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Improving outpatient treatment in schizophrenia: effects of computerized guideline implementation—results of a multicenter-study within the German Research Network on Schizophrenia

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Abstract Schizophrenia clinical practice guidelines are developed to provide expert- and evidence-based advice to practicing psychiatrists in order to improve the management of this disorder. However, the application of these guidelines in everyday health care can still be described as nonsatisfying. Within the project "Guideline-supported quality management in outpatient treatment", we investigated whether guideline adherence and quality of outcome can be improved by implementing a computer-based, guideline-oriented decision-support system. Therefore, a disease-specific decision-support system was developed interactively presenting guidelines to support the physicians decision-making process during the treatment of schizophrenia patients. We evaluated the system in a control group design: An experimental group consisting of 15 psychiatrists in private practice used the decision-support system, thus documenting the treatment of schizophrenic patients. Guideline-based algorithms were interactively and case specifically displayed on the PC-screen as soon as predefined triggers were met. A first control group in Munich provided treatment-as-usual, documenting the treatment via paper–pencil. Two further physician groups served as additional comparison groups: one also documented electronically using the decision-support system, however without receiving electronic guideline support, the second group carried out traditional quality circles while also using the paper–pencil approach. As a result of the intervention, we observed a strong initial but time-limited improvement with respect to the core aspects of outpatient treatment in schizophrenia in the experimental group. The findings suggest that decision-support systems, despite their limitations, can be used to enhance treatment outcome in schizophrenia outpatient care.

Keywords Schizophrenia · Private practice · Computerized guidelines · Treatment outcome

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Introduction

Measures regarding quality assurance in medical care of schizophrenia as well as other mental illnesses have been established for many years. Indeed until now, a unitary precise input regarding the embodiment of those measures, the way of data collection and the indicators of process and outcome quality does not exist. The development and use of clinical practice guidelines (CPG) for diagnosis and therapy of schizophrenia patients established an important step towards the definition of standards by which medical treatment quality can be measured [1]. Against this background, the question how the acceptance and effectiveness—and thus the anticipated positive medical and economical effects of guidelines—could be promoted, has to be of special interest. First of all, the methical quality of guidelines development is considered to be an unquestioned influencing variable [2]. This led to several selective

measures [3] to assure guideline quality at national—e.g. the establishment of a clearing system controlled by a superior clearinghouse similar to the American "National Clinical Guideline Clearinghouse" [4] in Germany [5]— and international level. Other factors influencing medical decision making and thus guideline acceptance—e.g. personal beliefs, preferences, physicians' experience values— are unequally more difficult to explore and can accordingly only be modulated in a restrictive manner [6]. Grol [7], therefore, stresses the consideration of the specificity of implementation strategies dependent on the target group, the clinical setting, the anticipated obstacles as well as factors supporting the process up to the added orientation on up-to-date practice guidelines. Recent research alludes that the promptness of their availability at the working place while the physician is still in contact with his patient increases the likelihood of consideration [8]. Considering this background the transfer of guidelines into computerized algorithms appears to be an effective strategy to tap the full potential in day-to-day health care [9]. To this the German Research Network on Schizophrenia developed a disease-specific Decision-Support System (Schizophrenia-Module) designed for the treatment of schizophrenic patients in private practices [10].

Therefore the main hypothesis of the study was that the implementation of the Schizophrenia-Module would improve outcome in outpractice schizophrenia treatment (measured as significant improvement in PANSS-score), compared to treatment as usual. Considering the guideline conformance rates lying below 50% for schizophrenia outpatient treatment in the USA [11, 12], the importance of improvement in this area through guideline-based quality management systems gains increased significance.

Further to this, it should answer the question whether schizophrenia patients currently receive treatment according to the at the time of the study available S1 treatment guidelines developed by the German Society for Psychiatry, Psychotherapy and Nervous Diseases (DGPPN).

