2015) Wirksamkeit eines ambulanten, verhaltenstherapeutisch orientierten Rehabilitationsprogramms—eine Wartelistenkontrollgruppenstudie. Verhaltenstherapie 25:192–200. https://doi.org/10.1159/000437449