Methods

Between October 2000 and April 2002 four practice networks (one in Duesseldorf, one in Freiburg and two in Munich) consisting altogether of 55 psychiatrists in private practices, documented a minimum of ten treatment courses each. The documentations took place once per quarter over a total time of 18 months. The first ten patients per doctors' practice, who had a regular appointment after the start of the study were included. This involved first-episode and multiple-episode patients. The practice network in Duesseldorf (consisting of 15 psychiatrists) used a computer-based decision-support system for documentation purposes, which

had been developed by the Department of Psychiatry— Heinrich-Heine-University Duesseldorf within the German Research Network on Schizophrenia. During the documentation process, practice guidelines adapted from the German Society for Psychiatry, Psychotherapy and Nervous Diseases [1] are displayed on the PC-screen in case a predefined constellation of specific treatment situations occurs (e.g. impending relapse, deterioration of psychopathology). In addition to social and demographic data, the current symptoms have to be recorded using the Positive and Negative Syndrome Scale (PANSS) [13], Global Assessment of Functioning (GAF) [14], Clinical Global Impression (CGI) [15] as well as other relevant parameters (e.g. possible side effects, compliance, quality of life, early warning signs, and suicidal tendency). Further on, all diagnostic and therapeutical measures have to be documented at each consultation. A category "measures" allows the adherence of all kinds of admissions, transferrals, etc. In addition doctors joined benchmark procedures at the end of each quarter. The control group, consisting of 15 psychiatrists in Munich collected treatment data per paper–pencil thus providing treatment-as-usual. Two further comparison groups were built: a second physician group in Munich carried out additional quality circles while using paper–pencil documentation, in Freiburg the computer-based documentation of ten treatment courses on the basis of the decision-support system was performed, but without having access to the algorithms. No benchmark took place within this group. Both groups (Duesseldorf and Freiburg) received a detailed introduction to the software as well as the technical support during the project. To ensure a satisfying interrater-reliability, a rater-training concerning the PANSS was conducted with all participating physicians (coefficient intraclass correlation: 0.514). In accordance with a vote obtained from the Ethical Commission of the Heinrich-Heine-University of Duesseldorf, informed consent had not to be obtained, since the intervention applied only to the participating physicians. All patient treatments involved only procedures that are commonly conducted in outpatient schizophrenia treatment and participants remained completely anonymous with no identifying code to link them to their identity.

With an expected middle effect ($w = 0.30$), a degree of freedom of 3 (four participating groups), $\alpha = 0.05$ and $1 - \beta = 0.80$, a total sample size of 484 patients (i.e. 121 patients per practice network) was needed to achieve significant results.

Subjects

A total of 522 patients suffering from schizophrenia or schizoaffective disorder with diagnosis confirmed according to the International Classification of Diseases (ICD-10)

(F.20.X and F 25.X) were included. Patients had to be between 18 and 65 years of age. Exclusion criteria were homelessness and missing German language skills. Table 1 outlines sociodemographic data and clinical parameters of the sample allocated by the four practice networks.

Results

Dropout rate

Since not all patients accomplished a continuous treatment plan during documentation, dropout rates were 4% in Düsseldorf and 8% in Freiburg. In Munich, all patients could be followed over the full documentation period. Since the predominant part of the dropouts occurred following the fourth quarter, all subsequent evaluations refer to the first four treatment quarters. Thus, the first documented consultation will be referred to as T0, the four treatment quarters as T1–T4.

Baseline data

At baseline, there were no significant differences regarding the clinical parameters between the four samples but they differed regarding the parameters age, sex, marital status and occupational status. Thus Spearman-Rho-Correlations and analysis of variance concerning these variables and the process parameters "prescription of continuative measures" and the outcome variables "reduction of psychopathology", "compliance" and "number of rehospitalizations" were conducted. Thereby, we found significant differences regarding the mean values in terms of pronounced negative symptoms in male patients and an improved compliance in employed patients. Older patients were more likely to suffer

from distinct negative symptoms but were more compliant and were less likely to be rehospitalized. There were no differences regarding medication strategies at baseline: in the experimental as well as the control group nearly all patients were treated with an antipsychotic agent (E.G: 92.3% CG: 98.5%), 46.5% of the patients being treated with second generation neuroleptics in the experimental and 41.2% in the control group.

Psychopathological status

The psychopathological status assessed by PANSS, CGI and GAF was compared between the groups at baseline and quarterly during the treatment course, the four patient groups being hallmarked by the first initial letter of the project sites (Duesseldorf, Freiburg, Munich 1 and Munich 2).

PANSS

The results of the one-way Anova (level of significance 0.05) and the Scheffé-Test showed significant differences regarding the average positive and negative syndrome score during the course of treatment. We found a pronounced group-effect when comparing the Duesseldorf group using the Decision-Support System and the control group (Munich 1) providing treatment-as-usual (TAU) ($P = 0.004$) with respect to positive symptoms. No group effects were apparent concerning negative symptoms. The analysis of the inner-subject-factor (Time) also revealed a significant effect ($P < 0.001$). Patients whose physicians used the Decision-Support System with integrated algorithms experienced a conspicuous decrease in positive and negative symptoms as measured by the positive- and the negative score of the PANSS. Separate t tests for dependent

Table 1 Sociodemographic and clinical patient characteristics of the four practice networks ($N = 522$)

| Characteristics	Duesseldorf ($N = 142$)	Freiburg ($N = 103$)	Munich 1 ($N = 136$)	Munich 2 ($N = 141$)	P
Age (SD)	40.9 (10.5)	39.9 (10.2)	45.9 (12.9)	45.7 (15.0)	<0.001
Sex (female)	53.5%	35.0%	61.7%	52.9%	0.001
Life situation					
With partner	24.2%	17.5%	32.2%	34.5%	0.021
Single/divorced	75.8%	82.5%	67.8%	65.5%	
Work situation					
Unemployed	17.6%	14.3%	32.2%	13.1%	<0.001
Employed	26.1%	51.8%	31.1%	31.7%	
Retired	25.4%	33.9%	35.8%	40.0%	
PANSS pos. (M, SD)	14.1 (6.5)	14.5 (5.5)	13.8 (6.7)	13.9 (6.9)	NS
PANSS neg. (M, SD)	19.7 (8.7)	20.5 (7.2)	19.5 (8.1)	17.9 (8.3)	NS
GAF (M, SD)	56.5 (15.2)	52.9 (15,2)	55.8 (16.7)	59.7 (18.5)	NS
CGI (M, SD)	4.3 (1.3)	4.3 (1.2)	4.1 (1.2)	3.9 (1.3)	NS

samples (level of significance 0.05) showed that this effect occurred concerning the positive score solely between T0 (Mean 12.97) and T1 (Mean 10.23, $P < 0.001$) and between T1 (Mean 11.74) and T2 (Mean 10.98, $P = 0.027$), after that point no significant symptom reduction took place. This applied to the average reduction of the negative score, too (Mean T0:18.13 vs. T1: 17.11, $P < 0.001$, T1 vs. T2:15.83, $P = 0.004$). Patients from the TAU sample (Munich 1) received neither initially nor in the further treatment any symptom reduction measured by the PANSS positive and negative score.

To assure that the differences between the decision-support-group and the TAU-group were not due to electronic versus paper-based documentation, we compared the decision-support group with the Freiburg group, whose doctors used the same software but without having access to the computerized guidelines. Both the positive and negative score had a distinct progression (Scheffé-Test: Positive score: $P = 0.015$, Negative score: $P = 0.003$). Also the time-effect in Freiburg was different: a reduction of positive and negative symptoms was achieved, but these results not being significant until completion of the fourth quarter (Positive score: Mean T0:15.46 vs. T4:14.29, $P = 0.022$/Negative score: Mean T0:20.50 vs. T4:19.37, $P = 0.036$). No significant group differences existed between the decision-support and the patients, whose physicians worked via paper–pencil and joined additional quality circles (Munich 2), but significant time-effects again occurred only after four treatment quarters (Positive score: Mean T0:13.96 vs. T4:12.22, $P < 0.001$, Negative score: Mean T0:19.94 vs. T4:17.86, $P < 0.001$). The interaction effect of time × group was significant with regard to the negative score ($P < 0.039$) and the positive score ($P < 0.001$) (Figs. 1, 2).

CGI (Severity)/GAF

A complementary time-pattern appeared regarding the assessment of disease severity basing on the Clinical Global Impression Scale (CGI) as well as the level of functioning measured by the Assessment of Functioning (GAF). The Duesseldorf patients experienced a significant reduction of general severity as well as a significant averaged enhancement of the assessed level of functioning between T0 and T1 (CGI: T0: 4.3 vs. T1: 4.1, $P = 0.001$/GAF: T0: 57.0 vs. T1: 60.9, $P = 0.001$), which did not increase in the further course of the treatment. The Munich control group (M1) noted no reduction in global severity of disease as well as no improvement in level of functioning in their patients.

Again the comparison group in Freiburg showed the mean treatment course as significantly improved (CGI: T0: 4.3 vs. T4: 4.0, $P = 0.002$/GAF: T0: 56.2 vs. T4: 60.1,
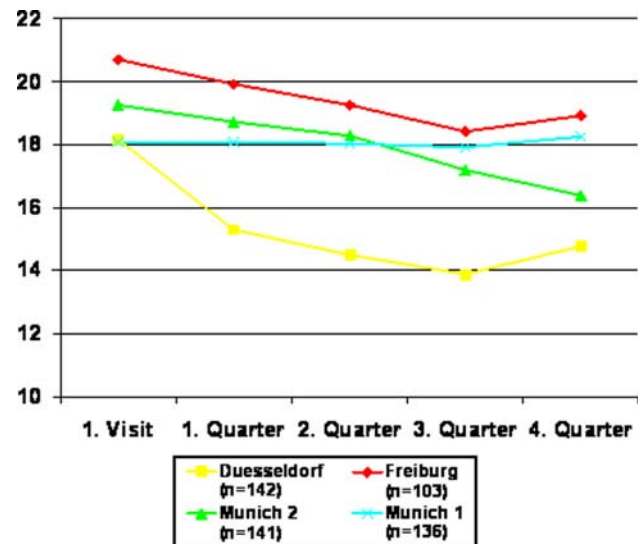
Fig. 1 Symptom course in the first treatment year ($n = 323$) PANSS Negative score
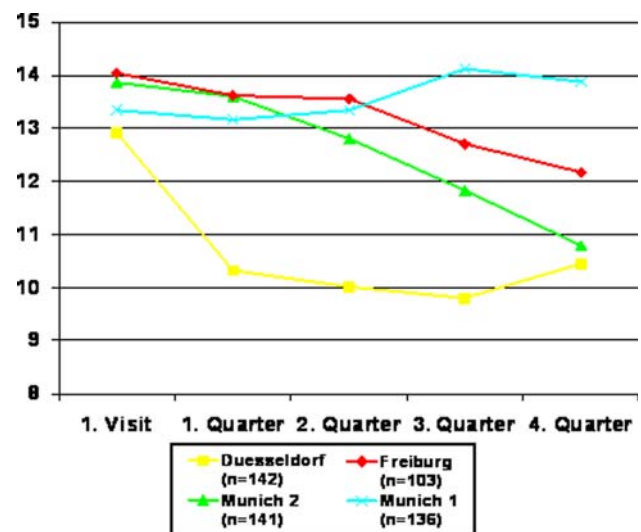
Fig. 2 Symptom course in the first treatment year ($n = 323$) PANSS positive score

$P = 0.001$), but this result however not arising until the end of the fourth quarter. Likewise, the quality circle group (M2) showed a significant time-effect between T0 and T4 (CGI: T0: 4.04 vs. T4: 3.75, $P < 0.001$/GAF: T0: 55.24 vs. T4: 60.36, $P < 0.001$).

Both interaction effects of time × group were significant (CGI: $P < 0.001$ and GAF: $P < 0.001$).

Rehospitalization

Concerning admissions to a psychiatric unit (voluntarily as well as admissions according to law) there was a major

Table 2 Therapeutic measures prescribed by treating physician at least once in the time between T0 and T4 (in % of patients)

	Psychotherapy	Psychoeducation	Social services	Family Counseling
Duesseldorf	52.5	33.6	1.0	5.4
Freiburg	43.7	10.3	14.9	5.7
Munich 2	6.9	11.5	7.3	3.6
Munich 1	6.9	7.2	11.9	4.1
Chi-square	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.815$

difference comparing the four documentation methods (Chi-square 10.4, $df = 3$, $P = 0.016$) in the period T0 up to T4. Concerning the patient group in Duesseldorf 5 in 142 patients (3.5%) were hospitalized, while the control group Munich 1 registered 20 admissions in 136 patients (14.7%). 12 in 103 patients (11.7%) in Freiburg had been committed to a psychiatric unit. Physicians from the paper–pencil and quality circles group (Munich 2) committed 15 out of 141 patients (10.6%), to a psychiatric inpatient treatment.

Psychosocial treatment

The definition for continuative treatment measures included psychoeducation, psychotherapy, family counseling and social services. Patients in Duesseldorf received—compared to the other groups—the highest number of psychological therapies (52.5%) as well as psychoeducational treatments (33.6%). On the other hand, patients in Munich and Freiburg received significantly more community services. There were no group differences regarding family counseling (Table 2).

Compliance

Table 3 shows the average compliance in terms of keeping appointments with his/her physician as well as medication compliance in each patient group during the documentation period T0 up to T4.

We investigated how many patients, who were not compliant at the beginning of the study attained good medication compliance and appointment adherence at T4. Compliance ratings were based on a six-ary scale and were made by the treating physician. Good compliance was defined as parameter-value "always keeping appointments" and "always taking the medicine". In Duesseldorf 12.9% patients enhanced their medication adherence, in Freiburg 14.1%, in Munich 2 3.0% and in Munich1 1.7% of all patients (Chi-square 21.05, $df = 3$, $P < 0.001$). Accordingly, in the Duesseldorf patient group there was an increased willingness to attend regular consultations (15.0%), in Freiburg 18.1% patients were rated as having a satisfying appointment adherence at T4 compared to T1, (Munich 5.3% and Munich 1 5.0%) (Chi-square 16.4, $df = 3$, $P = 0.001$). Bivariate Spearman-Rho correlations

Table 3 Good or satisfying medication and appointment adherence at T0 and at T4 (%) rated by treating physician on six-ary compliance scale

	Medication adherence		Appointment adherence	
	1. Quarter	4. Quarter	1. Quarter	4. Quarter
Duesseldorf ($N = 138$)	62.3	68.8	59.3	68.5
Freiburg ($N = 102$)	63.7	71.1	62.1	77.4
Munich 1 ($N = 124$)	87.1	87.6	73.6	76.9
Munich 2 ($N = 136$)	92.6	93.1	83.2	88.3
ANOVA	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.003$

showed a highly significant connection considering the documentation form via Decision-Support System and an increase in medication adherence between the first and the last treatment quarter (D correlation coefficient 0.122, $P = 0.007$, F correlation coefficient 0.125, $P = 0.006$) while paper–pencil-based documentation showed a negative connection with enhancement of medication and appointment adherence (medication compliance: M1 correlation coefficient -0.103, $P = 0.024$/M2 correlation coefficient -0.104, $P = 0.023$/appointment adherence: M1 correlation coefficient -0.129, $P = 0.004$, M2 correlation coefficient -0.108, $P = 0.017$).

Discussion

During the 1980s numerous projects, amongst them the often cited Maryland Hospital Quality Indicator Project in the US [16] began to systematically record the quality of treatment for inpatients. Regarding psychiatric inpatient health care an extensive documentation allowing the survey of outcome quality has been introduced for many years in Germany and elsewhere [17, 18]. In recent years, an increasing number of quality circles have been established in the outpatient sector. In these circles diagnostic and therapeutic methods are reflected and optimized voluntarily aided by a specially trained moderator [19]. The project at hand was designed to review the enhancement of health care quality in the psychiatric/neurological private practice area by means of dissemination and implementation of practice

guidelines for schizophrenia based on empirical evidence and expert consensus in the ambulant treatment setting. In order to assist medical decision making, the guidelines were provided in a computerized form. As instruments of quality assurance conducted by means of the Schizophrenia-Module tested at hand, the guidelines observe standards of medical treatment of patients suffering from schizophrenia. At the same time, the current status of out-patient schizophrenia treatment was measured in the control group providing TAU. The circumstance that only a limited number of psychiatrists/neurologists in the regional practice networks decided to participate in the study mirrors potential provisos regarding guideline implementation in health care which may be prompted by the increasing introduction of disease management programmes. Apprehensions regarding the loss of therapeutic freedom [20], standardization of medical treatment at the expense of the physician–patient relationship [21] and the role that clinical practice guidelines play in reducing costs [22] play an important role in the current discussion on guidelines which is led controversially among the medical fraternity. Besides, the additional temporal expenses due to documentation work using an electronic decision-support system cannot be dismissed.

On the other hand an initial treatment effect was apparent in the multi-center-comparison regarding patients of doctors who employed the decision-support system including automatic guideline display. This effect was reflected in a rapid decrease of the average psychopathology measured by the PANSS, CGI and GAF, even though the interrater reliability for PANSS was rather low with 0.514, which was perhaps reasoned by the high level of negative symptoms of the outpatients. Nevertheless the group of patients whose physicians deployed the Schizophrenia-Module without access to the guidelines provided, or got involved in quality circles, experienced a decline of disease-specific symptoms. However, it took longer, namely four treatment quarters, to measure a statistically relevant effect. In comparison to the results mentioned before there was no average improvement of psychopathological findings in patients who displayed the same psychopathology at the beginning of treatment and whose doctors documented the course of treatment solely via paper–pencil. First of all, this leads to the conclusion that both guideline-based quality management and quality management in terms of quality circles exert a beneficial influence on the aetiopathology compared to treatment/documentation as usual. Furthermore extensive pc-documentation differs considerably from the paper–pencil approach. Secondly, guideline-based therapy can raise the therapeutic potential in a much smaller amount of time. Miller [23] detected comparable initial effects measured by the Brief Psychiatric Symptom Scale after the implementation of treatment guidelines regarding psychopharmacotherapy in out-patient schizophrenia treatment.

The fact that after an initial reduction of symptoms no further amelioration of the psychopathology takes place can be attributed to several possible causes. It is conceivable that the computerized guideline approach supported the physicians to achieve the utmost attainable benefit in a short time. Secondly, the argument can be brought forward that limited resources (e.g. with respect to the availability of psychosocial measures) impeded a continuative diminishment of symptoms. Finally, a significant reduction of the positive and negative pathology could be considered from a medical point of view as the objective of treatment attained. Therefore, the sufficient contentment on the part of the physician could counteract the search for other effective treatment strategies.

However within the scope of guideline-based patient documentation positive effects also appeared regarding the four complete treatment quarters. Thus physicians who conducted guideline-based documentation admitted clearly less patients to in-patient health care over a long period (3.5%) than physicians who used other kinds of treatment or documentation. Similarly, the guideline-oriented group of physicians administered the highest proportion of psychoeducative (33.3%) and cognitive behavioral therapy (52.5%) and thereby most frequently observed the state of the art with respect to psychosocial treatment of patients suffering from schizophrenia according to which cognitive-behavioral and psychoeducative therapy elements represent effective means of recidivism prophylaxis beside psychopharmacological treatment [24].

A further topic was to assess the link between the usage of guidelines and compliance [25]. Since medication non-compliance unobserved by the physician in charge increases the patients' risk of relapse considerably [26], drug compliance during the course of treatment was documented in each patient by means of both the Schizophrenia-Module and per paper–pencil. Relating to the percentage of patients who had been assessed as noncompliant at T0 the patients being documented with computer-assisted device displayed a conspicuously greater improvement in compliance during the course of one year irrespective of the availability of guideline-triggering (taking into account the ceiling effect regarding the patients documented per paper–pencil). The significant positive correlation between electronic documentation and improvement of compliance versus the negative correlation between paper–pencil documentation and improvement of compliance may be due to the differentiated response categories of the relevant scale as well as the speedily visible electronic listing of previous compliance evaluations. Altogether an irregular pattern of drug taking, which prevents treatment progress, could have been recognized early and thus have been changed. Thus, the Schizophrenia-Module may have supported the physicians' efforts to obtain a better compliance.

Conclusion

Practice guidelines, whose development follows systematic and evidence-based rules, are effective instruments for quality measures if they are employed correctly and are used in form of structured decision support [27]. Their transfer into computerized algorithms opens a way of implementation by which treatment recommendations based on patient-specific data are automatically displayed. The results of this study reveal distinct initial effects regarding relevant treatment parameters such as reduction of negative symptoms and long-termed effects concerning the prevention of rehospitalizations and advanced treatment compliance when using the guideline-based Schizophrenia-Module. Still the low application of the system and thus the limited transfer of research findings into the daily delivery of health care appears to be a problem [28]. In order to increase the systems' usage, the technological optimization of the Schizophrenia-Module (e.g. ongoing actualization of guidelines, creating interfaces with common practice software) plays an important role. Furthermore, it seems to be indispensable to gain further increase in knowledge about central factors which influence the attending physician with regard to a change in previous treatment strategies.

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